RESTRICTED

WEATHER SERVICE BULLETIN

1950 No. 1

MILITARY AIR TRANSPORT SERVICE

HEADQUARTERS, AIR WEATHER SERVICE

WASHINGTON, D. C.

RESTRICTED

HEADQUARTERS, AIR WEATHER SERVICE
ANDREWS AIR FORCE BASE
WASHINGTON 25, D. C.
13 March 1950

TO ALL CONCERNED:

The Weather Service Bulletin No. 1, 1950, is published for dissemination of important information to all echelons of the Air Weather Service.

It is believed that much of the material in the Weather Service Bulletin is of enduring value, and therefore each USAF weather installation should maintain a permanent file of this publication for reference.

BY ORDER OF COLONEL SENTER:

LEWIS L. MUNDELL
Colonel, USAF
Chief of Staff

OFFICIAL:

Robert B. Edwards
ROBERT B. EDWARDS
Major, USAF
Adjutant General

Distribution

Each AWS Weather Station (1)
Each AWS Squadron Hq. (3)
Each AWS Group Hq. (5)
Each AWS Wing Hq. (10)
Hq., USAF (4)
Hq., MATS (1)
Hq., each MATS Div. Cd. (1)
Hq., ConAC (1)
Hq., AACS (6)
Hq., ARS (1)
Hq., ADC (1)
Hq., ATC (1)
Hq., TAC (1)
Hq., AMC, MCLAWS (20)
Hq., SAC (1)
Hq., Office of Flying Safety (1)
Cambridge Research Laboratories (20)
Hq., Air University (2)
Chanute Field, Dept. of Weather (200)
Research & Development Board (1)
Each Wea. Liaison & Staff Wea. Off. (1)
Each Numbered Air Force Hq. (1)
Hq., Dept. of the Army (2)
Each Army Field Force Hq. (1)
Chief, U. S. Weather Bureau (2)
Chief, Aerology Section, CNO, USN (10)
OCSigO (1)
OCE (1)
Stock, Middletown, AMA

The Cover . . .

Illustrating an important Air Weather Service activity, this RB-29 of the 373d Reconnaissance Squadron is shown coming in for a landing at Kindley AFB after completion of a "routine" hurricane mission.

1950 CONTENTS No. 1

WEATHER SERVICE MESSAGE

THE STATION WEATHER OFFICER (U)

General Yates has stated many times that our station weather officers occupy the key positions in the Air Weather Service. I welcome the opportunity to enlarge upon this thought during this period of our Chief's temporary absence because I agree with him that the station weather officer is the key to the successful accomplishment of our mission.

Being faced with manifold responsibilities, the station weather officer is forced to delegate some of his duties to his subordinates and to retain only supervisory control. Judicious delegation of duties is necessary and desirable for several reasons. First, it would in most instances be almost impossible for one man to accomplish all the work. Second, the ability to delegate authority and to supervise and coordinate the work of subordinates can be gained only from actual experience. Third, the assumption of certain responsibilities is necessary training in the career development of the subordinates in order to prepare them for future assignments in positions of greater responsibility.

As a commanding officer, the station weather officer must retain the responsibility for the satisfactory accomplishment of all phases of the mission of the weather station. In delegating various duties to his subordinates he must maintain a high degree of proficiency in all station activities in order to adequately insure, through supervision and surveillance, that delegated duties are promptly and properly accomplished. The ability to intelligently delegate, supervise, and control the operations of a weather station is the prime requisite of a station weather officer. Obviously, possession of this multi-phase ability is an impossibility without continued effort to maintain technical knowledge of all Air Weather Service functions.

The functions of the station weather officer listed below are of major importance to the mission of the entire Air Weather Service. I list them not in order of importance, but just as they have occurred to me:

a. Morale of station personnel as affected by the station weather officer's display of personal concern in their welfare and their degree of familiarity with personnel matters such as promotions, career and personal improvement opportunities.

b. Accuracy of observations and forecasts.

c. Liaison with, and advice to, base personnel.

d. Advice to his subordinates on technical matters.

The station weather officer's position of command is relatively low when thought of with respect to the number of personnel supervised, but when we realize that he is responsible for delivering to the consumer the end product of the labors of the entire Air Weather Service, the responsibility of his position assumes a magnitude which knows no bounds. He is our salesman, our contact man, our representative to our public and to the United States Armed Forces.

W. O. Senter

W. O. SENTER
Colonel, USAF
Chief, Air Weather Service

pilot parachute, and a small one to remove the parachute-pack cover. The main 'chute, a non-oscillating type made of cotton or rayon, is 5 feet in diameter.

The radiosonde modulator is a mechanical device consisting of an electric motor, a rotating disk, and pick-up arms which are positioned on the coded disk by their respective pressure, temperature, and humidity-measuring elements (Fig. 2). A relay, connected in series with the electromechanical pick-ups, is actuated by the pick-up impulses and keys the transmitter.

In operation, the motor turns the plastic disk which is 6 inches in diameter, contains 211 grooves, and closely resembles a phonograph record in appearance. A 90° segment (1/4 of the area) of the record is raised approximately 1/16 of an inch, however, and it is in the 211 grooves on the elevated portion of the disk that all the code impressions are con-

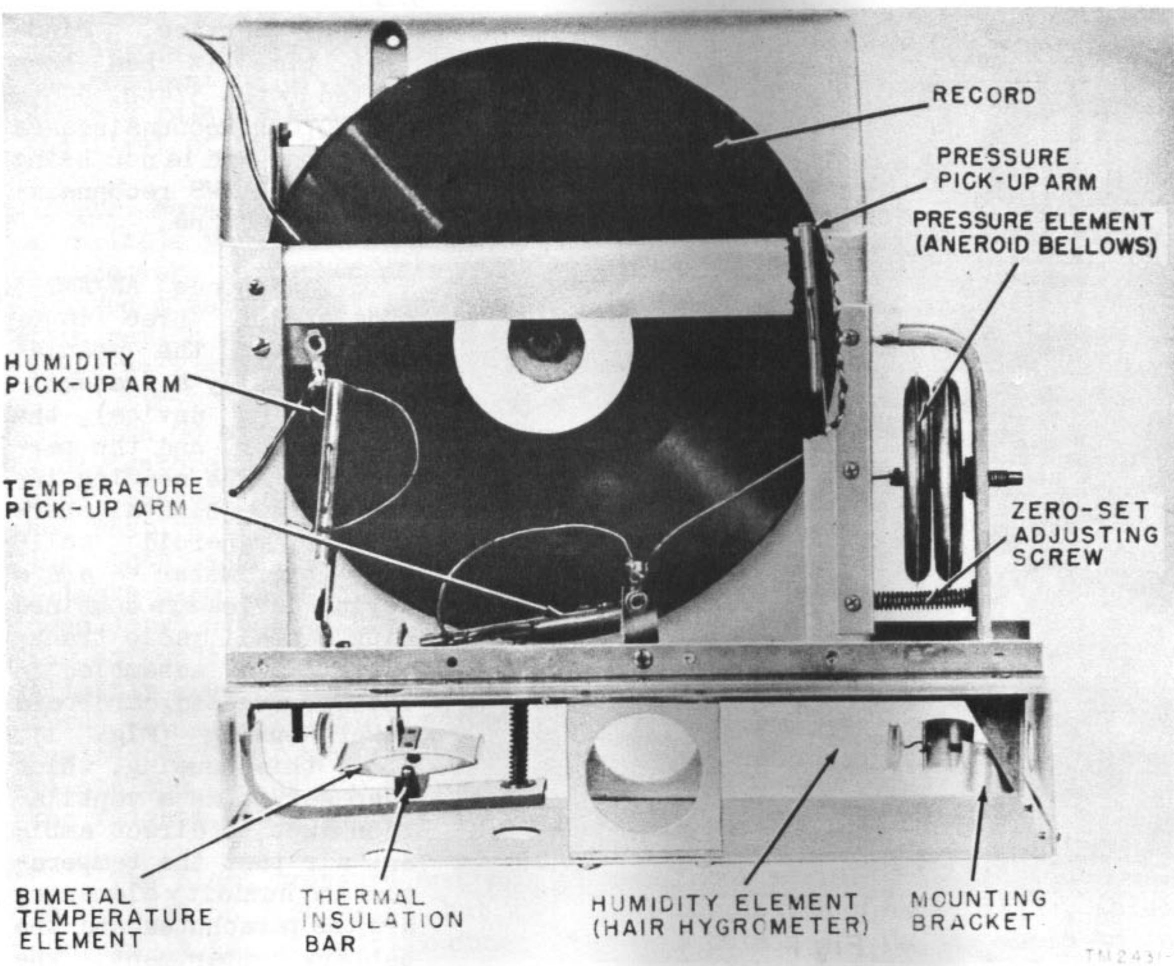


Fig. 2

Modulator chassis of Radiosonde AN/AMT-3, rear view.

tained. Each of the 211 elevated grooves is impressed with a two-letter group of Morse code characters arranged in alphabetical sequence. With changes in atmospheric conditions, each of the three inertia-type pick-up arms, equipped with a sapphire stylus (needle) and connected to the pressure, temperature, and humidity-sensing elements, respectively, reacts and positions itself over the corresponding groove in the record. The data are transmitted in the order: pressure, temperature, humidity. A complete cycle requires 8 seconds, including a 2-second period of silence (reference point) following the transmittal of humidity data. After release of the instrument the two-letter Morse code combinations are received and recorded by the radio operator aboard the aircraft; the data are evaluated by the weather observer.

A special ejection chamber is used in releasing the instruments from most aircraft of the reconnaissance squadrons, but until all planes are equipped with the chambers in accordance with the modernization program, some drops must be made from the bomb-bay or the non-pressurized rear hatch of the RB-29's.

CLOUD MODIFICATION PRINCIPLES (U)

During the last several years in which large-scale cloud-seeding experiments were taking place, basic research on cloud physics phenomena was also in progress. Recent articles in the <u>WSB</u> (No. 5, item 128; No. 8, p. 11) have stressed mainly the cloud-seeding experiments. Results of research on the underlying physics are presented here.

Four types or forms of nuclei in the atmosphere may be recognized for meteorological purposes: (1) condensation, (2) freezing, (3) sublimation, and (4) precipitation nuclei. As will be shown, none of these types is always strictly different from the others. Perhaps the best known type is the <u>condensation nuclei</u>, made up of hygroscopic particles, mainly sea salt and products of combustion, sufficiently numerous at all altitudes so that clouds (or fog) will always form at or slightly below the dew-point temperature with respect to water.

The other types of nuclei are differentiated as shown in the following example. A microscopic particle of unknown characteristics, the <u>freezing nucleus</u>, starts to take up water vapor into a crystalline form from an atmosphere supersaturated with respect to ice. The ice crystal thus begun serves as a natural <u>sublimation nucleus</u> for the further growth of the crystal. Certain crystals can grow to a size large enough to fall, and can then be termed <u>precipitation nuclei</u>.*

In cooling air to temperatures below freezing, since vapor pressure with respect to water is higher than that with respect to ice, the air

*In his falling-drop theory of rainfall, Langmuir also considers water droplets as precipitation nuclei.

becomes saturated first with respect to ice. Therefore, it might be expected that ice crystals normally form first. That this is not the case is demonstrated by the frequent observation of water fogs and clouds at temperatures well below freezing. (Naturally, in these cases of supercooled clouds the air is supersaturated with respect to ice.) The explanation of this fact lies in the lack of active freezing nuclei. Different freezing nuclei become active at different temperatures. Cwilong found that in conducting cloud-chamber experiments in ordinary outdoor air, only water droplets formed at temperatures above, and only ice crystals at temperatures below, 241°A (-32°C). Thus, this air contained condensation nuclei active at all temperatures, but freezing nuclei active only at temperatures below 241°A. Schaefer verified that ordinary air has freezing nuclei active at or below 241°A, for, when he passed metal cooled to -35°C (238°A) through saturated air, a trail of ice crystals formed in its path. The same effect was obtained when particles of dry ice (194.5°A) were substituted for the metal. Cwilong, however, found that over the ocean the air has less or a different form of freezing nuclei, for cooling to a temperature 232°A was required there before freezing nuclei became active. H. Palmer found the air at high levels to react similarly: above inversions, up to 6 km, 232°A was required for formation of ice crystals.

This situation is the basis for Vonnegut's use of silver iodide (AgI) in cloud seeding. He found that AgI particles acted as freezing nuclei at higher temperatures than any other material tested; it was found to be active at temperatures as high as -2°C (271°A). However, its activity increases as the temperature is lowered, so that at -20°C (253°A) about one thousand times as many of the AgI particles are active (and cause that many more freezing nuclei to form) as at -10°C (263°A).

It appears, then, that the effect of seeding with dry ice is not primarily due to introduction of new freezing nuclei into the air; the dry ice merely causes existing freezing nuclei to become active by virtue of its intense cooling power. Seeding with AgI, on the other hand, actually adds to the air additional freezing nuclei which are active at higher temperatures than most natural nuclei. However, ice crystals do often exist in natural clouds at relatively high temperature near the freezing level. Whether these ice crystals fall from ice crystal clouds at very high levels or are formed by spontaneous crystallization is not known, but seeding with either dry ice or AgI speeds the modification of these clouds.

Once the ice crystal has been formed, true sublimation onto the ice crystals can continue to take place from air supersaturated with respect to ice. Also, evaporation takes place from any nearby higher vapor-pressure water droplets, supplying water vapor for further sublimation onto the ice crystals. The phenomenon of "over-seeding" occurs when so many ice crystals have been formed that the further growth of any appreciable number of them to precipitable size is prevented by lack of sufficient moisture in the cloud.

A major deficiency in the "weather-control" program in the past has been the failure to measure the water content and droplet size distribution in clouds before seeding, due mainly to a lack of suitable instruments. It is expected that future cloud-seeding experiments will utilize instruments of the type discussed in the next article in this issue. (Maj. A. M. Longacre, Hq., AWS; based partly on "Ice in the Atmosphere" by G.M.B. Dobson in Quarterly Journal Royal Met'l. Society, April 1949.)

PROGRESS IN ICING RESEARCH (U&R)

INTRODUCTION (U)

Progress in icing research up to 1946 is well presented by an article in the June 1946 Bulletin AMS by Dolezel, Cunningham, and Katz. Since that time, laboratory, mountain station, and flight observation research has resulted in a large amount of additional data and some new theories.

It will be of interest to review here the accepted principles of cloud physics and icing:

1. For a given amount of liquid water per cubic meter of air, the amount of rime deposited on a stationary cylinder is a function of the wind velocity, droplet size, and the diameter of the cylinder. The combination of high wind velocity, large drops, and a small cylinder is most favorable for ice accretion. No cylinder will have a perfect collection efficiency, for that would require a zero diameter. The same principles apply to a cylinder moving relative to the air, as on aircraft, or the leading edge of a wing.

2. The severity of icing in the clouds of unstable air masses is due to the increased water content and larger droplet size possible with vigorous convection. The air enters the base of such clouds from below and condensation starts at a uniform height (which accounts for the flat base usually observed); the higher portions have been lifted through greater distances and cooled by greater amounts. Also droplets at higher levels have had time to grow to larger size, provided the vertical velocities are sufficient to sustain them. Consequently, within certain limits the liquid water content increases with height in convective-type clouds, and in turn icing severity increases with height and decreasing temperatures. However, the liquid water content never reaches the theoretical maximum value, possibly due to entrainment of drier air.

3. In stable clouds the amount of lifting and cooling is nearly the same for all portions of the cloud layer. The cloud extends itself upward, downward, and/or laterally through the air as the air moves. Most layer clouds have small vertical motion within the cloud so that the tendency for lower water content at lower temperatures is more than balanced by effects of vertical motion and mixing, but in comparing layer-type water clouds at low temperatures and convective-types at higher temperatures, the former will usually have lower liquid water content.

4. At a temperature of -12°C the maximum difference in vapor pressure between ice and water occurs. At that temperature, most rapid growth of ice crystals and most rapid withdrawal of water by precipitation occur. There is a slight dip toward a minimum at this temperature in the observed probabilities of icing in clouds.

Ideas of a more controversial nature have been formulated in the last several years:

1. Because definite substances are necessary to act as nuclei for crystallization, the presence of water droplets or ice crystals at any particular height above the freezing level depends on this unknown factor. It is especially dangerous to draw conclusions from observations over land and apply them to conditions over oceans where freezing nuclei are apparently more scarce.

2. A critical vertical velocity is found for the coexistence of water droplets and ice crystals. In layer clouds or in slowly rising air currents, coexistence of ice and water is unlikely except near the freezing level where the vapor pressures of ice and water are nearly or exactly equal. The top of the cloud must eventually be composed of ice crystals, but if the cloud forms in a current deficient in freezing nuclei, the top parts may exist as a water cloud for quite some time. In strong vertical currents ice and water particles can exist to high levels because there is little time for the ice crystals to take up the water droplets by sublimation or coalescence.

3. Observations and theoretical considerations indicate that continuous severe icing cannot occur in an extensive cloud mass giving simultaneous widespread, steady precipitation. This is because of the depletion of water content by precipitation and the widespread ice crystal distribution above the freezing level, as indicated by uniform low vertical velocities and the presence of precipitation. Low pressure areas having general convergence may have isolated cumulus towers in which severe icing of short duration may occur.

The main research in cloud physics and icing in the last several years has been conducted by the following agencies:

1. General Electric Company, sponsored by Signal Corps, Navy, and USAF. Personnel: Langmuir, Schaefer, Vonnegut.

2. MIT Weather Radar Unit, sponsored by Signal Corps, Navy, and USAF. Personnel: Cunningham, Miller.

3. Mt. Washington Observatory, sponsored by USAF, AMC. Personnel: Howell, R. Wexler.

4. NACA - Ames Aeronautical Laboratory and Flight Propulsion Research Laboratory, with the cooperation of the USWB and USAF. Personnel: Lewis, Kline, Hoecker.

5. USAF and Navy tests on Mt. Washington.

6. Smith, Hinchman and Grylls, Detroit and Minneapolis, sponsored by USAF. Personnel: Potter, Brock.

GENERAL ELECTRIC COMPANY (U)

Besides the widely publicized cloud-seeding experiments, the General Electric group has performed basic research in cloud physics and icing phenomena. Recently the main work has been in connection with freezing nuclei, discussed in the preceding article, "Cloud Modification Principles Outlined." In addition, development of equipment useful in icing research has been carried out, the most important probably being the "vortex thermometer" for airborne use. The principle utilized in its operation is that the aerodynamic heating experienced by thermometers exposed from airplanes can be very nearly eliminated over a wide range of operating conditions by mounting the thermometer in the center of an air vortex created by a simple spherical housing. The instrument holds promise as a means for measuring accurate temperatures in clouds. Rotational velocities of air circulated through the instrument are sufficiently large so that it is believed the high centrifugal force will prevent cloud particles from depositing on the thermometer in the center of the vortex, thus eliminating any errors which might be caused by evaporation or freezing of water on the thermometer. This instrument is being tested by the Signal Corps and the USAF.

A method which may improve the measurement of drop sizes in rain and clouds is the use of a sooted screen which will register a mark of proper size for each drop as it passes through. A water drop will pass through the screen with a minimum of splash and not flatten or spread out laterally to the degree it does when striking a hard, impenetrable surface. No satisfactory or indirect airborne method of drop-size measurement has heretofore been developed for use at temperatures above freezing. The indirect multi-cylinder method, based on the decrease of the collection efficiency of cylinders as the cylinder size increases, has been partially successful at freezing temperatures. The corona and visibility methods give only a crude indication of the average or predominant size.

MIT WEATHER RADAR UNIT (R)

In connection with weather-radar research MIT has developed instruments and collected some data of interest in icing research. A capillary collector was developed to measure liquid water content during flights through clouds and precipitation. Two collectors are used, the efficiency of the larger one, mounted on the nose of a B-17, is calculated on the assumption that it is a sphere whose diameter is that of the plastic nose of the aircraft. The efficiency of the small collector, mounted on a mast well out in the free air stream, is calculated by assuming it is a sphere whose diameter is equal to the outside diameter of the collector. The rate of collection is measured by an observer reading the position of the meniscus in calibrated glass tubing systems connected to the collectors. Average readings over 10-15 seconds are usually obtained. It has been found that the small collector retains most cloud water drops and all rain drops in its path, while the large one collects some of the larger cloud drops and most of the (rain) drops above 100 microns.

A disdrometer to measure droplet size distribution directly is being developed by MIT and also by the Naval Research Laboratory. Thus far, its operation has been disappointing, and it operates only in the range of rain drops. MIT has made several interesting icing runs which indicate that in warm-frontal clouds, aircraft icing is more likely in areas outside of the radar echo. A flight over Massachusetts in warm-frontal clouds was made 25 September 1947. The entire flight was made <u>between</u> two wide areas of radar echo. The diffuse base of the altostratus was entered at 13,500 feet and 0°C. As the aircraft climbed in a slow spiral, fine snow was picked up. Shortly afterward light icing, composed of a mixture of snow and ice on the leading edge of the wing, was encountered, and at 15,000 feet the plane passed through an area of freezing drizzle which rapidly covered the nose and windshield. At 16,000 feet (-7°C) the pilot decided the rate of icing made it inadvisable to attempt climbing further.

On 11 March 1948 another flight was made over Massachusetts in an area to the north of a frontal wave. At 8,200 feet (and -7° to -10°C), near the top of the radar echo region, an MIT icing-rate meter record was made and the results correlated with the radar picture. The icing rate became moderate or heavy only when the plane approached the top of the radar echo and in the weak portions of the echo. Runs at lower levels in the radar echo encountered snow with no icing. These observations suggested that the region above the echo consisted of a dense, supercooled cloud, the region of icing; below it was a region where the water drops were evaporating and the vapor recondensing as snowflakes. Below that, down to the ground, only snowflakes were present.

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS (NACA) (U)

During the past several years the largest program of actual flight tests in icing conditions was conducted under the supervision of NACA, using USAF aircraft, and meteorological personnel of the USWB. Instrumentation has improved each year. During 1948 the test aircraft were equipped with the following instruments for the measurement of meteorological and other factors related to icing:

1. Aircraft airspeed indicator and altimeter.

2. NACA airspeed and altitude recorder.

3. Thermocouple shielded against the accretion of ice, and millivoltmeter for measurement of free-air temperature.

4. Rotating multicylinders for the determination of liquid water content and mean effective drop size.

5. Cloud indicator.

6. Fixed cylinder for determination of maximum drop size.

7. Rotating disk icing-rate meter.

The functions of items 1, 2, 3, and 4 are well known. The cloud indicator (item 5) was developed to provide an instrumental means of supplementing visual observations of the time of entering and leaving clouds and the patchy or uniform characteristics of the cloud masses. This instrument consists of a heated cylinder, 5/8 inch in diameter, exposed at right angles to the air stream and with a thermocouple installed to measure the surface temperature of the cylinder at the stagnation point. To provide a continuous surface-temperature record, the thermocouple is connected to a self-balancing potentiometer equipped to provide a continuous ink trace of the variations in temperature. In use, the heating power supplied to the cylinder is adjusted to maintain a surface temperature of from 170°F to 200°F when not in a cloud. Immediately upon entering a cloud, the temperature drops very rapidly, sometimes by as much as 50°F in one second. Similarly, a rapid rise of temperature is observed on leaving a cloud. Small areas of clear air within a cloud and variations of cloud density are indicated by irregularities in the temperature trace. The instrument is more sensitive to liquid-water drops than to snow, thus making it possible to identify regions containing liquid water in a continuous snow cloud.

The fixed cylinder for determination of maximum drop size (item 6) permits the determination of the angular extent of ice collected on a stationary cylinder five inches in diameter. With this information the diameter of the largest drops present in significant quantity can be calculated. This diameter usually approximates the mean effective drop size, indicating that the water droplets accounting for most of the water content fall within a narrow range of size.

The rotating disk icing-rate meter (item 7) is a modification of the instrument first developed by the Massachusetts Institute of Technology, but the magnetic method of measuring thickness of the ice on the edge of the disk has been replaced by a mechanical and optical system. The disk, calibrated to give total ice accumulation and average rates of ice accumulation and water content, is rotated by a variable speed motor and operates so the ice film is cut off on each rotation. The ice accumulation is in terms of the thickness of ice which would form on a fixed object having the same average collection efficiency as the disk. The liquid water content is calculated by using the average collection efficiency -- ice density ratio under average conditions.

Only the results of the 1948 flights are given here because instrumentation in earlier years was not complete. In 1948 the test aircraft was operated a total of 51 hours in continuous cloud, or areas where cloud predominated, at temperatures below freezing. Much of the flying was in frontal zones and in low pressure areas. The data show the comparative scarcity of extensive areas of icing in continuous cloud. More significant is the scarcity of severe icing in continuous cloud formations. Since it is well recognized that cumulus towers often contain severe icing but that the duration is usually short and can rather readily be avoided, only the results of icing in continuous cloud areas are shown. Table I lists the 10 cases in which the maximum duration of icing occurred. In each case the cloud particles were liquid or liquid and snow with liquid predominating.

It will be noted from Table I that the layer-type clouds in all cases have a low average liquid water content, which means a low icing rate. Most pilots are concerned lest they encounter areas of continuous icing with a high rate of accretion.

Pilots who encounter icing areas must decide whether to ascend, descend, proceed straight ahead, or execute a turn to find ice-free areas. The NACA unit was not concerned in these tests with finding the variation of icing severity with height within a cloud. However, previous theoretical and experimental work, especially by Diem, has established that in a continuous water cloud, liquid water content and icing increase with height. The data of Table II (from the first three flights of Table I) give some indication of the natural variation horizontally and vertically of liquid water content in layer-cloud systems but not within one cloud. Except for the rules to escape freezing rain, it is clear, then, that no set procedure can be recommended to escape icing areas in layer-cloud systems. Proper action by the pilot must be based on a knowledge or intelligent estimate of temperature and cloud structure in the area.

Statements have been made, based on NACA data, that above areas of widespread precipitation only light icing is to be expected. This notion is based on the idea that large areas of ice crystal cloud are necessary for widespread precipitation and that the precipitation depletes the water content of the clouds. However, areas of widespread precipitation are often also areas of convergence in which altocumulus-type clouds with cumulus towers are common. The icing to be expected cannot safely be assumed to be less than that shown in Table I -- light to moderate.

USAF AND NAVY TESTS ON MT. WASHINGTON (R)

Particular attention during the past few years has been given to jet engine icing. Engine icing is very dangerous to jet aircraft because ice forms on the entrance vanes and rotor blades of the power plant, gradually closing off the openings so that less air can get in to the turbine blades.

Test engineers of Navy and Air Force agencies and their contractors found at Mt. Washington that axial flow turbojet engines iced up far worse than centrifugal flow types. While it is possible to ice a centrifugal flow engine on the test stand, the icing conditions must be extremely severe. Therefore, in the case of the centrifugal type, wing icing is the most serious problem when no wind anti-icing protection is used.

TABLE I

Flight No.	Maximum Duration of Continuous Icing (min.)	Total Ice during Continuous Icing* (in.)	Cloud Type	Average Liquid Water Content (g/m^3)	Location and Remarks
202	20.8	0.64	Ac	0.16	Northern California and western Oregon. Entire flight in frontal zone. Observations mostly in warm air mass above occluded front. Last three observations in cold air behind front.
193	15.9	0.50	Ac	0.15	Michigan. Altocumulus along cold front near Detroit. Stratocumulus in cold air mass following front.
170	7.0	0.23	Ac-As	0.25	Southwestern Washington, western Oregon, and offshore along Oregon coast. Stratiform clouds in area of convergence soutn of low center.
196	6.9	0.34	Ac		Southern Wyoming. Post-cold-frontal conditions with northwesterly flow. Low over Iowa.
152	6.5	0.78	Cu	0.55	Central California, Sierra Nevada and coastal mountains. Post-cold-frontal cumulus clouds.
183	6.4	0.27	Ac-As	0.24	Northwest of Seattle. Complex cloud system in southwesterly flow ahead of low pressure area.
203	5.9	0.19	Ac-As	0.13	Western Oregon. Weak high-pressure wedge. Cold front over Wyoming.
198	5.7	0.17	Ac	0.13	Northern California, western Oregon, and western Washington. Prefrontal cloud system in advance of low center 800 miles west of Seattle.
199	5.5	0.27	Ac-As	0.21	Northwest of Seattle. Prefrontal precipitation area. Low center off the coast of British Columbia.
174	4.9	0.86	Cu	0.85	Central California near Mt. Diablo. Heavy cumuli without precipitation about 15 hours after cold front passage.

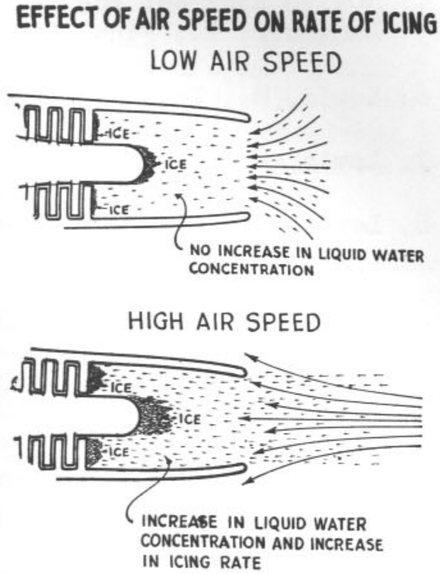
*"Total ice" is the thickness of ice which would form on a fixed object having the same average collection efficiency as the disk on the icing rate meter (1/8" d.).

TABLE II

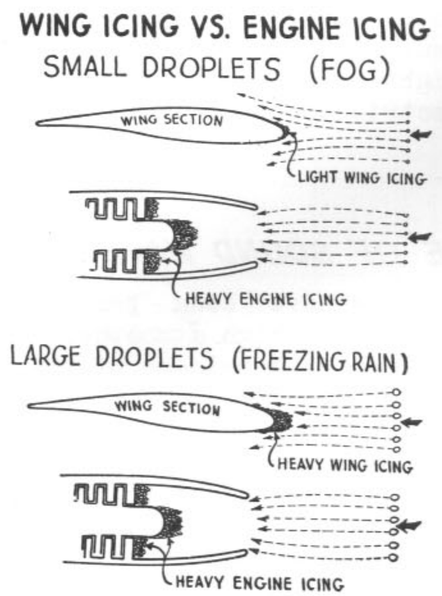
Flight No.	Total No. of Instances of Icing	Maximum Liquid Water Content Averaged over Various Elapsed Time Intervals (g/m^3) 10 sec.	1 min.	5 min.	20 min.	Time of Reading	All Measurable Readings of Average Water Content during Icing (g/m^3)	Duration of Rotating Cylinder Exposure (sec.)	Pres. Alt. (ft.)	Temp. (°F)	State of Cloud Particles	Cloud Type
						1445	0.06	193	19,700	-1	L	Ac
						1459	0.06	173	19,500	1	L	Ac
						1507	0.08	160	20,000	-2	L	Ac
						1526	0.10	178	19,900	-1	L	Ac
						1534	0.14	198	19,600	0	L	Ac
202	77	.37	.33	.19	.122	1541	0.12	212	18,600	3	L	Ac
						1549	0.14	189	19,000	4	L	Ac
						1559	0.11	204	18,900	5	L	Ac
						1606	0.07	202	18,800	5	L	Ac
						1743	0.24	210	11,000	13	L	Ac
						1746	0.22	200	10,000	16	L	Ac
						1812	0.07	206	13,000	3	L	Ac
						1122	0.31	170	10,000	25	L	Ac
						1130	0.30	168	9,900	25	L	As
193	27	.40	.28	.23	.17	1142	0.25	194	11,100	16	L	Ac
						1222	0.28	164	5,800	25	L	Sc
						1253	0.29	164	4,300	23	L	Sc
						1258	0.13	169	4,200	19	L	Sc
						1330	0.02	168	10,000	15	MS	Ac-As
						1333	0.03	161	10,100	15	MS	Ac-As
						1345	0.11	190	10,000	15	ML	Ac-As
						1353	0.07	179	10,200	14	ML	Ac-As
						1356	0.12	175	10,300	13	ML	Ac-As
						1406	0.12	183	10,200	14	ML	Ac-As
170	22	.52	.45	.28	.10	1420	0.08	184	9,900	13	ML	Ac-As
						1426	0.06	188	10,100	14	L	Ac-As
						1434	0.03	180	10,150	14	ML	Ac-As
						1445	0.34	169	6,800	24	ML	Sc
						1449	0.06	163	6,500	26	L	Sc
						1452	0.22	164	6,900	24	ML	Sc
						1457	0.32	189	6,400	24	L	Sc
						1551	0.03	190	8,700	16	ML	Sc
						1553	0.19	194	8,300	16	L	Sc

L = Liquid
MS = Mixed, snow predominating
ML = Mixed, liquid predominating

The axial flow turbojets are the new, long, lean types used in the higher-powered jet planes. Ice on the inlet guide vanes cuts the air flow, reducing thrust and boosting temperatures. The Mt. Washington tests established that the rate of engine icing generally is in proportion to the air flow, which in turn is controlled by engine RPM. Thus, to cut icing, one should reduce the engine RPM. At low air speeds, air is sucked into the inlet duct; at high air speeds it is rammed into the inlet. During the suction process there is little change in the concentration of liquid water in the inlet duct over that of the atmosphere. At higher speeds, when the air is rammed into the engine inlet, most of the water droplets suspended in the atmosphere ahead of the inlet go through the inlet duct while some of the air sluices around it. Therefore, a reduction of air speed below the critical speed of about 250 knots true air speed will reduce icing.



Wing icing varies with the amount of liquid water in the air <u>and</u> the size of the water droplets. Engine icing is dependent primarily upon the water concentration and is almost independent of the droplet size. Because of the deflection of small droplets by the wing, wing icing will be lighter for small droplets, but engine icing will be constant for equal liquid water content. Therefore, noting the icing on surfaces of small radius (such as the leading edge of the tail surface rather than the wings) would be a good indication of icing which may affect the engine.



The jets now in normal operation cannot be flown so fast that the ram temperature of the air will be high enough to melt engine or wing ice. In isolated instances where jets have flown through icing areas at speeds up to 400 knots, an extremely serious form of wing icing and near loss of aircraft control resulted. In each of these instances, the centrifugal flow engine was involved and no engine icing was noted. (Major A. M. Longacre, Hq., AWS.)

REFERENCES

1. Arenberg, D., Icing on Aircraft, <u>WSB</u>, December 1943.
2. Cunningham, R. and Miller, R., Five Weather Radar Flights, <u>Technical Report No. 7</u>, Weather Radar Research Unit, MIT.

3. Jones, A. and Lewis, W., Recommended Values of Meteorological Factors to Be Considered in the Design of Aircraft Ice-Prevention Equipment. NACA TN 1855, 1949.
4. How to Lick Jet Engine Ice, Naval Aviation News, December 1949. (R)
5. Langmuir, I., Final Report on Icing Research, General Electric Co., October 1945.
6. Lewis, W., Icing Properties of Non-Cyclonic Winter Stratus Clouds, NACA TN 1391, 1947.
7. Lewis, W., Icing Zones in a Warm Front System with General Precipitation, NACA TN 1392, 1947.
8. Lewis, W., A Flight Investigation of the Meteorological Conditions Conducive to the Formation of Ice on Airplanes, NACA TN 1393, 1947.
9. Lewis, W., Kline, D., and Steinmetz, C., A Further Investigation of the Meteorological Conditions Conducive to Aircraft Icing, NACA TN 1424, 1947.
10. Lewis, W. and Hoecker, W., Observations of Icing Conditions Encountered in Flight during 1948, NACA TN 1904, 1949.
11. Murray, Major J., Aircraft Operation in Natural Icing Conditions, CADO Technical Data Digest, 15 December 1949.
12. Taylor, B. and Serbein, O., Temperature and Probability of Icing in the Alaskan-Aleutian Area, Bulletin AMS, December 1946.
13. Blanchard, D., The Use of Sooted Screens for Determining Raindrop Size and Distribution, Occasional Report 16. Project Cirrus, General Electric Co.
14. Vonnegut, B., Vortex Thermometers for Measuring True Air Temperatures and True Air Speeds in Flight, Occasional Report 14, Project Cirrus, General Electric Co., September 1949.

PROBING THE STRATOSPHERE BY USE OF SOUND WAVES (R)

Although various experiments and calculations have been performed to determine the properties of the stratosphere and high atmosphere at levels above those reached by radiosonde instruments, knowledge of these regions is still very sketchy.

One procedure for experiments of this kind is to measure the time required for a sound of great magnitude to travel to recording points located at various distances and directions from the point of origin of the sound. This has been done heretofore in mid-latitudes only.

In an effort to obtain information on the upper atmosphere in the high latitudes, the USAF Cambridge (Mass.) Research Laboratory (AMC) transferred personnel and equipment from similar tests in the ZI to Fairbanks, Alaska, in the latter part of January 1948. Results of the Fairbanks tests have been compiled and recently released in AMC Geophys. Res. Dir., Technical Report No. 40, Part III, written by Mr. A. P. Crary.

The required sound for each of the 11 tests was obtained by electrically detonating a TNT explosive charge (ranging from 140 to 500 pounds each) at a prearranged time. The operating sites, nine in all, consisted in each case of five microphones in the form of a cross, with the two lines at right angles and from 250 to 300 meters long. Five of these sites were on or near air strips, three along the Alcan Highway, and one located just south of Fairbanks at a CAA station.

Azimuths of all incoming signals were obtained from the ratio of the time differences between the two right-angled lines, their apparent velocities being found by use of the time differences across either of the lines. Thus for each signal received, the travel time, distance, apparent velocity, and azimuth are found.

The computations of the sound travel make use also of the concurrent lower-level meteorological observations for the area, consisting of winds and temperatures from the surface level to as high an altitude as (raob) data were available. The velocity-height relations were determined for the various sound waves travelling between the source of the explosion and each recording site. At each site, a surface velocity was obtained

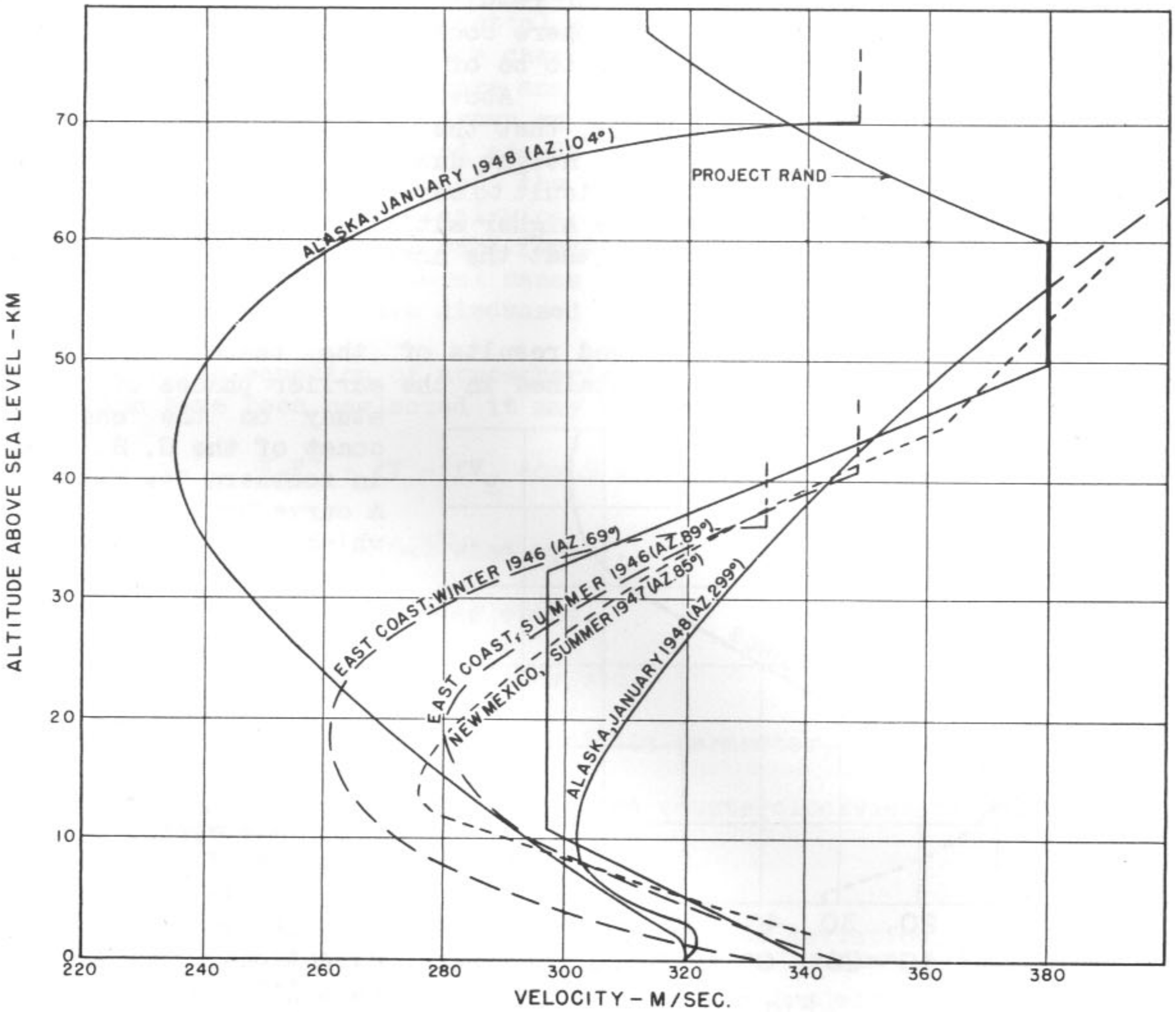


Fig. I

Variation of Compressional Wave Velocity with Altitude (Averages of Tests).

for each test by firing detonators at known locations in the spread and measuring the travel times directly. From the apparent velocities and the measured surface velocities, the angles of ascent and descent of the refracted compressional wave signals were obtained. Using these vertical angles, the travel time and horizontal distances covered for the waves traveling in the lower layers where meteorological conditions were known were subtracted from the total travel time and distance for each signal. The resulting remainders then pertained only to the paths traversing the stratosphere.

A large number of signals were received with apparent velocities ranging from the surface velocity, 320 mps to about 405 mps. After correction for effect of the lower atmosphere, it was evident that some of the signals were direct troposphere-refracted signals and the rest had been refracted through the stratosphere.

Significant variations were noted in time of arrival of the signals at stations to the east as compared with those to the west of the point of the sound origin. A summary of results indicated that relatively strong westerly winds in the stratosphere could account for the differences noted. These winds would need to be of the order of 60 mps or 135 mph at the approximate level of 50 km. Above this, at about 70 km, it seems likely, according to Mr. Crary, that the west wind decreases quite rapidly, although errors in computed height due to uncertainty about the precise distances make it quite difficult to establish quantitative estimates of the winds obtained at these higher altitudes. A study of the azimuth shifts obtained indicates that the north-south wind components were probably negligible.

In Fig. 1 are shown the averaged results of the tests. Indicated for comparison are the results obtained in the earlier phases of this study on the eastern coast of the U. S. and in southern New Mexico. A curve for latitude 45° which was compiled from other sources by USAF's Rand Project is also included. Fig. 2 shows the temperature-height distribution obtained from the average of the sound-velocity structures. On the same graph are the upper-atmosphere winds computed from the differences in the sound velocities in the two directions. (Based on Part III, Technical Report No. 40, Geophysical Research Directorate, Cambridge Field Station.)

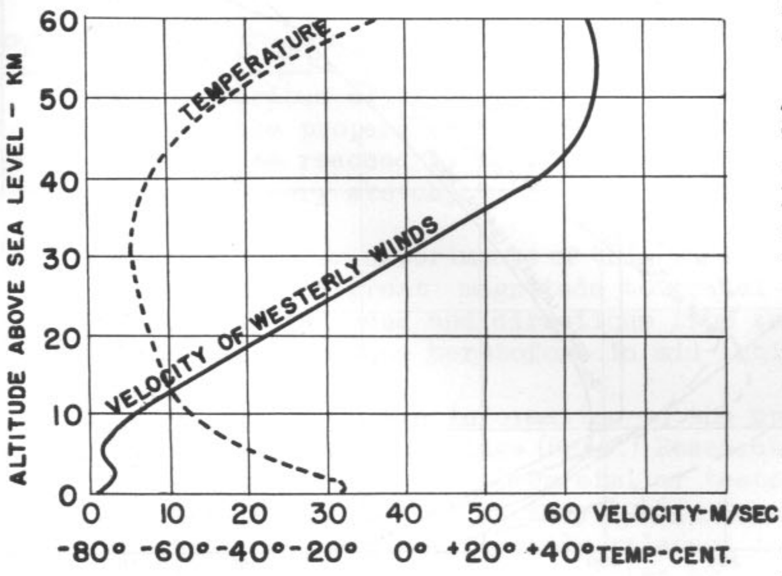


Fig. 2

Variation of Temperature and Variation of Westerly Winds with Altitude.

• TECHNICAL CONTRIBUTIONS •

AWS personnel are encouraged to experiment in their daily work in an effort to improve existing techniques and report on the results. Such reports received by Hq., AWS, and considered worthy of publication appear in this section of the WSB.

ON ANOMALOUS WINDS IN THE FREE ATMOSPHERE (U)

During the year beginning May 1948, a research investigation of upper level winds was carried out by U.C.L.A. under the sponsorship of Geophysical Research Division, Air Materiel Command. (Ref. WSB No. 7, p. 16.) One of the problems investigated was that of approximating upper winds from the pressure field when the latter is presumed to be known. As one approach to the solution of this problem, the equations of atmospheric motion corresponding to prescribed pressure-field models were integrated by means of a differential analyzer. In addition to this theoretical approach actual upper-air charts for which a great number of wind observations were available were analyzed. Streamlines and isotachs (lines of equal wind speed) were drawn on these charts and compared with the geostrophic streamlines and speeds represented by the constant-pressure contour lines. On some of the analyzed charts very large persistent deviations between the actual-wind streamlines and the corresponding geostrophic-wind streamlines were found. Also found in connection with these large deviations were several cases of "abnormal" winds, the meaning and significance of which are discussed here.

From the equation of atmospheric motion in which the effects of friction have been neglected it may be shown that

$$K_H V^2 + fV = fV_g \cos \beta + 2w\Omega \cos \phi \sin \psi, \quad (1)$$

where:

V = horizontal wind speed,

w = vertical wind speed,

V_g = geostrophic wind speed,

$f = 2\Omega \sin \phi$ = the Coriolis parameter,

ψ = wind direction measured counterclockwise from due east,

ψ_g = geostrophic wind direction,

$\beta = \psi - \psi_g$ = angle of geostrophic deviation, and

K_H = "horizontal" curvature* of the trajectory (positive for cyclonic, negative for anticyclonic).

*See Holmboe, Forsythe, & Gustin: Dynamic Meteorology. Sec. 707, p. 178.

In middle and high latitudes and for large-scale motions, the last term in equation (1) is usually very small compared to the other terms and may, therefore, be neglected without appreciable error. The resulting equation,

$$K_H V^2 + fV = fV_g \cos \beta = b_n, \tag{2}$$

is quadratic in V and therefore has the solutions:

$$V_1 = -\left(\frac{f - \sqrt{f^2 + 4b_n K_H}}{2K_H}\right) \tag{3}$$

$$V_2 = -\left(\frac{f + \sqrt{f^2 + 4b_n K_H}}{2K_H}\right) \tag{4}$$

Since V is the magnitude of wind velocity, it must always be a positive quantity. The solution, V_2, therefore, can only have physical meaning when K_H is negative (i.e., when the horizontal curvature is anticyclonic).

From equations (3) and (4) it can easily be seen that:

$$K_H V_1 \geqq -\frac{f}{2}, \tag{5}$$

$$K_H V_2 \leqq -\frac{f}{2}, \tag{6}$$

and hence from equation (2) that

$$V_1 \leqq 2V_g \cos \beta , \tag{7}$$

$$V_2 \geqq 2V_g \cos \beta . \tag{8}$$

Winds whose speeds satisfy the relations (6) or (8) will be called anomalous.* (Antibaric winds for which $\cos \beta < 0$ are obviously extreme cases of anomalous winds.) Anomalous winds have been observed in small-scale atmospheric disturbances, for example in anticyclonic dust whirls. They are not, however, generally believed to occur in large-scale atmospheric motions, and the solution, V_2, is usually discarded, as for example in the derivation of the formula for the gradient wind speed.

The occurrence of anomalous winds could be verified using the trajectory of a constant-pressure balloon such as described by A. Spilhaus**

*In Dynamic Meteorology, Holmboe, Forsythe, and Gustin refer to such winds as "abnormal." The term "abnormal," however, has popular connotations which do not quite describe this phenomenon. The alternate term "anomalous," therefore, seems preferable.

**Controlled-altitude free balloons, J. of Met., Vol. 5, No. 4 (1948).

et al., provided the successive positions of the balloon were determined accurately enough to obtain reliable values of $\underline{K_H}$ and $\underline{V}$. Until this can be done, however, anomalous winds must be identified indirectly using the relation (8).

This indirect means of identification requires that geostrophic winds be determined with sufficient accuracy to permit quantitative comparisons between them and observed winds. Ordinarily this cannot be done. Isolated instances of wind speeds greater than $2V_g \cos\beta$, therefore, cannot be used as proof of the occurrence of anomalous winds. On the other hand, if several wind speeds greater than the computed values of $2V_g \cos\beta$ are found consecutively at the same locations relative to a moving system, it is unlikely that all these cases are due to errors in the determination of the geostrophic wind.

The 700-mb streamline and contour analyses for 1500Z, 2 April, and for 0300Z and 1500Z, 3 April, are shown in Figs. 1, 2, and 3, respectively. This situation was chosen primarily for the great number of wind observations which were available. Because of the dense network of wind reports, fairly reliable independent streamline analyses could be made.

The contours were drawn in the usual fashion making use of the wind directions to the extent that the reported contour heights are not violated. Relative to the moving contour ridge and to the right of the geostrophic wind maximum (i.e. where the horizontal shear of the geostrophic wind is anticyclonic), the pattern of geostrophic deviations is the same on each of the three charts. These deviations are positive to the west of the ridge and negative to the east.

This same pattern of geostrophic deviation was also found in the trajectories given by the differential analyzer as solutions to the equations of motion for a moving sinusoidal pressure field model with strong horizontal shear of the geostrophic wind. It may, therefore, be typical of the wind flow associated with such moving contour configurations.

It can be shown that the isallobaric field associated with a moving pressure wave having an anticyclonic shear of the geostrophic wind is such as to give an isallobaric wind component in the same direction as the ageostrophic components found in these examples. The stronger the shear and the more rapid the movement of the system, the larger will be the isallobaric component. Other effects, such as fanning or convergence of the contours or vertical motions, may also give rise to accelerations and hence to ageostrophic wind components. In some cases these effects might be such as to cancel the effects of the isallobaric field.* In the case of rapidly moving, well-developed waves with strong horizontal geostrophic

*In other cases the fanning or convergence of the contours may be such as to reinforce rather than to cancel the isallobaric effect. East of the ridge on the chart for 1500Z, 3 April, for example, the convergence of the contours would tend to reinforce the isallobaric effect producing positive angles of geostrophic deviation.

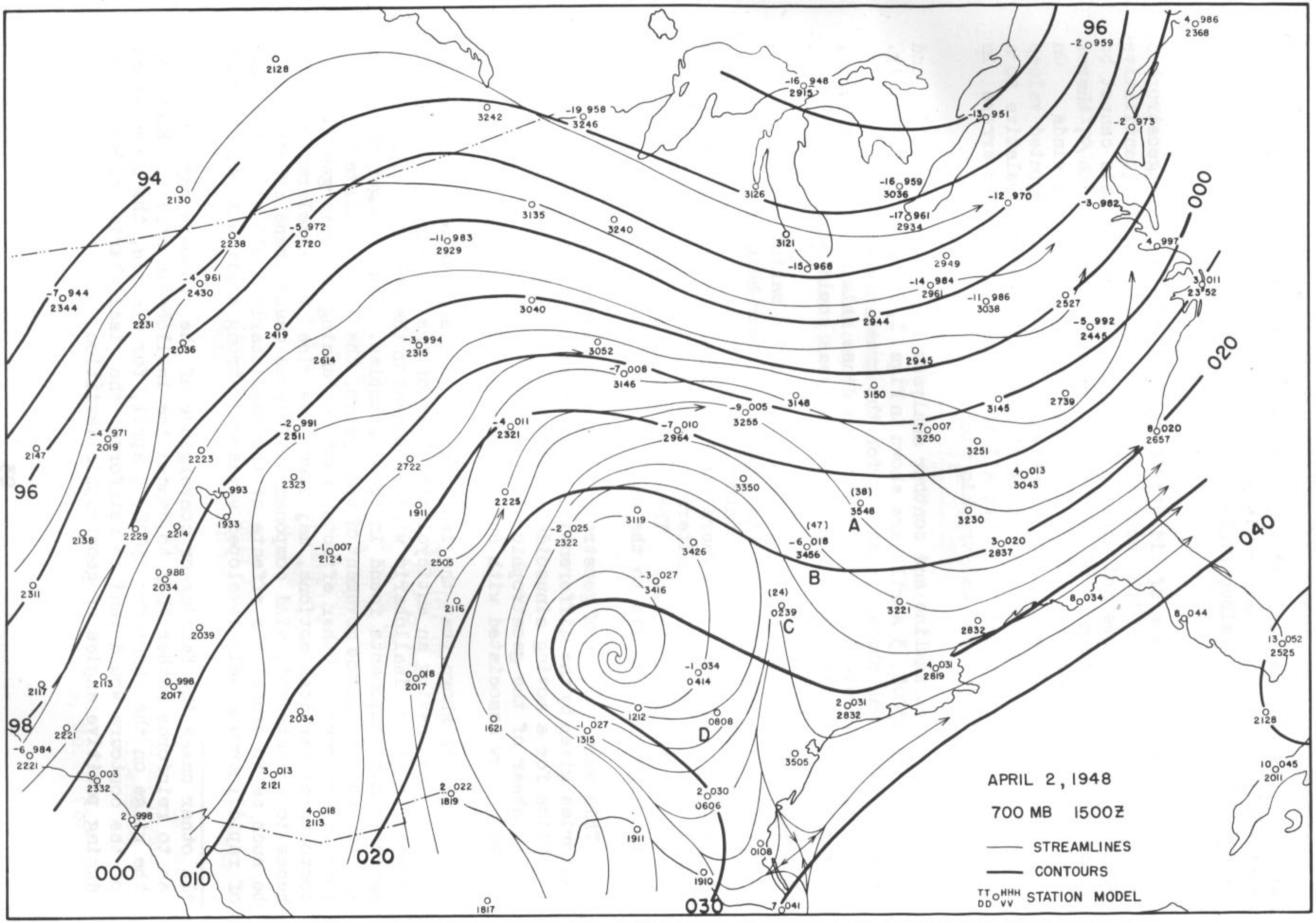

APRIL 2, 1948
700 MB 1500Z
STREAMLINES
CONTOURS
TT HHH DD VV STATION MODEL
94
96
98
000
010
020
030
040
A
B
C
D
(38)
(47)
(24)

Fig. I

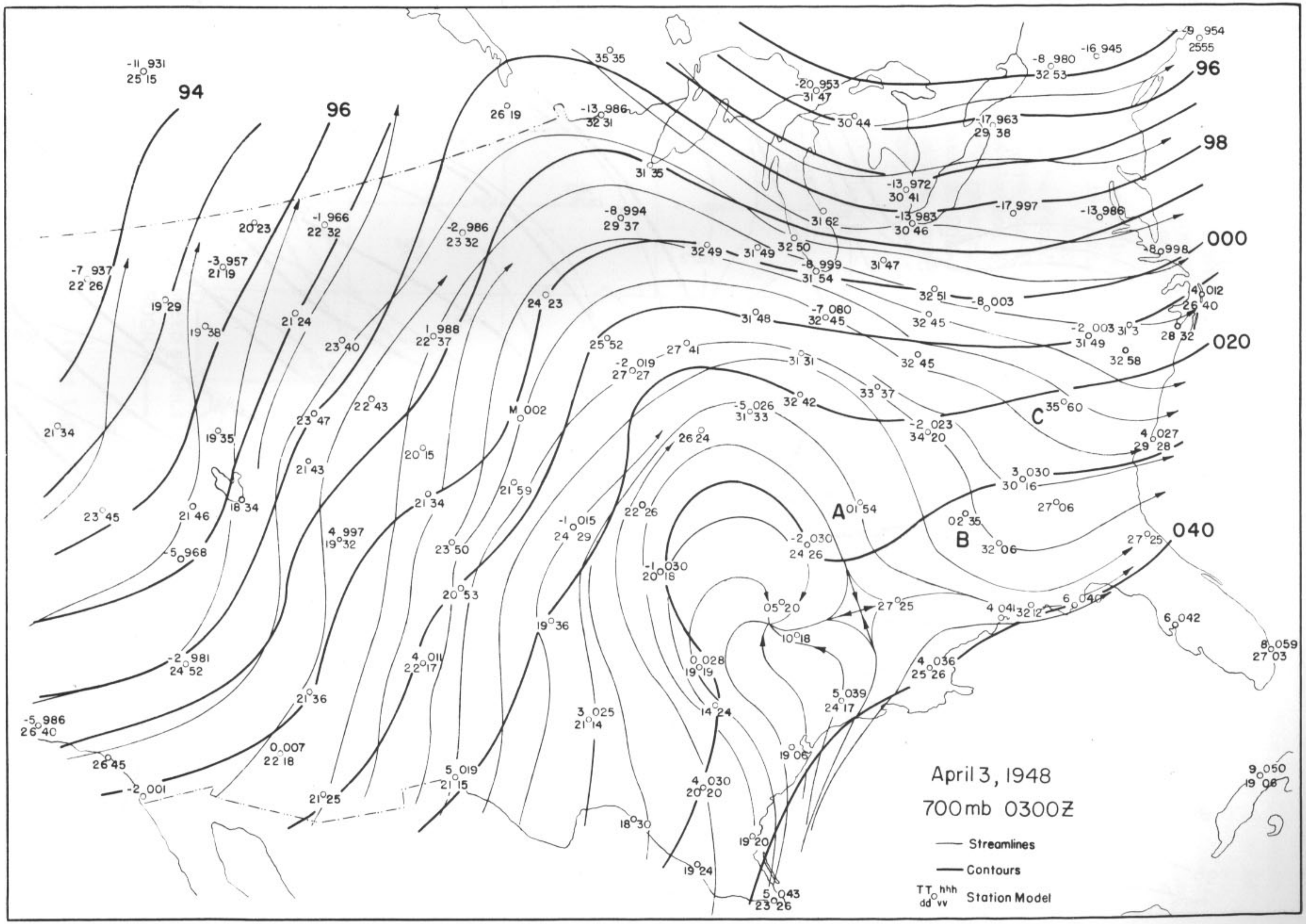

April 3, 1948
700mb 0300Z
Streamlines
Contours
Station Model
94
96
98
000
020
040
A
B
C

Fig.2

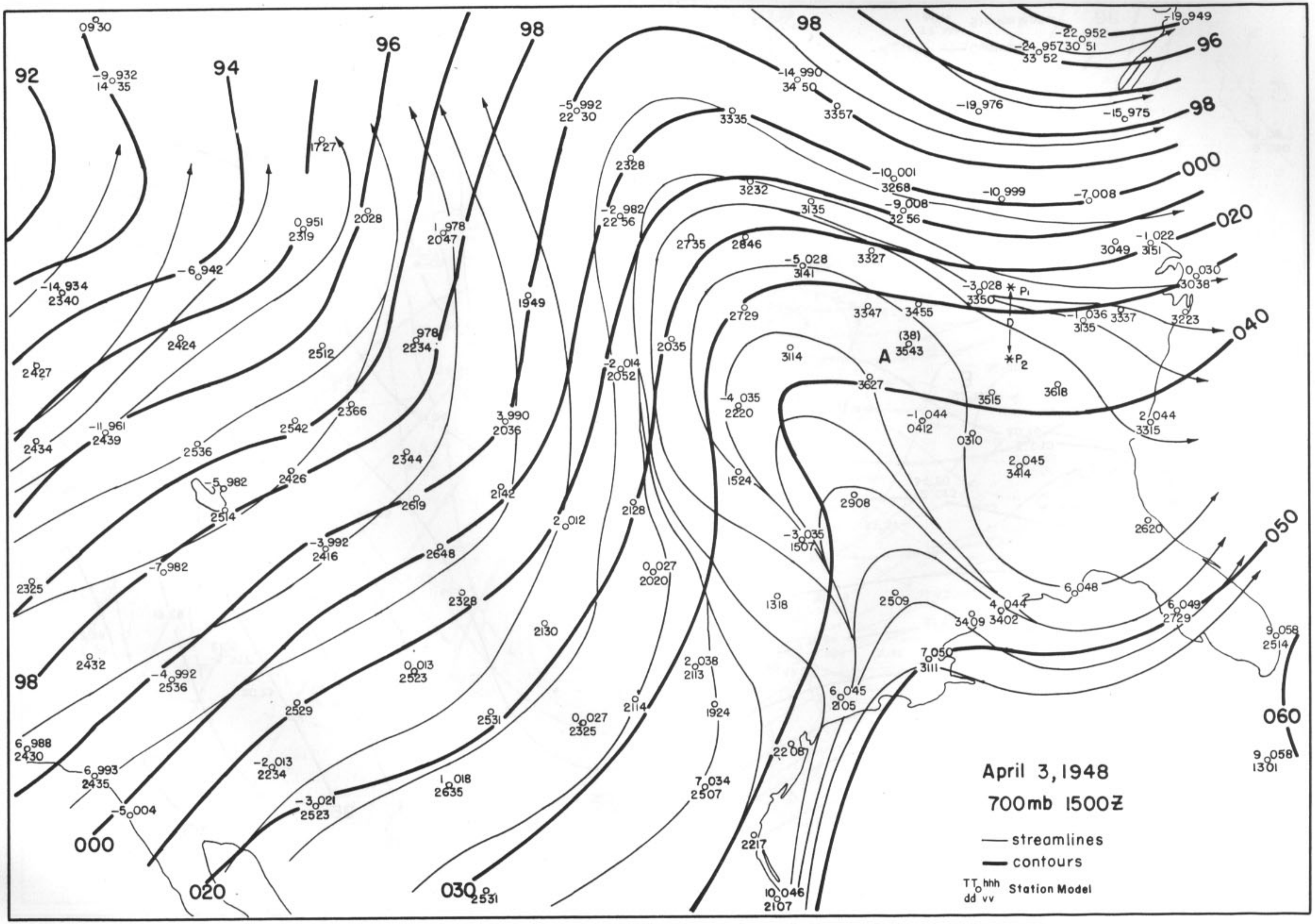

April 3, 1948
700mb 1500Z
streamlines
contours
Station Model

Fig.3

wind shear such as the ones shown in Figs. 1-3, however, the isallobaric effect could be expected to dominate. Once the cross-contour flow is started, the presence of a strong anticyclonic geostrophic shear has the effect of further magnifying the deviations. Cyclonic shear, on the other hand, tends to suppress the deviations from gradient flow produced by the effects of isallobars, contour fanning, etc.

In the solutions given by the differential analyzer, large angles of geostrophic deviation were found to be associated with cases of anomalous wind speeds. Hence it was expected that occurrences of anomalous winds might also be found associated with the large angles of deviation on the 700-mb charts for 2 and 3 April. Looking at Fig. 1, we see that at Little Rock (Station B), for example, the reported wind speed is 56 mph, whereas the geostrophic wind speed given by the spacing between the 10,100- and 10,200-foot contours is about 27 mph.* The angle of geostrophic deviation here is estimated as about 30° so that $2V_g \cos \beta = 47$ mph. Little Rock, which is a rawin station, is therefore reporting a wind

*The solution, $\underline{V}_1$, in this case would have given: $V_1 = 40.5$ mph.

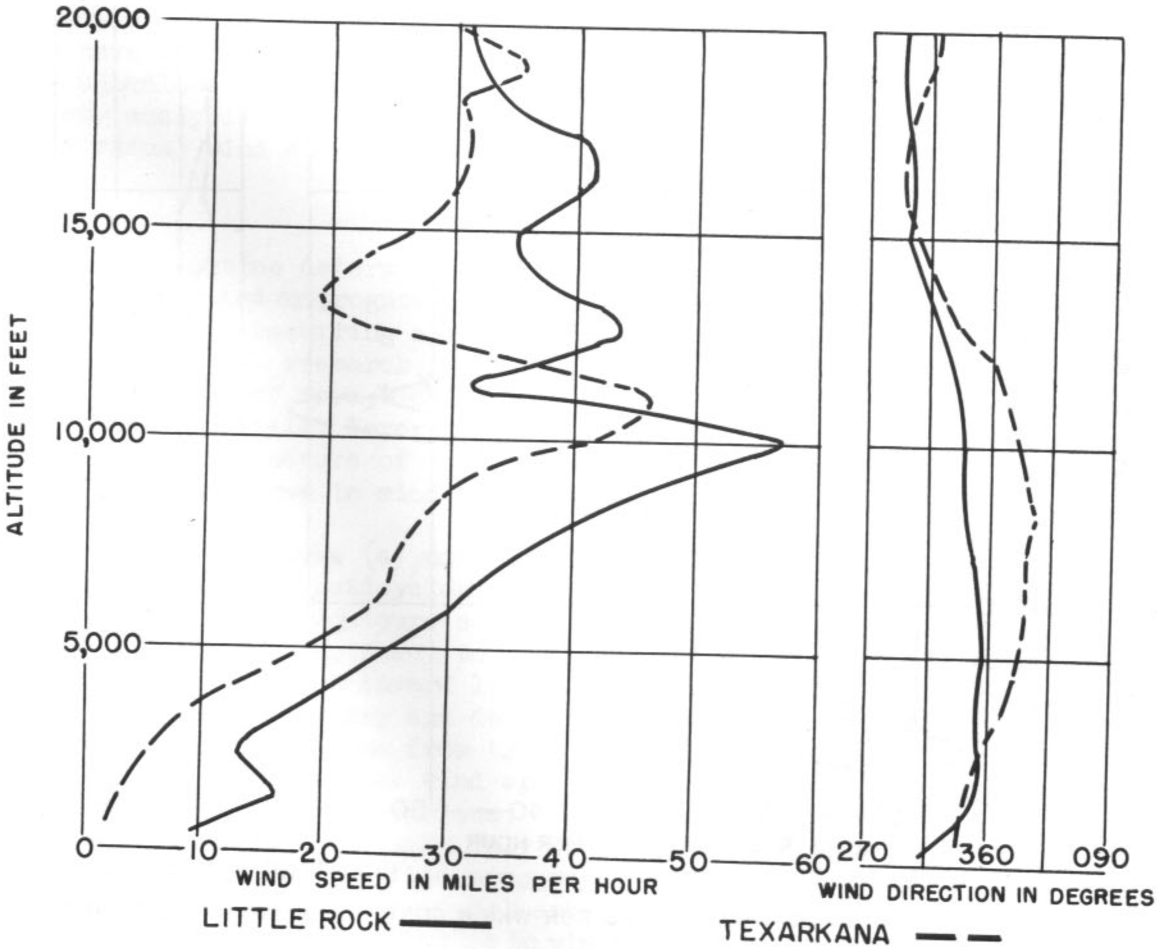


Fig. 4

Comparison of Wind Velocity at Little Rock and Texarkana, 1500Z, 2 April 1948.

speed which is anomalous. On the same chart Memphis (Station A: $V = 48$ mph, $2V_g \cos \beta = 38$ mph) and Texarkana (Station C: $V = 39$ mph, $2V_g \cos \beta = 24$ mph) are also seen to be reporting wind speeds which are anomalous. Similarly, in Fig. 2 Memphis (A), Birmingham (B), and Spartanburg (C) were reporting anomalous wind speeds as was Louisville (A) in Fig. 3.

The question might be asked as to how these anomalous wind speeds come about. A possible explanation is that <u>due to very rapid local changes in the pressure gradient (as represented by strong isallobaric gradients), winds which formerly experienced strong pressure gradients find themselves in weaker ones</u>. An adjustment towards lower speeds begins the moment the winds turn toward high pressure. In the presence of an anticyclonic geostrophic shear, however, this adjustment results in carrying the parcel even more into weaker pressure gradients requiring further adjustment, and so on. The speed of the parcel is, of course, diminished during this process but so are V_g (due both to local changes and cross-contour flow) and $\cos \beta$. Anomalous wind speeds ($V_g > 2V_g \cos \beta$)

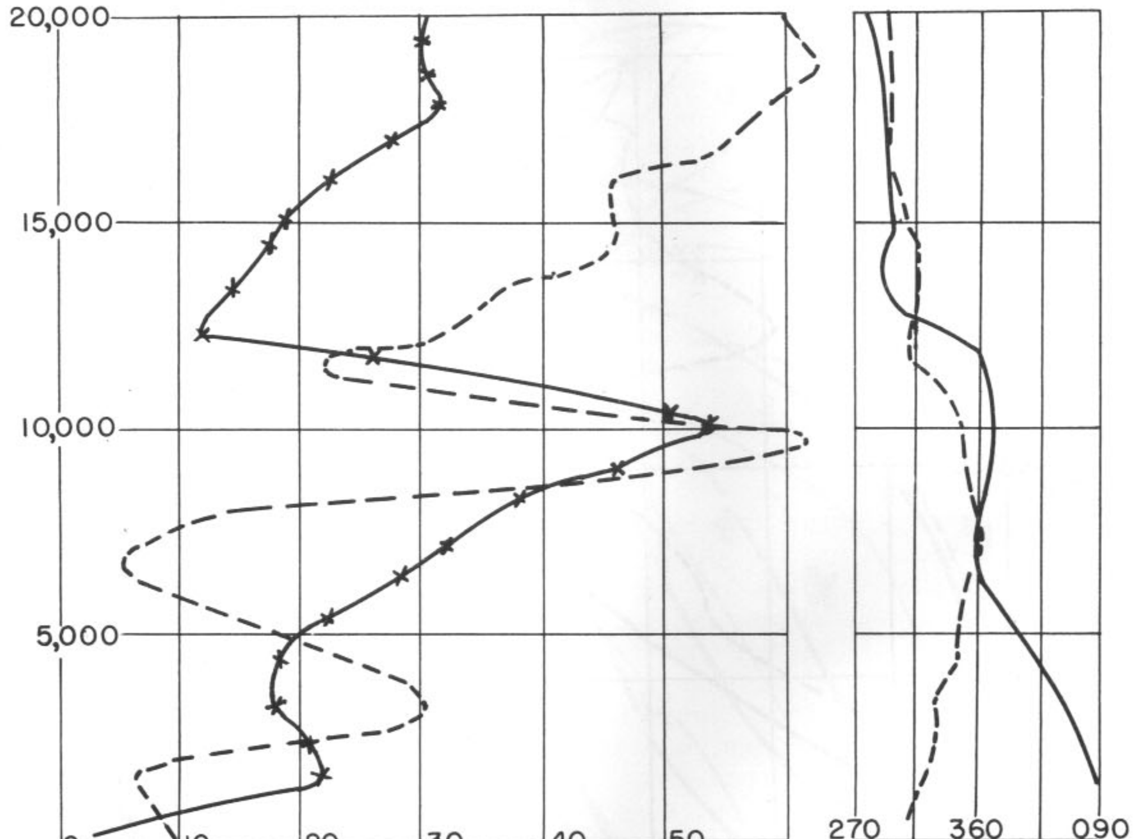


Fig.5

Comparison of Wind Velocity at Memphis and Spartanburg, 0300Z, 3 April 1948.

will occur, then, when $V_g \cos \beta$ decreases much more rapidly than $\underline{V}$.

Having located several instances of anomalous wind speeds at the 700-mb level, the question immediately arises as to whether they might also be found at other levels for the same time. A check of the vertical distribution of speed with height for these stations showed that in most instances the anomalous speeds were confined to a very thin layer (2,000-3,000 feet thick). Figs. 4 and 5 show the vertical distribution of wind as taken directly from the original WBAN Form 20A's for four of the stations mentioned above.

The sharp maxima at about 10,000 feet for each of these stations are due to the rapid changes with height of the cyclostrophic component of the wind which is further accentuated by the occurrence of the anomalous solution $\underline{V}_2$. The change in the geostrophic component as given by the thermal wind equation is simply a gradual, continuous increase with height and could not, therefore, account for the observed profiles.

It is obvious that if it were not for the fact that the maxima happened to occur just at 10,000 feet, these winds would not have been discovered. Moreover, taken alone, any one of these wind soundings would probably have been judged unreliable. It is entirely possible, therefore, that anomalous winds occur more frequently than we might expect, either from our analysis of standard pressure charts or from a cursory inspection of individual wind soundings.

CONCLUSIONS

In the routine determination of the upper-wind field from the sequence of analyzed or prognostic constant-pressure charts, the forecaster must reckon with recurring systems of ageostrophic winds. True, the limited synoptic research on these systems does not yet warrant their generalization (of form, development, and place and time of occurrence) into idealized models. Nevertheless, certain considerations, representing the most probable nature of the ageostrophic wind systems at the present time, should be borne in mind by the forecaster:

For pressure waves (a) moving fairly rapidly, (b) with large amplitude, (c) pronounced anticyclonic geostrophic wind shear, and (d) fanning or convergence of the contours so as not to compensate for the isallobaric effects of a, b, and c, then (to the right of the geostrophic wind maximum) accelerating winds toward lower pressure are likely to occur upstream from the pressure ridge, and decelerating winds toward higher pressure may be expected downstream from the ridge. In such cases neither the geostrophic nor the gradient wind speeds can be relied on, and the actual wind speeds may even be anomalous. In the absence of any wind observations, the forecaster can warn only that in these regions the gradient or geostrophic winds may be quite erroneous. If, however, one or two wind reports confirming the above model are available in such regions, they should be relied on in preference to winds scaled from the analyzed pressure field. They should certainly not be discarded as erroneous simply because they differ greatly from the geostrophic wind. (Major A.F. Gustafson, Hq., AWS.)

SOME RECENT STUDIES OF THE PRESENT CLIMATIC VARIATION (U)

Professor Hans W. Ahlmann, Professor of Geography, University of Stockholm, well known for his thorough work in glacial climatology, draws some interesting conclusions in his article, "The Present Climatic Fluctuation," appearing in The Geographical Journal, Vol. CXII, Nos. 4-6, October-December 1948.

He points out that during recent decades extensive literature has been published about the present climatic fluctuation*, based on series of climatological records. Of earlier work in Europe, Prof. Ahlmann mentioned A. Wallen's study of 1916 in which he used observations made in Stockholm from 1757 to 1914 to prove an increase in mean temperature. In a later work Wallen extended his investigations to include the period up to 1925. R. Scherhag in 1931 published an article about a remarkable climatic improvement in northern Europe, and later found it to be of such importance in the extreme north that he introduced the expression "the warming of the Arctic." A. Wagner, in summarizing the data relating to climatic changes in general, finds on the basis of a wide range of material that the climate of Europe and adjacent areas has improved in recent times, although he rejects evidence of any regular periodicity.

From the longest series of climatological records (Holland, beginning in 1706 and published by A. Labrijn) Prof. Ahlmann notes that winter temperatures decrease from the first half of the 18th century to a minimum in the beginning of the 19th, after which an increase prevails to our day. The hard winters of the 1940's depress the end of the curve. June and October temperatures show the same decrease in the beginning of the 19th century as do the January temperatures. The April and mean annual curves do not show any notable change. The curve showing the difference between July and January -- that is, the degree of maritime or continental influence -- is on the other hand very significant in its apparent decline from the end of the 18th century. The recent hard winters raise the end of the curve.

Records for Stockholm indicate rising winter temperatures and a decreasing number of very severe winters since 1757. The occurrence of winters when the average December-March temperatures have been more than 1° below the mean value has successively decreased in Stockholm from 13 in the period 1861-90 to 3 in the period 1911-40. The annual precipitation increased between the 1861-1900 and 1901-30 periods by 5 percent in northern Sweden and by 2 1/2 percent in southern Sweden.

Similar rises in temperatures and increases in precipitation are noted in the records for Norway, Spitsbergen, Finland, Russia, Denmark, and are implied in Greenland and Iceland from the history of receding

*Prof. Ahlmann follows the IMO recommendations in differentiating between climatic variation and climatic fluctuation, meaning by the former a change of climate maintained over a long period of time, by the latter a change over a shorter period (from one 30-year period to the next) which is imposed on the long-period variation.

glaciers throughout those countries as well as from available weather records.

When Prof. Ahlmann was speaking of this climatic improvement in Copenhagen in February 1947, it was very cold, and people had no fuel for heating. The day after his lecture the newspaper Politiken published a drawing called "Propaganda for Optimism." The husband is shown going to bed in the icy room where his wife is already installed. Both are dressed suitably for the "improved" climate. The husband has a pocket-flask of brandy in his hand and is saying, "Things are looking up, my dear. The meteorologists say that the temperature during the last 200 years has risen 2° and the glaciers are disappearing in northern Norway." To which his wife answers hopefully, "Thank goodness for that."

From a more scientific standpoint, however, Prof. Ahlmann notes that it may often happen that a year falls completely outside the main trend of a series. In fact, the cold European winter of which the woman and her husband spoke was the mildest ever recorded in Greenland and Spitsbergen.

In attempting to define the meteorological cause of the remarkable "warming of the Arctic," Prof. Ahlmann speaks of increased atmospheric circulation or increased transfer of heat from low to high latitudes. The fact that the temperature is gradually increasing in the north has thus been connected with the circumstance that, assuming the mean air temperature of the earth to remain practically constant during a change in the atmospheric circulation, the extensive area of the low latitudes would show only slight changes while the relatively small area of the high latitudes would show much larger ones.

Dr. Sverre Petterssen, Director of Scientific Services, Hq., AWS, in his paper, "Changes in the General Circulation Associated with the Recent Climatic Variation," appearing in "Glaciers and Climate" (Geografiska Annaler, 1949, No. 1/2) notes that the temperature rise increases with latitude and is largest along the Arctic coasts where the horizontal temperature gradient is largest. This might suggest, according to Dr. Petterssen, that the temperature rise is brought about by increased advection of air from southern latitudes. But he points out that although such advection is possible within a limited region, it is evident that it must be compensated for by advection in the opposite direction elsewhere, unless an accumulation of air is to result in the Arctic. It is well known that the winter temperature has increased not only in the regions where the prevailing winds are from a southerly direction but also in regions where they are predominantly from a northerly direction; this suggests, according to Dr. Petterssen, that the changes in the general circulation associated with the climatic variation are exceedingly complex.

The aim of Dr. Petterssen's investigation was to ascertain whether the general circulation has varied in a manner that would harmonize with the observed increase in temperature throughout the polar region. On account of the considerable amount of statistical work involved -- investigation is based upon observational material contained in the Historical Weather Maps, 1899-1939 -- the investigation has, so far, been limited to winter conditions of the North Atlantic region.

Fig. I

Letters identify the regions for which the zonal transport was evaluated, and numbers identify the sections of parallel circles for which the meridional transport and meridional exchange were evaluated.

Mean pressure charts for the winter months (December-February) were prepared for each decade and the area divided into 11 regions (A-K), each covering 300 square degrees (Fig. 1). In Fig. 2 is given the difference in mean pressure between the last and the first 20-year period under review. It will be seen that the Siberian anticyclone has had a tendency to spread westward toward Scandinavia while the Icelandic and the Mediterranean lows have intensified somewhat. There is also a slight indication that the North American high has spread eastward. A feature of considerable interest is the relative reduction of pressure over the Norwegian Sea, suggesting increased cyclonic activity in that region. As far as the Baltic and southern Scandinavia are concerned, the change in the pressure distribution suggests an increase in continentality. Thus, although the increase in temperature in northern Norway, Spitsbergen, Iceland, and southeastern Greenland could be explained by reference to the fact that the mean flow has had a tendency to turn to a more southwesterly direction, the rise in temperature in eastern Scandinavia, cen-

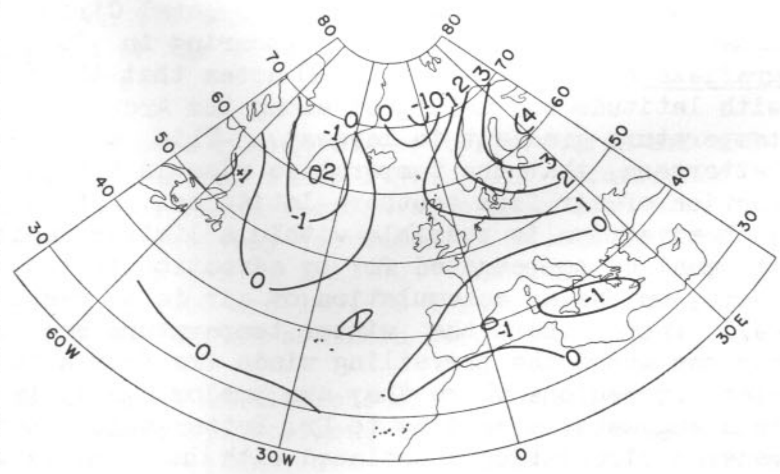


Fig. 2

Change in barometric pressure (mb) at sea level from the period 1900-19 to the period 1920-39.

tral Europe, northeastern Greenland and Labrador could hardly be explained by reference to the change in the mean pressure distribution.

Various other computations were made to determine: (1) the net zonal transport, defined as the mean value of the product of the density and the eastward component of the geostrophic wind, expressed in terms of kg/m^2sec, and evaluated from the mean pressures at the corners of 5-degree squares (counted positive toward the east); (2) the net meridional transport, defined in the same manner as the zonal transport except that it refers to the transport across sections of circles of latitude, and evaluated similarly but counted positive toward the north; (3) the total meridional transport, defined as the mean magnitude of the individual values of the product of air density and the meridional component of the geostrophic wind without regard to sign, and evaluated from the individual synoptic charts; and (4) the meridional exchange, defined as the total meridional transport minus the magnitude of the net meridional transport.

Results of the computations indicate that there is no trend toward a general increase in the net zonal transport from one decade to the next. On the whole, the strongest transport occurred in the 3d decade and the weakest in the 4th. Only in the extreme north (i.e., regions D and H in Fig. 1) does there appear to be a systematic increase in the zonal transport. On the average the zonal transport decreased from the first 20-year period to the second, but in the absence of any systematic trend within the individual regions, no conclusion can be drawn, except that it does not appear possible to ascribe the increase in temperature to a speeding-up of the general westerly winds in middle and high latitudes.

The net meridional transport shows more pronounced trends than does the net zonal transport, particularly in the northern regions where there is an almost continuous increase in northward transport over the Scandinavian countries and southward over the Greenland, Labrador, and Newfoundland area. The convergence of the meridional transport suggests an intensification of the polar and arctic frontal zones over the North Atlantic.

Although the increase in the net meridional transport may be said to account for the increase in temperature in the European area, it is clearly incapable of explaining the simultaneous increase in temperature in Labrador, Newfoundland, and parts of Greenland. Thus, the general mechanism of the climatic variation cannot everywhere be associated with increased advection of air from more southerly latitudes.

The rate of total meridional transport by decades shows a general rise beginning in the 3d decade and continuing into the 4th. Of considerable interest is the geographical distribution of the increased transport -- the rise increases with latitude and amounts to more than 1 kg/m^2sec north of 60°N in the eastern part and north of about 50°N in the western part of the area. This rise is as large in the cold northerly currents in the Greenland-Labrador region as it is in the warm southwesterly current over Scandinavia. It appears, therefore, that the most systematic and pronounced change in the general circulation consists of a vast intensification of the rate of total transport between the cold arctic source and middle latitudes, and a much smaller intensification of the total transport across subtropical latitudes.

The meridional exchange has decreased appreciably from the first to the second 20-year period over the Scandinavian region and less markedly over the remainder of Europe. On the other hand, the rate of exchange has increased markedly in the Labrador-Newfoundland area and also to the west of Morocco; over the remainder of the Atlantic and in the Mediterranean, the rate of exchange has increased slightly.

On the whole the rate of exchange has increased in those areas where the net meridional transport was from the north and decreased in those areas where it was from the south. This opposite variation in the net meridional transport and the meridional exchange, Dr. Petterssen believes, is of considerable interest for the discussion of the mechanism of the climatic variation.

It will be seen from Fig. 3 that the frequency of cyclone centers has varied appreciably from the first to the second 20-year period under review. It is evident that a shifting toward the west of the cyclone activity in the region will tend to increase the supply of warm oceanic air to the Arctic region.

Fig.3

Increase (+) and decrease (-) in number of cyclone centers in 10-degree squares from the period 1900-19 to the period 1920-39. For convenience, the three northernmost squares comprise 20° Longitude and 5° Latitude.

From the statistical evidence presented by Dr. Petterssen in his report, it appears to him that, in broad outline, the mechanism of the climatic change during the 40-year period under review must have been due to changes in the intensity of the heat and cold sources of the atmosphere resulting in the following changes in the general circulation.

1. A reduction of the zonal circulation and an intensification of the meridional circulation. Thus, the over-all change in the Atlantic-European region is characterized by a development from a high index to a low index circulation in the meaning defined by Rossby.

2. An increase in the cyclone activity and in the meridional

exchange of air in the Mediterranean-Balkan area, leading to increased supply of warm air to eastern central Europe.

3. An increase in the northward transport of air from eastern central Europe toward Scandinavia, and simultaneously, an increased northward transport of air from the eastern North Atlantic toward Iceland and the Norwegian Sea, leading to an increase in temperature and humidity in the European polar and sub-polar regions.

4. An increase in the cyclone activity in the Newfoundland area and a substantial increase in the meridional exchange in the western North Atlantic, which presumably are sufficiently intense to offset the influence of the increased southward advection in the Labrador-Newfoundland area.

5. An overweight of net northward advection within the Atlantic sector which must be compensated for by a southward transport from the Arctic in other longitudes (apparently in the Baikal region and to the east thereof). Thus, with an increased rate of inflow to, and outflow from, the Arctic, the average length of the sojourn in the Arctic of the air mass has been reduced, with the result that the air masses that invade the Arctic do not, on the average, acquire such low temperatures as they did in earlier years.

6. Although the conditions in the Scandinavian region have become more anticyclonic, the pressure gradient has increased substantially, with the result that the wind velocity near the earth's surface has increased over the region as a whole. The most obvious result of increased wind velocity would be a reduction of the intensity and duration of temperature inversions near the ground. This would contribute greatly to the increase of the temperature, and would account for the fact that the temperature has increased so much more in the winter (when radiation inversions occur frequently) than in the other seasons (when inversions are rare).

7. Although the temperature increase at the earth's surface associated with the climatic variation increases with latitude, it would seem incautious to conclude that the same applies to all strata. As has been shown by Lysgaard in a lecture presented to the Meteorological Association of the UGGI in Oslo, in 1948, there is evidence of a slight increase in temperature near the heat equator, and since this increase cannot be due to advection or exchange, it is reasonable to assume that the heat supply has increased either through increased solar activity or through change in the radiative heat balance of the atmosphere. In either case, over a long span of years the whole atmosphere would be likely to be affected. However, an increase in the supply of heat to the atmosphere as a whole could hardly result in anything but an accentuation of the meridional temperature gradient in winter, and not in a reduction as is actually observed near the earth's surface. If it is assumed that the supply of heat to the atmosphere has increased, it must also be assumed that the meridional temperature gradient between low and high latitudes in winter has increased when all strata are considered. Since the change

in temperature gradient at the earth's surface is in the opposite direction, it appears that the change in gradient would be reversed in the upper layers. Observational evidence in support of this view may be sought in the analysis of the changes in the distribution of rainfall in Scandinavia. It has been found that the rainfall has increased not only in southeastern Norway which has become increasingly exposed to southerly winds blowing up the mountain range, but also along the coast of Troendelag and in other districts which are sheltered by the mountains. The increase in rainfall in these sheltered areas would be consistent with an increase in the vertical temperature gradient resulting from the reversal of the change in the horizontal gradient referred to above, for an increase in the vertical gradient would lead to an increase in showery precipitation. Direct evidence of increased vertical temperature gradient has been found by Lysgaard.

It is well known that the winds in the free atmosphere are largely determined by the horizontal temperature gradient. If it is assumed that the reduction in the meridional temperature gradient recorded at the earth's surface is representative also of the upper strata, the consequence would be a reduction of the kinetic energy of the general circulation, which would be difficult to associate with the existing indication of increased supply of heat. (Based on "The Present Climatic Fluctuation" by Prof. Hans W. Ahlmann and "Changes in the General Circulation Associated with the Recent Climatic Variation" by Dr. Sverre Petterssen.)

A MODIFICATION OF THE BELLAMY DRIFT FORMULA (U)

With the increasing popularity of pressure-pattern flying, considerable use is being made of D-values -- the difference between true altitude read on the radio altimeter, and pressure altitude read on the pressure altimeter -- to calculate the lateral drift displacement of an aircraft due to crosswind during flight. The accepted formula for the computation of this lateral drift displacement (LD) is:

$$LD = \frac{21.5}{\sin \phi}\left(\frac{D_2 - D_1}{TAS}\right) \text{ nautical miles,}$$

where:

ϕ = the average latitude of the flight course from D_1 to D_2,

D_2 = the D-value at point 2 at the time of arrival of the aircraft (this may be a forecast value for the estimated time of arrival of the aircraft at point 2),

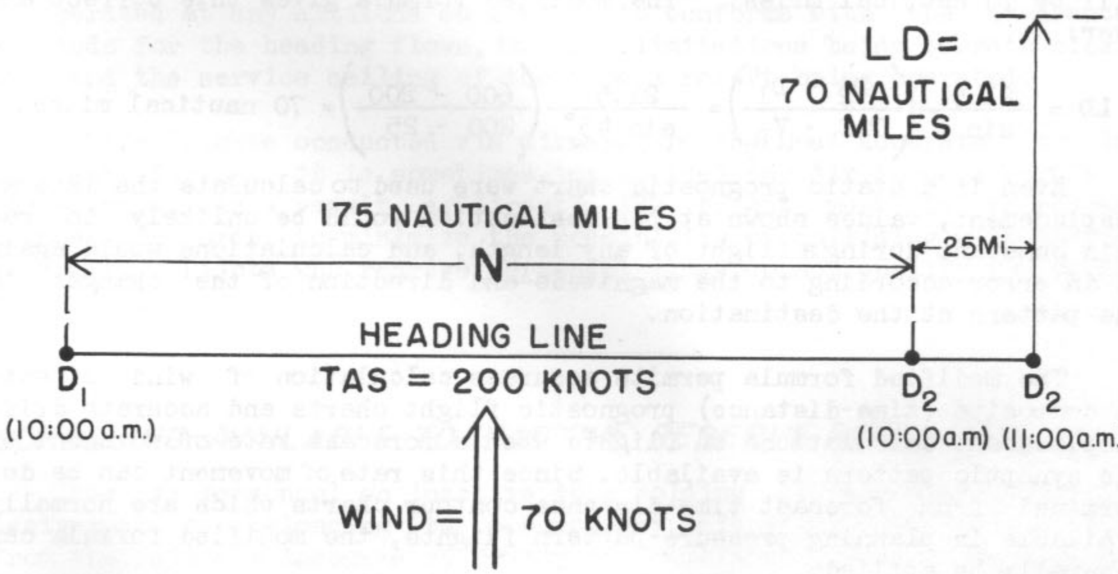
D_1 = the present D-value at point 1, and

TAS = the true air speed of the aircraft, in knots.

This formula may be applied during actual flight, either over water or over terrain of known altitude, when D-values are obtainable by comparison of the radio and pressure altimeters; or it may be used in conjunction with a forecast chart. With this formula the net displacement of the aircraft from the heading line may be determined. However, it can be shown that the displacement of the pressure pattern with respect to time requires a modification of the accepted basic formula. The formula then becomes:

$$LD = \frac{21.5}{\sin \phi}\left(\frac{D_2 - D_1}{TAS - V_p}\right) \text{nautical miles,}$$

where V_p is the average rate of movement (during time of flight) of the flight level contour height which will exist at the destination at time



of arrival. V_p is expressed in knots and measured along the course line; it is positive if in the direction of flight and negative if in the opposite direction.

In comparing the two formulae, assume the following conditions (see figure above):

ϕ = 45 degrees N; D_1 = 200 feet; V_p = 25 knots;

TAS = 200 knots; D_2 = 600 feet; Wind = 70 knots.

Distance between D_1 and D_2 (initially) = 175 nautical miles.

During the one hour of flight, D_2 will move 25 nautical miles along the course (V_p = 25 knots).

According to the geostrophic wind formula, crosswind velocity will be:

$$WV = \frac{21.5}{\sin \phi}\left(\frac{D_2 - D_1}{N}\right) = \frac{21.5}{\sin 45°}\left(\frac{600 - 200}{175}\right) = 70 \text{ knots}.$$

However, since the aircraft will determine $\underline{D_1}$ at time of departure and $\underline{D_2}$ at time of arrival, and since $\underline{D_2}$ will have moved 25 nautical miles during the flight, an apparent stretching of the contours will result so that the value of $\underline{N}$ will apparently be 200 nautical miles instead of 175. In the lateral displacement formula this apparent "stretching" will also be reflected, so that an erroneous value results:

$$LD = \frac{21.5}{\sin 45°}\left(\frac{600 - 200}{200}\right) = 61 \text{ nautical miles}.$$

However, it is immediately realized that, since the 70-knot wind has been acting on the aircraft for one hour, the correct lateral displacement will be 70 nautical miles. The modified formula gives this correct answer:

$$LD = \frac{21.5}{\sin \phi}\left(\frac{D_2 - D_1}{TAS - V_p}\right) = \frac{21.5}{\sin 45°}\left(\frac{600 - 200}{200 - 25}\right) = 70 \text{ nautical miles}.$$

Even if a static prognostic chart were used to calculate the lateral displacement, values shown at the destination would be unlikely to remain constant during a flight of any length, and calculations would again be in error according to the magnitude and direction of the changes in the pattern at the destination.

The modified formula permits accurate calculation of wind effects on composite (time-distance) prognostic flight charts and accurate drift displacement calculations on flights when a forecast rate of movement of the synoptic pattern is available. Since this rate of movement can be determined from forecast time-distance contour charts which are normally available in planning pressure-pattern flights, the modified formula can generally be applied.

It may be noted, also, that when either the distance between D-values or the ground speed is known, the drift correction angle (DCA) may be calculated by the formula:

$$DCA = \sin^{-1}\left(\frac{21.5}{S \times \sin \phi}\right)\left(\frac{D_2 - D_1}{TAS - V_p}\right) \text{degrees},$$

where $\underline{S}$ is the distance (or ground speed x time) between $\underline{D_1}$ and $\underline{D_2}$ expressed in nautical miles.

This formula may be simplified by the approximation for small angles which states that the angle is equal to 60 times the sine of the angle. (This approximation is accurate within 1/2 degree for all angles up to 35 degrees. A drift angle above 35 degrees is very unusual.) Therefore,

$$DCA = \frac{60 \times 21.5}{S \times \sin \phi}\left(\frac{D_2 - D_1}{TAS - V_p}\right) \text{degrees}.$$

(Major D. G. Williams, Hq., AWS.)

AWS PLANS & POLICIES

FLYING SAFETY STRESSES RESPONSIBILITY UNDER IFR (U)

Under IFR conditions, Air Traffic Control (ATC) has complete jurisdiction over all aircraft that fly on airways, across an airway (control area), or through a control zone. An IFR clearance received from ATC applies only while the aircraft is flying in any of the above areas. Therefore, each pilot's flight planning for off-airways flying is a personal responsibility. Quadrantal altitudes, as specified in paragraph 35c, AF Reg. 60-16, have been designated for the purpose of insuring an adequate and safe separation of aircraft during IFR flights off airways. While flying off airways and out of the control of ATC, then, the aircraft may be operated at any altitude so long as it conforms with the quadrantal altitude for the heading flown, the only limitations being terrain clearance and the service ceiling of the type aircraft being operated.

While flights conducted via airways are the most accurate for instrument flying, it is sometimes impractical for Air Force aircraft to fly airways. As a result, a "direct" IFR flight must be thoroughly planned in order to minimize the possibility of colliding with another aircraft. Pilots who receive permanent wings do not qualify for hazard pay.

SCHOOLING AVAILABLE TO INACTIVE RESERVE PERSONNEL (U)

Reserve personnel on inactive duty holding either a mobilization assignment or belonging to a corollary unit stand to benefit greatly from the recently inaugurated policy on schooling. Anyone applying and being accepted for any of the courses offered will be placed on a short tour of active duty for the duration of the course.

Applications from qualified personnel for any of the courses except the Radiological Defense Officer Course should be submitted on MATS Form P&O-22 through the unit of assignment direct to Headquarters, Air Weather Service. Applications for the radiological course are to be submitted on ConAC Form AG2 in triplicate. Subject to budgetary limitations, active duty training at Air Force Schools is in addition to the regularly scheduled active duty training tour authorized each assigned reservist eligible to be paid for his training.

Commanders are being requested to monitor applications to insure that training requested is in line with the individual's mobilization job assignment. At this time, class quotas for AWS are rather small, but in most cases new classes are started immediately upon completion of each course so that a continuous flow of students is assured.

Courses now available are shown below (name, length, and location of course, and the eligibility requirements are listed):

Radiological Defense Course. 15 days. Keesler AFB; Edgewood Arsenal; and Treasure Island, Calif. Eligible: Reserve officers not on extended active duty who have satisfactorily completed U. S. Naval Correspondence Course, "Nuclear Physics"; minimum of two years college with one year of mathematics and one year of either physics or chemistry; be cleared for classified information up to and including "secret."

Field Economic Mobilization Course. 12 days. Detroit, Mich., 27 Mar-7 Apr; Milwaukee, Wisc., 10-21 Apr; Omaha, Nebr., 1-12 May; Rochester, N. Y., 15-26 May; Philadelphia, Pa., 5-16 Jun; New York City, 5-16 Jun. Eligible: Field grade inactive reserve officers who on mobilization would hold a position at a policy-making level; must belong to corollary unit or hold a mobilization assignment. Course is a condensed version of the 10-month course given at the Industrial College of the Armed Forces in Washington.

Air Command & Staff School (Associate Course). 13 weeks. Maxwell AFB. Eligible: USAF reserve officers participating in organized reserve training program who have served for at least six months as a squadron or group CO or as chief of a staff section of a group or higher headquarters.

Air Command & Staff School (Orientation Course). 14 days. Maxwell AFB. Eligible: Same as above except must be field grade officer; course designed for those unable to attend the 13-week course.

Aircraft Maintenance. 14 days. Chanute AFB. Eligible: Officer reservists presently assigned to corollary units or holding mobilization assignments and to whom course would constitute refresher training.

Auto Maintenance & Repair. 14 days. Ft. Francis Warren. Eligible: Reserve officers training in this MOS.

Budget & Fiscal. 14 days. Lowry AFB. Eligible: Reserve officers training in this MOS.

Classification & Assignment. 14 days. Lowry AFB. Eligible: Reserve officers training in this MOS.

Intelligence. 14 days. Lowry AFB. Eligible: Reserve officers training in this MOS.

Statistical Services. 14 days. Lowry AFB. Eligible: Reserve officers training in this MOS.

Supply Officer. 14 days. Lowry AFB. Eligible: Reserve officers training in this MOS.

Transportation. 14 days. Lowry AFB. Eligible: Reserve officers training in this MOS.

QM Subsistence Course. 14 days. QM Food and Container Institute, Chicago, Ill. Eligible: Reserve officers training in this MOS.

Weather Observer Refresher Training. 10 days. Chanute AFB. Eligible: Airman reservists (SSN 784) presently assigned to corollary units.

Supply Technician. 14 days. Lowry AFB. Eligible: Airman reservists holding SSN 348, 581, 583, 815, 821, 826, 835, or 848.

Ap & Engine Mechanic. 14 days. Sheppard AFB. Eligible: Airman reservists holding SSN 747.

Acft Power Plant Mechanic. 14 days. Chanute AFB. Eligible: Airman reservists holding SSN 684.

Acft Hydraulic Mechanic. 14 days. Chanute AFB. Eligible: Airman reservists holding SSN 528.

Acft Elec Mechanic. 14 days. Chanute AFB. Eligible: Airman reservists holding SSN 685.

Acft Inst Mechanic. 14 days. Chanute AFB. Eligible: Airman reservists holding SSN 686.

Acft Prop Mechanic. 14 days. Chanute AFB. Eligible: Airman reservists holding SSN 687.

PILOT-TO-FORECASTER VHF FACILITIES BEING EXPANDED(U)

The increasing number of jet aircraft placed in normal use during 1947 brought to the fore the importance of transmitting, without delay, weather information to pilots in flight. Since that time, Air Weather Service in conjunction with Airways and Air Communications Service has been attempting to improve and expand the type of pilot-to-forecaster communications facilities originally inaugurated in the ZI at Langley, March, and Tinker Air Force Bases. (See WSB No. 3, p. 33; No. 5, p. 24.)

At the present time, some 18 Air Force bases throughout the ZI are equipped with VHF radio facilities available for use by forecasters in direct contact with pilots in flight. Plans call for further expansion of this service to other forecasting stations in the ZI; however, some changes in operation are anticipated:

a. Immediate plans call for implementation of the service to enable pilot-to-forecaster contact on those channels now being guarded at each AACS VHF station: 137.88 mc (Channel "C"), 121.5 mc (Channel "D"), and 132.3 mc (Navy Channel). For the more distant future, plans will no doubt include a separate channel to be used solely for this purpose in lieu of sharing the three channels with GCA, Airways stations, etc.

b. Pilot-to-forecaster facilities were originally instituted for jet aircraft only. USAF has directed that all aircraft be authorized to utilize the facilities in an emergency or in case of urgent necessity (the latter including jet aircraft about to make a letdown from altitude).

With many overseas Air Force units converting to jet-type aircraft, the problems now being encountered by AWS personnel at some bases outside the ZI are similar to those which were faced by the 2059th Air Weather Wing, Tinker AFB, in 1947. The interest being taken in finding solutions to these problems is reflected in the many worthy suggestions offered by AWS personnel throughout the world. It is from the varied experiences of all personnel directly involved in jet operation that new and better weather service procedures will be developed.

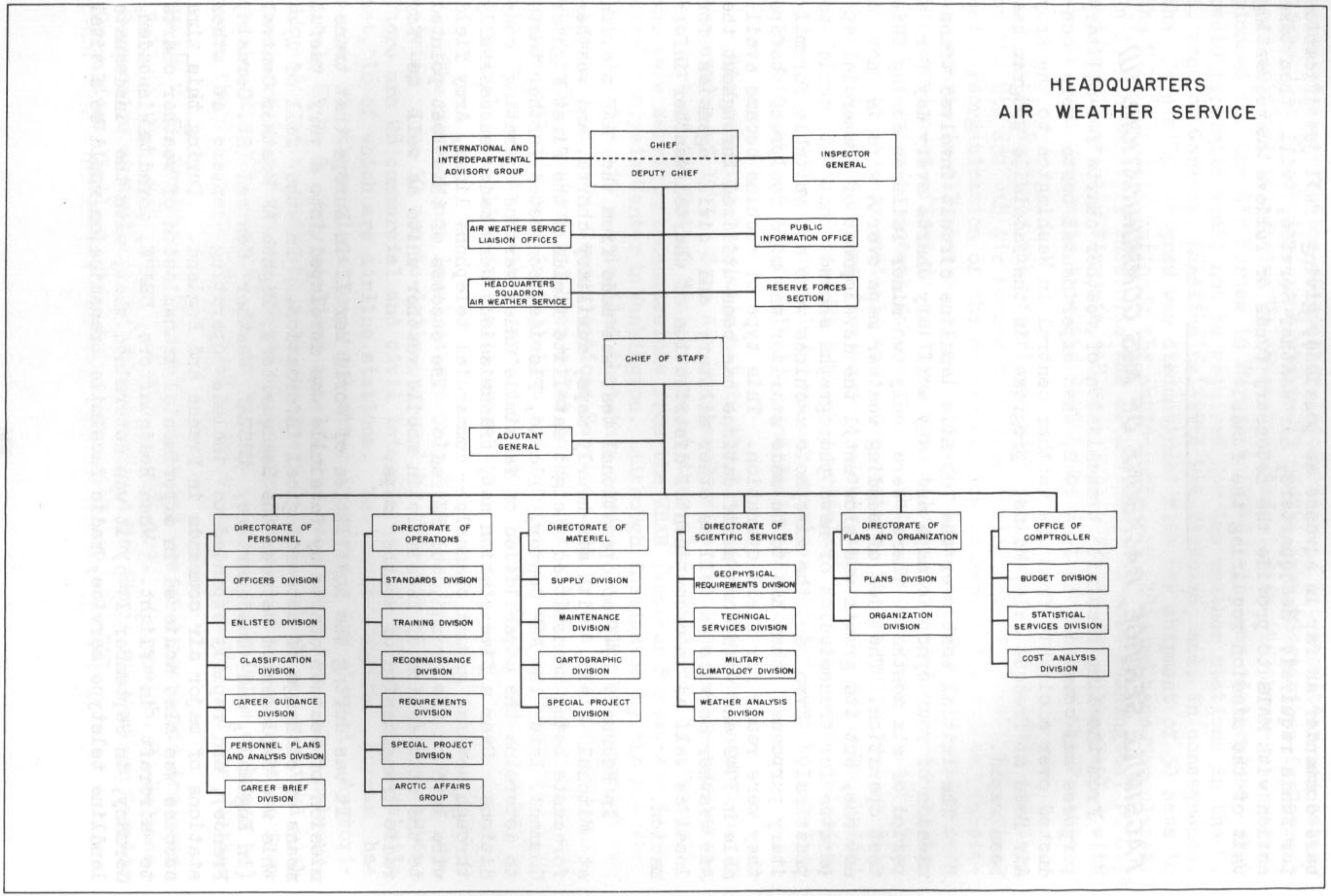
Some points to consider in providing weather service for jet aircraft are those dealing with taking surface observations more frequently at jet bases when ceiling and/or visibility drop below certain minima, flying tactical weather reconnaissance in advance of all cross-country jet missions, establishing closer liaison between the forecaster and base operations, having as many pilot-forecasters as possible checked out in jet aircraft, and generally exhausting every effort to improve high-altitude wind, cloud, and turbulence forecasts.

But the main problem, all agree, is to decrease the time required to transmit weather information, of whatever type, from the many stations in a given area to the pilot in flight. And VHF pilot-to-forecaster facilities are doing just that.

COMPTROLLER'S OFFICE ADDED TO HQ., AWS, STAFF (U)

An Office of the Comptroller has been added to the staff functions of Headquarters, Air Weather Service. This office combines the Statistical Service Division with the budget and cost control functions which Air Weather Service has been performing by direction. The extent to which Air Weather Service will be responsible for budget and cost control functions in the future has not yet been determined by higher headquarters, but at a recent meeting of the services with the MATS Comptroller, a working group including Air Weather Service representatives was organized to examine the entire comptroller functions in MATS and specify exactly what responsibilities should accrue to the services. Findings of this group will be indicated later, together with the extent, if any, to which comptroller activities will be authorized at subordinate units of Air Weather Service. In the meantime, each commander is being urged to secure effective liaison with the base to which assigned concerning cost functions, funding problems, etc.

The Comptroller emphasizes that each commander is personally responsible for performing his assigned mission as economically as possible without reduction of performance standards. Where shortages of funds are expected to become factors adversely affecting Air Weather Service operations, commanders are responsible that Hq., AWS, is advised through the



ORGANIZATION OF HEADQUARTERS AIR WEATHER SERVICE base commander as far in advance as possible, giving full justification for funds required. Headquarters, Air Weather Service, will then take action with MATS to provide the necessary funds or relieve the requesting unit of the mission requiring the funds.

FACSIMILE SERVICE, BACKBONE OF AWS COMMUNICATIONS (U)

From the time facsimile transmission of weather charts for military purposes was commenced in June 1942, when experimental tests were conducted over a circuit from the weather central in Washington to the Army Air Base at Presque Isle, Maine, progress in the facsimile program has been rapid.

The initial test over the 700-mile landline circuit involved transmission of four synoptic maps and many auxiliary charts every day for a period of six months. There were only two minor failures during this test operation. The idea of sending weather maps over a wire is not a new one, but its growth was slow until the development of commercial apparatus for transmission of news photographs showed that it could be practical. Even so, the wirephoto machines were not suitable for military purposes; they had to be made sturdier and more foolproof before they were ready for field operation. This type of machine became available in 1942 and with some modifications has been utilized throughout the Air Weather Service as well as other military and civil agencies for local as well as intercontinental distribution of charted weather information.

In February 1943 an operational test was made from the AAF station at Mitchel Field, with six-hourly maps, auxiliary charts, and weather forecasts being transmitted to eight satellite fields of the First Fighter Command. Later the AAF Center, Orlando, Florida, conducted further tests to determine the capabilities of facsimile under various operating conditions. Over a five-station net, transmissions were made successfully through several ground channels -- commercial telephone lines, Army field wire laid on the ground, and FM radio. The success of this test pointed to the utilization of facsimile in mobile weather units as well as for radio transmission of weather maps.

It was during the hostilities of World War II in Europe that transmission of weather charts by facsimile was developed into a very useful means of exchange of meteorological information. In the fall of 1944 this was implemented between the Headquarters, Eighth AF Weather Central (in England), and Headquarters, USSTAF Weather Central (St. Germain, France), and rapidly expanded to include operating centers at other stations of major air commands in France and England. During this time success was also achieved in experimental transmission of weather charts to aircraft in flight. When Headquarters, USAFE, moved to Wiesbaden, Germany, in September 1945, it was determined that, with the inadequate landline teletype service, radio facsimile transmission would be a vital means of distribution of weather information. A transmitter was established at Wiesbaden, and within 12 months some 18 stations in Germany were equipped to receive 20 charts per day. With the phase-out program planned for the Air Forces in Europe in 1947, it was determined that radio facsimile would not be required for the weather stations in the U. S. zone of Germany. Landline teletype had improved, and, in consequence, the facsimile program was discontinued with the shipment of 30 sets to the U.S. for utilization in the nation-wide net which had been formulated. In 1946 a landline facsimile was established between Washington, D. C., and Langley Field, Virginia, to supply Hq., AWS (then at Langley), with charts and forecasts from the Weather Central Division in the Pentagon.

As a result of the experience with facsimile in the weather stations of the 8th and 9th Air Forces in Europe during 1944-45, Hq., AWS, planned a reorganization of the entire service to depend largely on facsimile charts in all weather forecasting stations, thereby eliminating much duplication of effort in plotting and analysis and freeing personnel for more attention to actual forecasting. This proposal was at first considered to be very radical by most forecasters, the majority feeling that they could not forecast from someone else's analysis. Major Bernheisel and Col. Holzman of the AWS published articles* proposing and defending the general use of facsimile by weather services and did much to convince meteorologists of its feasibility and desirability.

The existing facsimile net in the ZI actually had its inception in the spring of 1947. Some Air Weather Service stations in the northeastern part of the United States were at that time connected by facsimile and were served by transmissions from the WBAN (Weather Bureau-Air Force-Navy) Analysis Center in Washington. Although instigated by the Air Weather Service, it was decided that this service should be provided by Airways and Air Communications Service, and by the fall of 1947 after additional stations had been added to the net, AACS gradually assumed responsibility for installation and maintenance of the facilities. By mid-1948 most Air Weather Service stations in the U. S. were served by 24-hour/day landline facsimile operation.

The present net involves approximately 100 AWS stations, each receiving some 50 charts daily prepared by the WBAN Center in Washington. There are 28 commercial and civil interests served by the USAF facsimile net, 16 of which are airline stations. The U. S. Weather Bureau has drops at three locations and other extensions are planned. Approximately 60 U. S. Navy stations receive weather charts from the network, in addition to Navy ships in the North Atlantic which are provided with receivers to obtain the charts through radio facsimile transmission from station NSS, Washington. There is also a two-way facsimile exchange between the Global Weather Central at Offutt AFB, Nebraska, and the Weather

*Major W. F. Bernheisel: Dissemination and Use of Atmospheric Analyses, Bull. A. Met. Soc., April 1945, pp. 103-109. Colonel B. G. Holzman: Separation of Analysis and Forecasting: A New Basis for Weather Service Operations, Bull. A. Met. Soc., June 1947, pp. 281-293.

Analysis Division (WAD) at Andrews AFB. The WAD also relays charts received from Europe and Ernest Harmon AFB to the Global Weather Central. In February 1950 transmission of charts from Ramey AFB to the WAD commenced, with relays scheduled to Offutt, Westover, and Harmon AFB's. Charts from Harmon will also be relayed to Ramey and other stations in the Caribbean area.

The intercontinental facsimile network involves direct radio facsimile channels from the Air Weather Centrals at Haneda AFB, Hickam AFB, and Rhein/Main AFB to the WAD. Six to eight transmissions are made daily to the WAD over each channel, the maps consisting of synoptic analyses, both surface and upper air, of selected portions of the Northern Hemisphere. Facsimile exchange also operates between Hickam AFB and Fairfield-Suisun AFB weather stations. Plans for the future include installation of facilities for the transmission of charts from Elmendorf AFB to the WAD and for reception at Johnston Island, Kwajalein and Guam of charts transmitted from Honolulu and Haneda.

In 1949 the radio facsimile network was reinstated in Germany to serve 14 AWS stations with transmissions from the Rhein/Main Weather Central. In Japan eight stations are served by radio facsimile for receipt of weather maps from Haneda Weather Central, and in Alaska there are four stations receiving facsimile charts from the central at Elmendorf AFB.

Further developments in the AWS facsimile program will include 24-inch-wide charts received on a continuous roll at a speed which will provide considerably faster service. Dual facsimile (simultaneous transmission of two charts on the same circuit) is currently carried as a project by the U. S. Navy and may later be utilized within the Air Weather Service. In the meantime, research continues on black-on-white transmission, mimeographed reproductions from stencil recordings, recording on discs for relay purposes at various schedules, and simultaneous transmission of facsimile signals over radio teletype facilities through moduplex operation.

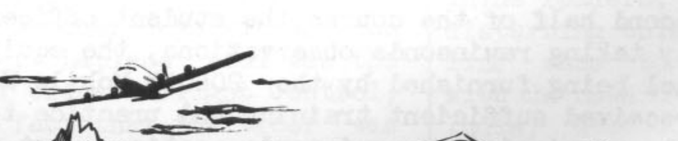
Facsimile service for the AWS is a comparatively expensive means for the dissemination of meteorological information -- in the ZI approximately $600,000 per year is expended for this service, which is about twice the cost to the Air Force of weather teletype Services "A" and "C". Much compensation is realized in that with analyzed weather data provided by facsimile, Service "C", which contains coded data, can be eliminated at those AWS stations which are adequately served by facsimile. Further, the fact that a number of commercial interests and other military agencies are utilizing facsimile for meteorological purposes indicates that economy can be effected through its use, for it is possible to reduce the number of personnel used in plotting and analyzing voluminous data normally received by teletype. Too, jet aircraft demand faster dissemination of all weather data, and long-range aircraft require information for a much larger area of the world and in less time. Facsimile facilities provide this service.

The AWS plans to further develop this program so that all the AWS centrals will be provided with two-way facsimile exchange, enabling each one to become the transmitting center of analyzed data sent to stations which each serves. With the more recent developments and recognition of the potentialities of facsimile-type service, it is readily apparent that the dissemination of weather information in charted form is, and will continue to be, a most essential part of weather communications for the Air Weather Service.

SINGLE-DRIFT-CORRECTION MANUAL DISTRIBUTED (U)

Because of the urgent need at forecasting stations for instructions concerning preparation of single-drift-correction flight plans, Headquarters, AWS, in February mimeographed and distributed direct to all AWS units Extract No. 1 of the forthcoming AWS Manual 345-1, "Instructions for Preparing Single-Drift-Correction and Minimal-Flight Plans."

Data in Extract No. 1 pertains only to single-drift-correction flight plans, illustrating the latest techniques and procedures developed by AWS. The complete manual is to be released later this year and will be given full field distribution.



AWS ACTIVITIES

2059TH ESTABLISHES OFFICERS' RAWINSONDE COURSE (U)

From the emphasis placed on improvement of upper-air observations during the past year or so has evolved the first class of the Rawinsonde Familiarization Course for officers held at Tinker AFB during the period 28 November through 13 December 1949. Designed to familiarize supervisory and inspection personnel with the operating and maintenance procedures involved in rawinsonde observations, the course was established by Headquarters, 2059th Air Weather Wing, under the supervision of Captain Jesse Miller of that headquarters. Assisting him as instructors for the first class were 1st Lt. R. E. Beck, Hq., AWS; T/Sgt Ridenour, 2060th Mobile Weather Sq.; and T/Sgt Cleavelin, Hq., 2059th AWW.

Colonel Smith, Wing Commander, opened the first class by outlining the purpose of the course and stating his desires for the upper-air program. The students for that class were selected from among the officers at each type "R" section within the 2059th AWW. Upon return to their respective stations they will apply their newly-gained and refreshed knowledge to the supervision of the rawinsonde sections.

The first half of the course was devoted to the discussion of the maintenance that must be performed on the various items of equipment in the rawinsonde section. Demonstrations of various maintenance procedures were given, and the students were encouraged to question the instructors. In addition, the rawinsonde procedures were completely discussed on a class-wide basis and later a complete observation evaluated.

In the second half of the course the student officers devoted their time to actually taking rawinsonde observations, the equipment and supervisory personnel being furnished by the 2060th Mobile Weather Squadron. Each student received sufficient training and practice to enable him to perform any duty required in a rawinsonde section, not as a skilled observer, but as one who thoroughly understands each job in the section.

Future classes are to be composed primarily of inspectors from Headquarters, AWS, 2059th AWW, and from each group and squadron within that wing.

512TH SCHEDULED FOR "BUZZARD" FLIGHTS (U)

The 512th Reconnaissance Squadron (VLR) Weather, activated in February 1949, completed training in October at Fairfield-Suisun AFB and has been in the process of overseas movement during the past few months.

Movement of the squadron to its new station, Yokota AFB, Honshu, Japan, was accomplished in three echelons, the advanced echelon having departed by air early in November. During the first week of January the second group of personnel left via water transportation. As the fully-equipped RB-29's assigned to the 512th are received from AMC, they are being flown to Japan by crews from the air echelon, the first of 14 planes having departed the ZI the latter part of January. The tentative schedule calls for delivery of the remaining aircraft at approximately two-week intervals thereafter, with completion date set for 12 May 1950.

The 512th is assigned to the 2143d Air Weather Wing, and when fully operational, their flights -- BUZZARD -- will replace the LOON Charlie and VULTURE Charlie tracks now being flown by the 375th Recon. Sq. and the 514th Recon. Sq., respectively.

514TH CREW WATCHES DESTRUCTION FROM EYE OF TYPHOON (U)

Mention July's "Faye" to people of Kyushu or the next storm, "Gloria," to Okinawans or the residents of Shanghai, and they will shudder with fear. Untold damage was wrought, and death was commonplace as these two storms passed inland. But not unexpectedly. Two days previous to the time "Gloria" struck Okinawa, 514th Reconnaissance Squadron planes were out scouting the disturbance and reporting data needed to forecast its future movement. All subsequent forecasts indicated Okinawa to be in the path of "Gloria." Warnings were broadcast.

As "Gloria" swirled over the helpless populace of Okinawa, a weather reconnaissance crew from Guam circled their aircraft in the eye of the "big blow" and watched the destruction of the island while talking to another eye-witness on the ground. That hapless soul was the duty operator for Okinawa Flight Control, and, despite the fact that the roof was being ripped from over his head and his world was literally disappearing before his eyes, he stuck to his post and eventually contacted three aircraft flying within the control zone and cleared them to other bases away from the storm's path.

Describing the situation, Captain Roy E. Ladd, the aircraft commander, stated that he attempted radio contact with Okinawa for some time but could not get through the severe static. Contact was

Christopher Rand,
writing from Shanghai...

That's No Lady

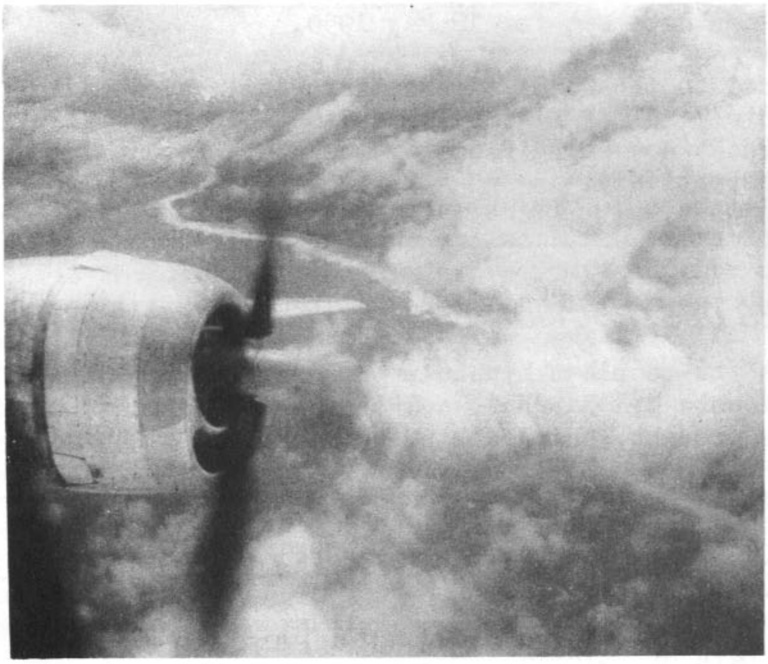
There can be no quarrel with the appropriateness of giving women's names to typhoons, which are lethal and unpredictable. And there may be no bad effect on feminine readers. But it's a disturbing thing for masculine ones to read, along with the news from Palestine, India, Greece, and other trouble spots, of ominous feminine presences whooshing around offshore, ready to descend on them any time.

It's hard to see what the weather services would lose by giving these things numbers.

--N.Y. Herald Tribune,
15 February 1948.

finally established when they were 100 miles east of Okinawa.

A short time later the RB-29 broke through heavy cloud formations into the comparatively clear eye of Typhoon "Gloria." The southern tip of the island became visible just under the western edge of the eye. Gigantic swells were breaking upon the shore, and the control operator advised that winds were reported 105 mph just thirty minutes before and had been increasing rapidly. He reported the roof of the control building had just blown off, all kinds of debris were flying by, and aircraft were being tossed about the field like toys.



Taken from 10,500 feet in the eye of Typhoon Gloria, this photo shows a portion of the Okinawa coast-line. Some concept of strong winds may be realized by noting the tremendous swells breaking against this particularly precipitous extent of coast-line.

Radio frequencies had to be changed after one transmission because the antenna blew away, but the operator and flight crew continued to talk even though the operator had to retreat under a table after most of his shelter disappeared.

Contact with the operator on Okinawa was then broken off, for the crew decided that the reconnaissance mission should continue so as to obtain a complete set of observations for relay to forecasting stations of the Typhoon Warning Network.*

After circumnavigating the typhoon, the aircraft returned to Guam without further incident.

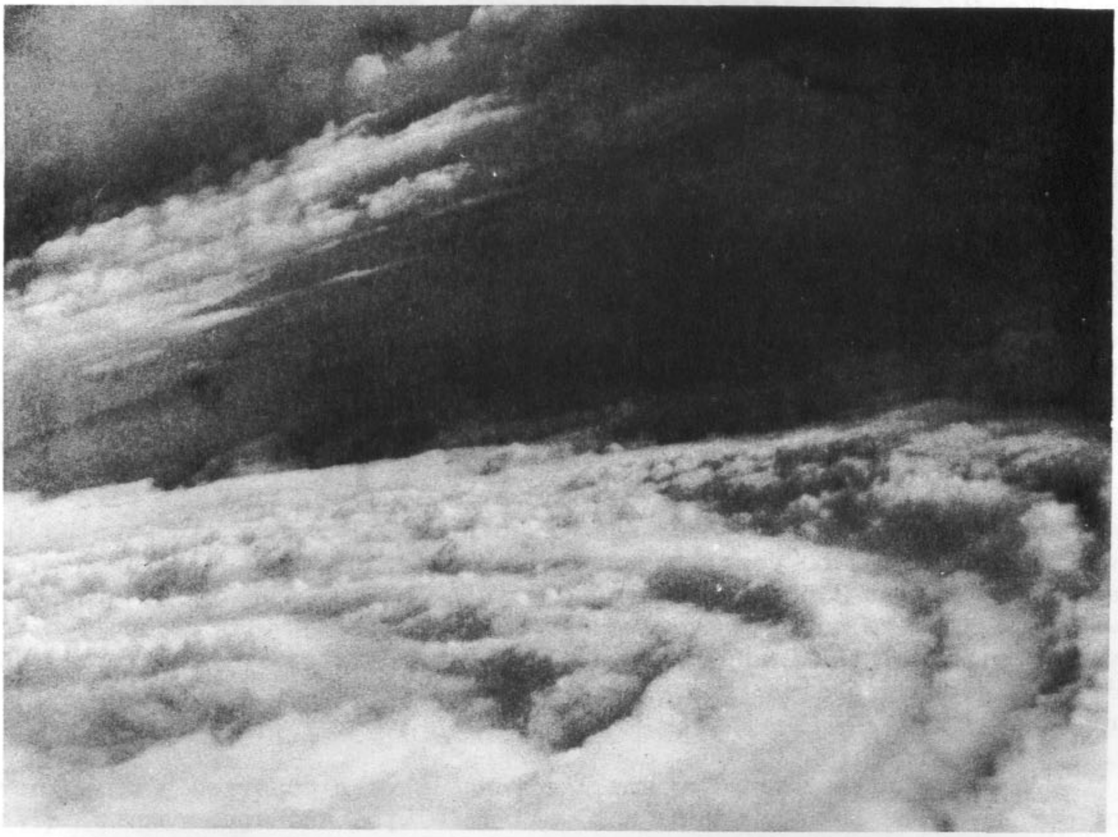
Although brushed by Typhoon "Faye" and struck disastrously by "Libby" during 1948 (the latter inflicting 10 million dollars damage), Okinawa had never undergone anything the equal of "Gloria." Unofficial but reliable reports placed damage at $20,000,000, the Air Base at Naha 60 percent damaged and Kadena AFB damaged up to 30 percent. In addition, one American child was killed and 16 other Americans seriously injured; 38 Okinawan natives were fatally hurt and 236 suffered injuries. Collected

*Experience of AWS centrals in using various techniques for typhoon and hurricane forecasting is reported in AWS Technical Reports 105-37, 105-40, 105-42, and 105-43; and Bulletin AMS, June 1946, pp. 288-305.

reports indicated that the island was practically wiped clean. World-wide attention was focused on Okinawa as it bore the brunt of "Gloria's" 150(+)-knot winds.

"Gloria" lashed unmercifully at the China coast, especially around the Shanghai area. Here, too, forecasts of the path proved accurate. Shanghai recorded about three inches of rain in 25 hours with many floods occurring in the Yangtze valley. The toll in this storm, the worst since 1915, in the Shanghai area alone amounted to 29 dead, 23 injured, and approximately 200,000 homeless.

General observation of the extensive damage on Okinawa may be adequately summed up in the words of Brig. General Jarrad V. Crabb, Far East Air Force plans and operations officer: "We learned some bitter



This picture is probably destined to become one of the best known cloud pictures of typhoon circulation. These excellent results were obtained with a K-20 camera during reconnaissance into Typhoon Gloria on 24 July 1949. Taken from 10,500 feet within the eye by T/Sgt Robert Aston, 514th Squadron, this photo captures the cyclonic arrangement of clouds and indicates the intense velocity of the circulation as the storm moves away from Okinawa toward Shanghai. The black shadowed areas are towering cumulus surrounding the eye and rising to approximately 35,000 feet. The eye was clear above; below was a 9/10 cover of stratocumulus associated with fractostratus.

lessons. Most quonset huts, which we thought were nearly typhoon proof, are not. Nearly all were damaged to some degree."

Since then considerable preventative work has been accomplished on Guam in preparation for typhoons. Unused buildings of questionable durability have been secured or removed, uprooting and felling of dead trees completed, and scattered war litter and other trash removed in a general island-wide clean-up. Particular emphasis has been placed on educating personnel concerning typhoons and what to do in the event one does pass over or nearby. Both radio and newspapers have cooperated in disseminating typhoon emergency procedures and preparations.

TORNADOES OBSERVED AT MARKS AFB, ALASKA (U)

Although theoretically possible, tornadoes seldom if ever occur in the Arctic. One of the few times went on record at Marks AFB, Nome, Alaska on 28 August 1949 when warm, moist surface winds and cold air advection at 700 mb combined to cause the first tornadoes reported in Alaska. No damage was noted, for the disturbances passed north of the field.

The surface synoptic situation at 1800Z, 28 August 1949, showed a deep low lying to the southwest of Marks AFB, while the 700-mb chart for 1500Z the same day showed a low situated directly west of the station with cool air being advected from Siberia. Raob data indicated conditionally unstable air from 1,000 feet up to 11,000 feet. It is believed that the instability was triggered by forced lifting of the air mass over a 2,000-foot range of hills approximately 10 miles north of the station.

The SWO at Marks AFB stated that at 0955 local time the first of a series of tornadoes was observed. An overcast layer of altostratus (M2) was present at 10,000 feet; the funnel extended from scattered cumulus and stratocumulus at 2,500 feet down to within 300-400 feet of the ground and was estimated to have an average diameter of at least 200 feet. The forward motion of the funnel-shaped cloud did not appear to be very great. By 1015 hours the disturbances faded from view behind fractostratus and rain.

A few minutes later two smaller funnels were observed 5 miles north of the station, but they were not well-developed and appeared to dissipate. A larger, well-developed funnel about 500 feet in diameter was noted five minutes later in the vicinity of the two previous ones. By 1040 hours all signs of tornadoes had vanished.

Although a number of planes were flying in the immediate vicinity during the 45 minutes of tornado activity, none reported turbulence. Presumably, then, instability was realized only in the spots where tornadoes actually appeared.

● I have never known a man who died from overwork, but many who died from doubt.--Dr. Charles Mayo.

"PTARMIGAN" TRACK CHANGED 1 JANUARY 1950 (U)

Covering a distance of 3,495 nautical miles as against the previous 3,392, a revised PTARMIGAN polar reconnaissance track, approved by the Air Coordinating Committee and Hq., AWS, was implemented by the 375th Reconnaissance Squadron (VLR) Weather in January 1950. The track is now located so that significant points are Eielson AFB (take-off), Kotzebue, Point Hope, 80°N 170°E, North Pole (turn around), Pt. Barrow, and Eielson AFB (terminal).

The new track was proposed because newly-established fixed weather stations in the Canadian archipelago area northeast of Alaska made the previous track in some respects a duplication of coverage. In addition, weather data obtained by the new track, which will extend to an area further west of fixed weather installations than the previous one, is expected to be of more value for synoptic analysis of the Arctic.

AWS at St. Louis — "NEITHER RAIN NOR SNOW NOR BLACK OF NIGHT..."

Nature cooked up a beautiful synoptic situation 3-6 January 1950 -- freezing rain, fog, thunderstorms, sleet, and snow -- but all to no avail. The Headquarters, AWS, delegation to the 30th Anniversary Meeting of the American Meteorological Society in St. Louis got through anyway, along with 500 other meteorologists from throughout the country.

During the business portion of the meeting, Brig. Gen. D. N. Yates, Chief, Air Weather Service, was named President of the American Meteorological Society for a two-year term. He replaces Captain Howard T. Orville, USN, Head of the Aerology Section, Department of the Navy.

Among the various papers presented during the sessions were these by AWS personnel:

"A Theoretical Estimation of the Forces Necessary to Accomplish Certain Observed Phenomena Resulting from Tornadoes" by Capt. George W. Reynolds (on duty at St. Louis Univ. for graduate study). Computed wind velocities of well under 200 mph were derived to account for observed destruction by tornadoes. Preliminary indications are that much damage to buildings could probably be prevented by bolting the structures to their foundations.

"A Practical Method of Determining Areas of Probable Tornado Formation" by Major E. J. Fawbush and Capt. R. C. Miller. Excellent forecasting results have been obtained by Major Fawbush through use of his method. (See WSB No. 7, p. 25, for details of the procedure, though it has since been slightly modified.)

"The Use of the Dew-Point Deficit in the Forecasting of Aircraft Icing" by H. S. Appleman and Capt. Loyd G. Starrett. It is claimed that for aircraft icing, the subfreezing cloud containing water in the liquid phase must be supersaturated with respect to ice, not water.

"Improved Techniques in Forecasting and Computing Minimal Flight Courses" by Major Donald G. Williams. Proper techniques were presented that may be used by weather personnel and navigators without special equipment. (Forthcoming AWS Manual 345-1, "Instructions for Preparing Single Drift Correction and Minimal Flight Plans," will give details of the procedures. Also see page 47, this issue of WSB.)

"Sea Ice Conditions Influencing Weather Forecasts in the Arctic" by Major A. R. Gordon, Jr. and Capt. W. G. Woodworth. This paper presented the interdependence of sea ice, wind, tides, cloud cover, and snow cover in the Arctic; comparison was made between the meager arctic data available to U. S. forecasters and the Soviet program of snow and ice analysis and forecasting. (Some plans of the AWS for snow and ice studies are found in WSB No. 8, p. 31, and No. 9, p. 25.)

"Acoustical Studies of Stratosphere Winds and Temperatures" by A. P. Crary and J. Peoples, Jr., Cambridge Research Laboratories, USAF. (See page 18, this issue of WSB.)

The Three Chiefs at the St. Louis Meeting: Dr. F. W. Reichelderfer, U. S. Weather Bureau; Capt. H. T. Orville, U. S. Navy; Gen. D. N. Yates, Air Weather Service.

PORTUGUESE OFFICIALS VISIT U.S. WEATHER ACTIVITIES (U)

In recognition of the fine cooperation shown the Air Weather Service in the Azores, the United States Air Force invited the Chief of the Portuguese Weather Service, Dr. H. A. Ferreira, and the Chief of the Azorean Weather Service, Col. Agostinho, to come to Washington via MATS aircraft to visit Headquarters, Air Weather Service. The visitors spent ten days in Washington, New York, and New Orleans observing various weather activities of the Air Force, Navy, and Weather Bureau as well as meteorological training at New York University. An officer from Headquarters, Air Weather Service, served as tour conductor.

AWARDS AND COMMENDATIONS (U)

We are pleased to list the organizations and names of personnel who have performed their duties in a manner so as to merit the recognition of officers in other organizations during the past few months. It is probably by no means a complete list, but includes all those awards and letters of commendation noted by Headquarters, AWS.

COL. NICHOLAS H. CHAVASSE
(CO, 2105th Air Weather Group)

Legion of Merit from Lt. General John K. Cannon, CG, USAFE; for exceptional service rendered during the recent Berlin Air Lift operations.

CAPTAIN HOWARD G. DICE
(12th Weather Squadron)

Commendation Ribbon from Maj. General Lawrence Kuter, Commander, MATS; for meritorious service during period from 1 Dec 1947 to 11 Jan 1949.

CAPTAIN JAMES B. PLANCK
(1st Weather Squadron)

Letter of Commendation from Col. Walter A. Carlson, Chief, Aero Medical Laboratory, Air Materiel Command; for his part in the initiation and prosecution of research on the project "Weather Station Layout and Briefing Techniques" conducted by the Aero Medical Laboratory.

S/SGT THOMAS F. MULLIGAN
(2103d Air Weather Group)

Letter of Commendation from Brig. Gen. Charles H. Grahl, The Adjutant General of the Iowa National Guard; for his sound judgment, during heavy wind and thunderstorm at Iowa ANG Base in Des Moines, in rescuing, together with three members of the Iowa ANG, two occupants of light civilian plane which had flipped over in landing, and in assisting another similar plane to avoid damage after landing by anchoring and heading the craft into the wind.

"PELICAN" TRACK REVIVED BY 513TH (U)

Manning and training of the 513th Weather Reconnaissance Squadron (VLR) Weather, activated in August 1949, was started shortly after the first of this year. The squadron is based at Tinker AFB where its training was begun by the 2078th Air Weather Reconnaissance Squadron (Special). To make the training program realistic and also to meet operational weather reconnaissance needs in the Gulf of Mexico, a fixed track has been designated to be flown by the 513th Squadron during its training period. Since the flights will be primarily for training purposes, they are necessarily on a non-scheduled basis. The name "Pelican" selected for the track revives the name of a former weather reconnaissance track flown from Florida over the Gulf of Mexico until December 1945.

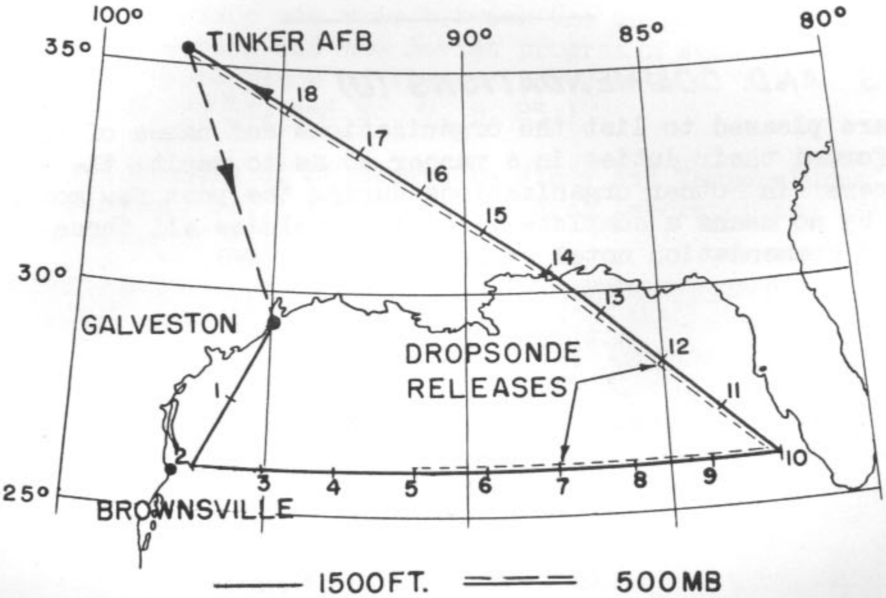


Fig.1

Track of "PELICAN" Reconnaissance Flight.

The track is to be flown from Tinker AFB over the route indicated in Fig. 1 with an aircraft sounding from 1500 feet (flight level over water) to 500 mb at position five and dropsonde soundings from that altitude at positions seven and twelve.

KNOW YOUR COMMANDERS (U)

COL. JAMES B. BAKER, CO, 2102d Air Weather Group, Mitchel AFB, was born in Bird Island, Minn. After attending high school there he went to the U. of Minn., graduating with a degree in aeronautical engineering.

In 1936 he was accepted for pilot training at Randolph Field and after completion was transferred for duty with the 15th Observer Sq. at Scott Field where he remained until accepted for the meteorology course at MIT in 1940. Completing the course a year later, he was assigned as SWO at France Field, C. Z., and later was made Asst. RCO and Staff Weather Officer for the 6th Air Force at Albrook Field, C. Z. In July 1942 Col. Baker was appointed RCO, 6th Weather Region, and later RCO of the 9th Weather Region. Prior to assuming the duties of CO, 102d Weather Group (now the 2102d Air Weather Group) in July 1947, Col. Baker served as Theater Staff Weather Officer in Brazil in 1943, CO of 2d Weather Recon. Sq., Key Field, Miss., in January 1944, departing with that unit for Guskhara, India, and Chengtu, China, in September 1944 and assuming additional duties as CO, 10th Weather Squadron. In the spring of 1945 Col. Baker returned to the ZI and served in S-3 (Recon. Branch) of Hq., AAF, subsequently being assigned as RCO, 104th Weather Group in November 1945; Chief, Weather Recon. Branch, Hq., AWS, Langley Field in April 1946; and a student at the Air Command & Staff School in August 1946. In July 1947 Col. Baker was assigned to his present position, and a year later was appointed a Lt. Col. in the regular Air Force.

<u>LT. COL. JEROME A. PRYBER</u>, a native of Cleveland, Ohio, began his army career in 1927, attended the Signal Corps weather observer course in 1928, the radio electrician and operators' course in 1933, teletype maintenance course in 1934, and weather forecasting school in 1938. As a M/Sgt he was an instructor at Scott Field and also served as a station chief prior to being commissioned a 1st Lt. in May 1942 and assigned to the Directorate of Weather (Hq., AAF) in July 1942 as Section Chief, Supply & Maintenance Division. In January 1943 he was made Chief of the Equipment Division and in April 1943 Asst. A-4, Hq., AAF Weather Wing, Asheville, N. Car. Col. Pryber was appointed Director of Materiel and Services in Jan. 1945, and a year later departed for Hq., 43d Weather Wing in Manila, to become Special Projects Officer and in Feb. 1946 CO of 20th Weather Sq. In April 1946 the squadron moved to Japan with the 43d Weather Wing. Upon his return to the ZI in June 1948 Col. Pryber was appointed Executive Officer, 104th Weather Group (now the 2104th Group), Robins AFB. He attended the Senior Officers' Management Course in early 1949 and returned to the 2104th Air Weather Group as Executive Officer prior to being assigned as CO, 2101st Air Weather Group, McClellan AFB, California, his present position, in July 1949. Col. Pryber is a major in the regular Air Force.

<u>LT. COL. ARCHIE J. KNIGHT</u>, CO, 2104th Air Weather Group, Robins AFB, Ga., was born in Richmond, Indiana, graduated from Fountain City (Ind.) High School in 1934 and from West Point in 1940. Immediately thereafter he attended pilot school and in June 1941 was transferred to MIT for the meteorology course. Graduating in March 1942, he was assigned to the 57th Fighter Group and became S-3 and Deputy CO a few months later during the period in which it assisted the British Eighth Army under General Montgomery in driving the Afrika Korps from North Africa. It was during that time that Col. Knight was shot down in a dog fight with five ME-109's and landed among the German artillery positions in Tunisia. Although exposed to direct artillery fire for four hours and wounded, he escaped

at night by swimming five miles across a bay to the British lines. In January 1944 Col. Knight became Commander of the 57th Fighter Group which later moved to Italy, and he remained with the group in that capacity until the German collapse in May 1945. His brilliant combat record during the war is reflected in the numerous decorations bestowed upon him by his own government as well as the governments of Britain and France. After his return to the ZI for rest and recuperation, he was assigned to serve as technical advisor in Hollywood for the war commentary film "Thunderbolt," a story of the fighter group he commanded. In March 1946 he attended the Command and General Staff School at Ft. Leavenworth prior to becoming S-3 Officer, Liaison Division, at Hq., 12th AF. Col. Knight was made CO, 20th Fighter Group, Shaw Field, S. Car., in February 1947, and in August of that year he returned to the Air Weather Service to become CO, 104th Weather Group (now the 2104th).

MAJ. LEWIS R. RILEY, CO, 18th Weather Sq., Wiesbaden, Germany, was born in Wichita, Kans., graduated from high school and the U. of Wichita, the latter with a BS in petroleum engineering and geology. Shortly thereafter he was accepted as an aviation cadet, attended pilot school in Calif., and was commissioned a 2d Lt. in March 1941. Then he served for a year as a flying instructor at Moffat Field before being transferred to Chico, Calif. In January 1943 Maj. Riley took 4-engine transition training at Lockbourne AAF, Ohio, followed by assignment as an instructor and later as engineering officer at Hobbs AAF, N. Mex. He was made operations officer of the 879th Bomb Sq. at Salina, Kans., in March 1944 and went to Saipan with the unit in January 1945. One month later he was appointed Asst. operations officer of the 499th Bomb Group there, and in August its operations officer. Upon his return to the ZI in October 1945 he was assigned briefly as a group safety officer and later operations officer of the 45th Bomb Sq. at Davis-Monthan Field, Ariz., before attending the weather officers' course at Chanute Field. After completion in June 1947, he was appointed Asst. SWO at Eglin Field, Fla. The following October Maj. Riley was assigned as air inspector for the 5th Weather Group, Wiesbaden, Germany, and a year later S-3 officer for the 18th Weather Sq. In April 1949 he was appointed to his present position, CO, 18th Weather Sq. Major Riley is a captain in the regular Air Force.

MAJOR A. W. THROGMORTON, CO of the 2060th Mobile Weather Sq. based at Tinker AFB, was born in Mayfield, Ky., attended high school in Farmington, Ky., and graduated with a BS in chemistry from the Western State Teachers College there. Enlisting in the army in 1936, he attended radio and teletype school and weather forecasting school, subsequently serving as a forecaster for 2 years. Returning to civilian life in 1939, he accepted a position as an administrative and executive official with the Spartan School of Aeronautics, Tulsa, Okla., and later the Riddle School of Aviation, Miami, Fla. In March 1943 he was commissioned a 1st Lt. and sent to the 2d Weather Sq., Bolling Field, as a weather forecaster. Shortly thereafter he was transferred to the 21st Weather Sq., Bradley Field, Conn., as executive officer. The 21st departed for England in July 1943, and in January 1944 Maj. Throgmorton was made CO of the mobile squadron which provided weather support to the 9th Air Force as it moved onto the continent in 1944. After VE-Day, Maj. Throgmorton was Staff Weather Officer to 9th Air Force and for a short time to Hq., USAFE, before becoming CO, 18th Weather Sq., in Germany in August 1945. Late in 1945 he returned to the ZI and became adjutant of Continental Weather Wing at Tinker Field. In August 1946 he was appointed SWO at Enid AAF, Okla., and in February 1947, Asst. SWO at Fort Worth AAF. Four months later he was made CO, Mobile Weather Squadron, attached to Hq., CWW, at Tinker. In June 1948 the 21st Mobile Weather Sq. evolved, and Maj. Throgmorton was appointed its CO. In November 1948 that squadron was redesignated the 2021st, and in February 1949, the 2060th, the latter the unit of which Maj. Throgmorton is the present commander.

LT. COL. FREDERICK J. COLE, CO of the 8th Weather Sq. since 1946, was born in Springfield, Mass., and graduated from Massachusetts State College with a degree in physics in 1940. Shortly thereafter he attended the meteorology course at MIT, being commissioned a 2d Lt. upon completion in 1941 and subsequently assigned as a weather officer at Mitchel Field, Turner Field, and later with the 310th Bomb. Group at Columbia, S. Car. The 310th departed for the ETO in January 1943. In June 1944 Col. Cole returned to the ZI, and after attending the weather officers' refresher course at Chanute Field he was appointed Asst. RCO, 25th Weather Region, and later Staff Weather Officer to Hq., 3d AF, at Tampa.

He served in the Personnel Division at Hq., AWS, from October 1945 to September 1946 before becoming CO of the 8th Weather Sq. at Westover AFB. In 1948 that headquarters was moved to Ft. McAndrew, Nfld., and shortly thereafter Col. Cole attended the Air Command and Staff School, returning to Ft. McAndrew on completion. Col. Cole holds a captain's commission in the regular Air Force.

INTERNATIONAL INTERSERVICE

ASPECTS

ARE WE A GOOD RISK? (U)

The American people believe that air power is needed to guarantee their country's security.

They have asked for a strong Air Force -- not one bigger than the preservation of our democracy requires, nor one so expensive that it will bankrupt the country. Americans are paying heavily to provide the budget out of which such an Air Force can be built. They have faith that we in the Air Force will match their sacrifices with efficient and economical operations. In effect then, the Air Force has the mission of getting the maximum air power for the minimum funds expended.

In carrying this mission to its goal there is one factor which we must bear in mind constantly. America's resources are not unlimited. Therefore, we must be aware of the danger in squandering any part of them. Otherwise economic suicide could defeat us. By eliminating unnecessary waste in our operations not only will we be able to forego the shadow of economic suicide, but we will also be able to live up to the expectancies of the people who support us.

The question, then, is this: Are we a good risk? Or are the people, our partners and supporters in this Air Force, being cheated? Let's look at the facts:

A pilot puts on a private air show (even though he knows such an act is contrary to regulations) so his home-town folks can see the fine new fighter they helped buy and the fine training thousands of dollars provided. When they gather around the smoking wreckage after a neat buzz job, they are faced with the fact that tax money and resources, perhaps of a higher valuation than the entire village, have been wiped out -- squandered.

Was this pilot serving the people?

A mechanic lets a faulty fuel line go until the next inspection. Later the plane bursts into flame and crashes.

Was he aware that every man who wears our country's uniform is in partnership with the American people?

A commander fails to brief his crews properly on procedures to be used during a formation flight. Two planes collide, three others crash-land after becoming separated from the squadron.

Was he trying to help give the American people an Air Force within the price they can afford to pay?

It would be a startling thing to question a man about his loyalty to the country after he had caused an aircraft accident.

Without a doubt he would insist that he as much as anyone else was concerned that this nation be provided with the most powerful air arm possible. Unthinkable that anyone would hint that he had betrayed the trust of his nation or the mission of the service.

General Bradley once said: "A democracy such as ours cannot be defeated in this struggle (for freedom); it can only lose by default. It can only lose if our people deny through indifference and neglect their personal responsibilities for its security and growth.

"Our danger lies not so much in a fifth column whose enmity is avowed. It lies in a first column of unconscionable men who are 100 percent citizens in their daily routine of neglect."

Our people are buying an insurance policy. In it there is no room for the squanderer, the waster, the careless, or the neglectful. We must strive to see that we do not betray the trust of our nation as a whole or of ourselves as individual servicemen and citizens. We must be a good risk! (From Sept. 1949 issue of Flying Safety.)

AIR RESCUE SERVICE and AIR WEATHER SERVICE (U)

Air Rescue Service, as is the case with the other services of the Military Air Transport Service, aids in speeding military aircraft, their crews and passengers, to their planned destinations -- but with one marked difference. Generally, by the time Air Rescue Service facilities are called into action, an aircraft may be even beyond salvage.

Briefly, the assigned mission of Air Rescue Service is to search for, give aid to, and rescue personnel aboard military aircraft which for any reason do not land at the proper destination or a suitable alternate. Under certain conditions ARS is called in to assist in searching for civilian planes, but their primary mission concerns military aircraft.

> Number two in a series treating the interrelationship of the Air Weather Service with other agencies.

To accomplish its job, the Air Rescue Service, organized in 1946 and now composed of units strung across a large expanse of the Northern Hemisphere, keeps a 24-hour vigilance, ready to go into action the instant an alert indicates that an aircraft is overdue, missing, has crash-landed, or is in trouble while still in flight.

Headed by Colonel Richard T. Kight, who has over 5,000 hours to his credit, Air Rescue Service, with headquarters in Washington, D.C., is made up of seven squadrons, each consisting of four flights. A fully manned and equipped flight is capable of acting independently, or, where necessary, in conjunction with other flights. Squadron and flight headquarters are located all the way from Japan and the Philippines eastward across the Pacific Islands, throughout the United States, the North Atlantic, the Caribbean, Europe, the Near East and the Middle East, ending with the unit at Dhahran, Saudi Arabia.

While no two flights have exactly the same equipment, a standard ARS outfit generally is equipped with SB-17's (which include airborne lifeboats), SA-10 or SA-16 twin-engine amphibians, C-47 or C-82 personnel and cargo carriers, and H-5 helicopters. Usually there are two of each type aircraft at a location so that one will always be ready to fly while the other is undergoing maintenance.

Pilots and air crews are specially trained in the type of flying necessary on search missions. Normally search flying is done at 500 to 1,000 feet above terrain, for a small plane on the ground would probably never be sighted from a higher altitude. A series of search patterns or methods of approach have been evolved to meet specific situations encountered, one or more of which may be chosen by the mission commander to fit the problem. Rescue crewmen must be cross-trained in several types of aircraft (but in the helicopter only if he is a graduate of helicopter school) and must be ready to perform his duties anywhere, whether it be over dense jungle growth in Central America or over the barren Arctic north of Goose Bay, Labrador. Rocket-assisted take-offs; water take-offs and landings; short field landings and take-offs; para-rescue team jumps and supply drops; all these are standard training for any Air Rescue unit.

On 21 January 1950, Air Rescue Service activated the 2156th Rescue Unit, a technical training outfit to provide checkouts and transitional training in such aircraft as the SB-29, SA-16 amphibian, or H-5 helicopter. Crew training courses are

Colonel Richard T. Kight, CO, Air Rescue Service, was born in Collinsville, Texas, and began his military career in 1932 as a private in the Texas National Guard. He was accepted for cadet training at Randolph Field and in 1939 was awarded a regular commission as second lieutenant. In 1941 Col. Kight was assigned to the Air Corps Ferrying Command (later to become the Air Transport Command) to pilot aircraft for diplomatic courier flights.

As one of the pioneers of ATC, Col. Kight had the honor of performing the first military service tests on the C-54 and was also at the controls when the first one departed the ZI for an overseas destination.

Because of his brilliant flying record and knowledge of world affairs and protocol, Col. Kight was chosen to pilot the plane in which the late Mr. Wendell Willkie flew around the world in 1942. Mr. Willkie was so favorably impressed by his military aircraft and crew that he dedicated his book, "One World," to Col. Kight and the other crew members.

Col. Kight later served as operations officer and executive officer of ATC's India-China Wing at Chabua, assuming command of Air Rescue Service in December 1946 only a few months after it came into existence.

to be expanded to include other types of aircraft when they are received. Medical and survival personnel are welded into para-rescue and land rescue-survival teams at the school. Training is identical for personnel of the two teams, except the para-rescue men are qualified to jump into a crash area, while the land rescue-survival personnel get there by any means except parachuting. In each case, training has but one object: prepare the men to furnish medical care to survivors of air crashes or other disasters in isolated places, often without resupply of either food or medicines; and be able to make life for the survivors as comfortable as possible until evacuation is effected.

Equipment and training are constantly being improved so that eventually Air Rescue Service hopes to make the search-and-rescue aftermath of an air disaster a more speedy and simplified process. Wasted time, even though measured in minutes or seconds, may mean the difference between life and death for an injured survivor. And as Col. Kight stated recently in a personal message to each man in his organization, "Air Rescue Service exists only to save lives."

Invariably when an "alert" is received at a Rescue Control Center, one of the first things checked is the weather. Air Weather Service forecasters, upon hearing an alert over the inter-com system from Rescue Control, prepare a complete weather briefing for the area to be searched, thus aiding materially in locating missing aircraft. Forecasts of winds, icing, ceiling, and visibility are perhaps the most important, but in the Arctic, for example, information concerning snow depths and thickness of ice may be required. At times, knowledge of tides and ocean currents is most essential.

One of the most publicized missions in recent months was the ditching of an Air Force B-29 with 20 men aboard at an unknown position somewhere near Bermuda. The aircraft, en route from the west coast to Bermuda on its way to England, had become lost, although radio contact with Kindley AFB was possible. Within a short time two SB-17's -- especially modified for search and rescue work, including the installation of an airborne, droppable lifeboat -- left Kindley AFB and began the search. Personnel of the weather detachment at Kindley worked hand-in-hand with the rescue unit, providing vital, up-to-the-minute weather information.

Large-scale search plans were thrown into action when the pilot of the B-29 radioed that he planned to ditch within five minutes. All available planes at Bermuda, including other SAC B-29's from the same flight, MATS transport planes, RB-29's of the Air Weather Service, and U.S. Navy PBM's, were put in the air to aid the ARS SB-17's. Other Air Rescue Service flights -- those at Ramey, MacDill, Lowry, and Westover Air Force Bases -- and the U.S. Coast Guard, all surface vessels in the area, and dozens of SAC B-29's participated.

Search during the first day covered the areas of greatest possibility; an all-out search was scheduled for the following morning. Weather was bad throughout the area, with low ceilings and poor visibility prevailing. However, two encouraging facts were logged in late in the afternoon of the first full search day. One B-29 reported sighting flares, and another was able to obtain a bearing on some dashes transmitted on 500 kcs. The line of bearing crossed within one mile of the reported flares. An SB-17, equipped with the droppable lifeboat and staffed with a more experienced search crew, was diverted to the area. Nothing further was seen that night, however.

Late the second full day of search a B-29 reported sighting several pieces of debris, assumed to be from the missing B-29, in the general area northeast of Bermuda where the flares had been sighted and the radio bearing obtained.

Approximately 75 hours after the B-29 had ditched, a scanner, Sgt. Ralph E. Hawes aboard an SB-17 flown by Lt. Edward W. Lynch of the Kindley Rescue Flight, reported "two life rafts at 9 o'clock, one-half mile." Shortly thereafter the lifeboat was dropped and a surface vessel alerted to speed to the area, about 350 miles northeast of Bermuda. The men on the life rafts boarded the lifeboat dropped by the SB-17 and soon were picked up by the Canadian Destroyer, HCMS Haida. While the ARS SB-17 circled overhead, it reported that there were 18 survivors. The plane continued to search until a later report stated that two men had gone down with the aircraft. The B-29 crewmen were taken to Bermuda several hours later, and another mission was completed.

More fortunate have been several aircraft of the Air Weather Service. Occasionally in the past, RB-29's of the 373d Reconnaissance Squadron (VLR) Weather, operating out of Bermuda, have come in with one or more engines feathered, usually with an ARS SB-17 hovering nearby. One such plane was an RB-29 on GULL Charlie track, reporting number four engine feathered 1,100 miles east of Bermuda. Fifteen minutes later an SB-17 at Kindley AFB was airborne, making CW contact with the plane five munutes later. While the two aircraft were still 40 miles apart, the Rescue plane "saw" the RB-29 through use of radar and IFF. The RB-29, reducing airspeed so the slower SB-17 could provide escort, landed safely at Kindley. Four minutes later the SB-17 touched the ground, mission completed.

During a recent three-month period, Air Rescue Service provided similar precautionary interceptions over water for 23 aircraft, both commercial and military, with an average time lapse of 21 minutes from first alert to take-off. Typical of other missions has been the use of a helicopter to evacuate a jet pilot from an otherwise inaccessible mountain plateau where he had landed after making a seat-ejection parachute jump from his crippled plane; location of, and dropping an airborne lifeboat to, three crewmen after their C-46 was ditched while on a local flight from a Pacific Island Air Base; and delivery of medicine by SA-10 amphibian to a quiet bay in the far North where a Navy helicopter picked it up and transferred it for immediate use aboard a Navy vessel.

During a recent search for a light plane in southwestern U. S., Air Rescue Service followed down every possible lead or rumor as to its location. The aid of all agencies was enlisted, and with Civil Air Patrol and military planes a wide area was searched. Other civil and military aircraft surveyed an extremely wide path between Tulsa and Houston. Most areas were air-searched at least twice and some as many as four and five times. Although the mission was pressed for a total of 27 days and thousands upon thousands of square miles were searched, no trace of the missing plane or its occupants could be found. In this case, typical of many others, the plane had made no radio position reports since taking off, the pilot's proposed route was unknown, and there was a time lag between actual time he would have exhausted his gas and the time authorities learned he was overdue.

A word to pilots which might help Air Rescue Service save you some day: Fly the flight plan you file, never pass up an opportunity to make an accurate position report to Flight Service, and when you land, if at an Air Force Base, make sure that Operations has closed your flight plan; if at a non-military base, get in touch immediately with Flight Service or CAA as required. In failing to do so you may be safe and know it, but Air Rescue Service won't. It costs the U.S. taxpayer (which includes YOU) just as much to operate a search mission which later is termed "false" as to operate one for a plane actually down. By failing to notify the proper authorities, you may, in some cases, cause planes and personnel to be diverted from an actual incident and thus indirectly harm your fellow-pilots' chances of being found and rescued. With flight plans and frequent position reports to check on, Air Rescue Service can decrease the area of search by many hundreds of square miles, thus concentrating on the areas of greatest possibility with no wasted motion.

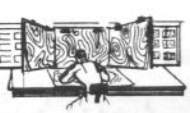
Air Rescue Service has asked for development of a light-weight radio transmitter (both HF and VHF) which would be installed in the tail end of all aircraft and would be released automatically by crash impact or manually by a pilot prior to a premeditated crash-landing or ditching. Each beacon would have its own code and a self-contained power unit for automatic transmission; it would be shock-proof and self-righting in all terrain, including ability to float on water. Thus, a DF-net could pick up and identify any beacon immediately after a crash, pinpointing it in an area of a few square miles. Rescue planes then need only fly to the area, locate the actual scene (still homing on the locator signal) and drop supplies, medicine and/or personnel as necessary until actual rescue evacuation could be made.

But in the meantime, no matter where an aircraft finds itself in difficulty -- be it mountains or ocean, forests or deep snow -- Air Rescue Service will be there, sparing no effort to "search for, give aid to, and rescue" the personnel involved.

WEATHER AND THE BUILDING INDUSTRY DISCUSSED (U)

In order to correlate climatological research and discuss its impact on building design, construction, materials, and equipment, the Building Research Advisory Board of the National Research Council (National Academy of Sciences) convened a conference in Washington, D. C., on 11 and 12 January 1950. Members were welcomed by Dr. Detlev Bronk, Chairman, National Research Council.

In attendance were representatives of various universities, commercial heating and air conditioning companies, architectural magazines, the National Bureau of Standards, the Research and Development Board, Quartermaster Corps, U. S. Weather Bureau, and Air Weather Service. The USAF's Air Weather Service delegate was Dr. W. C. Jacobs, Chief, Military Climatology Division.



On The Lighter Side

NO FUTURE FOR METEOROLOGISTS! (U)

It appears that the future of meteorologists will be a bit on the gloomy side if a "forecast" of Dr. Hans Pettersson,* Swedish professor of oceanography, proves to be correct. According to him, it will only be a matter of a few thousand million years before all free water on the earth will be gone. And, we say, what can a meteorologist do if he has no moisture to produce his clouds, snow, rain, or fog? No water, no job.

Dr. Pettersson, in a recent lecture at the Royal Institution of Great Britain, stated that the earth is suffering from progressive dessication, an ailment common to all aging planets. This old, weary earth, it appears, is converting its water into components of its solid crust, and when the process is complete, will find itself in the present tragic state of its neighbor, Mars, whose oceans are gone.

Apparently New York City doesn't really have a water problem -- yet.

GOLD? PROBABLY NOT, BUT LOTS OF ANIMALS (U)

In late October the cry of "Gold at Fishwheel" resounded through Alaska, and people from all over the Northern Hemisphere and some from the southern half of the world made bee-lines for that remote Alaskan encampment. Fishwheel was growing into a metropolis of tents with perhaps more airstrips than any Alaskan city.

The 375th Reconnaissance Squadron was represented at the gold-mad assemblage by Lt. George M. Sliney who proceeded to Fishwheel to stake out a few claims of his own. He was accompanied by Mr. Harvey Fondiller, a writer and photographer, who intended to cover the story for LIFE magazine. Mr. Fondiller wrote a comprehensive story of the "strike" at Fishwheel and took some fifty photographs of the activity. Lieutenant Sliney was anxiously waiting to see his picture in LIFE, but since Fishwheel turned out to be a magnificent farce, Mr. Fondiller's article apparently came face to face with the editor's REJECT stamp. At any rate, Lt. Sliney claims it was worth the experience, and in addition he is now the proud owner of a few acres of Alaska's boundless wilds. His account follows:

Whether or not there's gold is the question in everyone's mind when they hear the story of Fishwheel. One thing is certain: I have some of the most beautiful swampland that has ever been staked out as a placer claim in the Yukon River Valley. "Gold is where you find it," and if there's any gold within the limits of my claim, I hope to find it. After I had heard about the gold strike, I thought about the venture for a long time. As a matter of fact, it must have been all of five minutes before

---

*Not to be confused with Dr. Sverre Petterssen, Director of Scientific Services, Air Weather Service.

I made up my mind to go to the frozen north and stake out my two claims which, I think, should have been named "Got 1" and "Hope 2."

Prior to my departure for Fishwheel, I heard that it was below zero there. I almost immediately (but only temporarily) lost all interest in gold, for zero meant that it was cold outside, and that would be just where I'd be sleeping -- outside. But the decision was made, and northward I went.

On one cold evening I built a roaring camp fire which I thought was the last word in camping. It brought forth a pearl of wisdom from one of the natives in the area: "White man build big fire, stand way back; Indian build small fire, stand up close." But our big fire kept us warm and provided a small place to dry out our mukluks, although I nearly burned my footgear off when I stood in a bed of hot coals.

If the prospect of gold grows dim*, then I may later go into the trapping business on the property. There must be something attractive about the land or there wouldn't be so many animals or so many kinds of animals on my land. Rats, mice, snowshoe rabbits, bear (ugh), moose, fox -- and things that I undoubtedly missed when I was tramping around the property -- all have left their tracks or marks on MY land.

They say you can't have everything, and I guess that's right. But I don't want everything. All I want is something -- anything -- preferably gold.

NOT TOO KEEN (U)

They say the so-called temperate zone
Contributes to our mental tone,
And who, I ask, would wish to be
Both sluggish and inert?
They tell us, too, the constant change
We have in our climatic range
Is bound to stimulate our minds
And make them more alert.

It is, I grant you, quite all right
Thus to become a bit more bright,
But now and then I rather think
I'd rather have a chance
Perhaps to be a trifle slow
And let the frigid breezes blow
Elsewhere, while I was warming up
In blissful ignorance.

--George Ryan.

---

*Apparently the prospect of gold not only grew dim but blacked out altogether, for the last we heard about gold in Fishwheel was that it wasn't.--Ed.

AIR WEATHER SERVICE STATISTICS

RAWINSONDE PERFORMANCE, SEPTEMBER—DECEMBER 1949 (U)

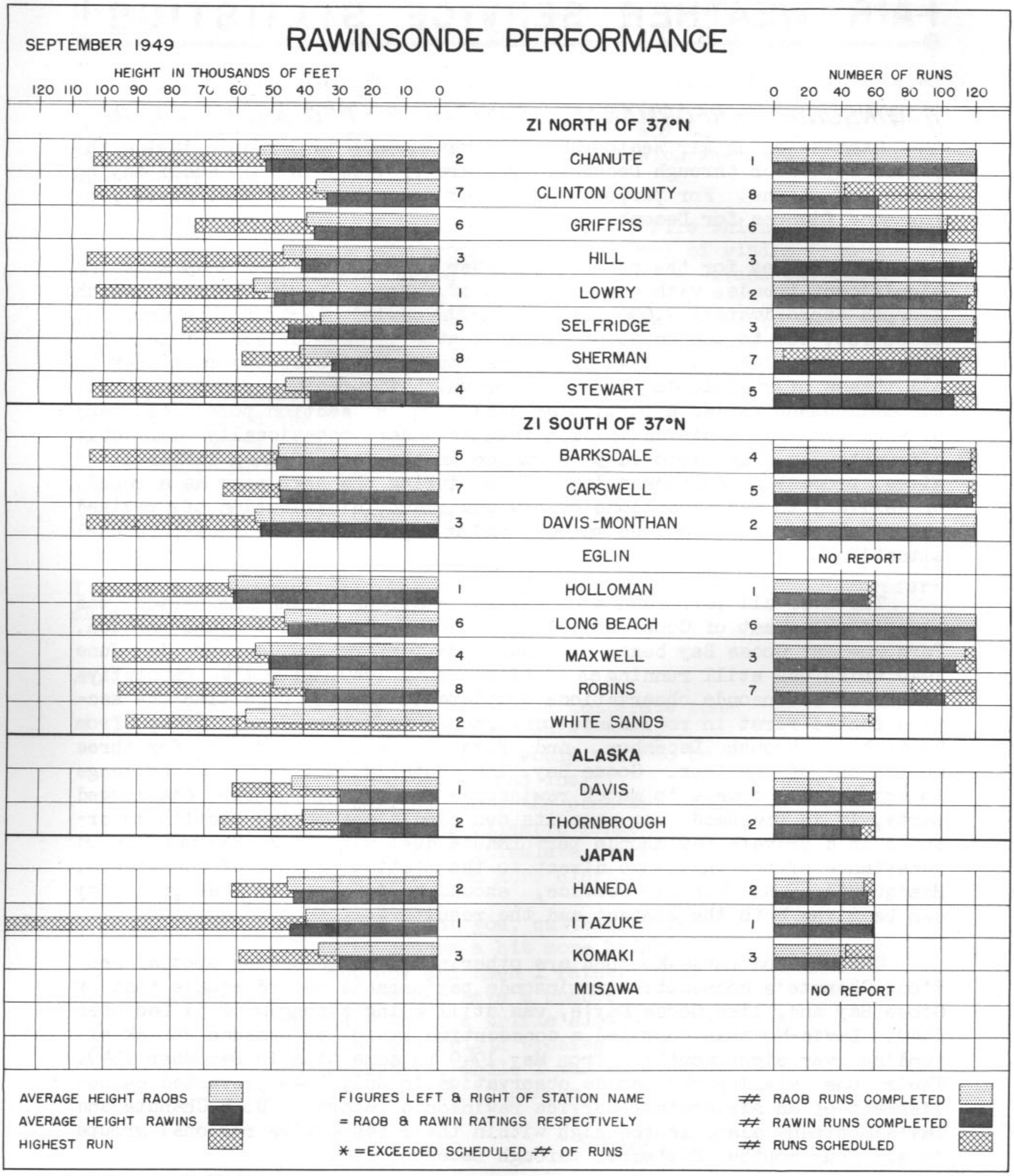
Statistics on Air Weather Service rawinsonde performance during the period September through December 1949 are provided in the accompanying table and graphs. For purposes of comparison, the table also gives performance figures for December 1948.

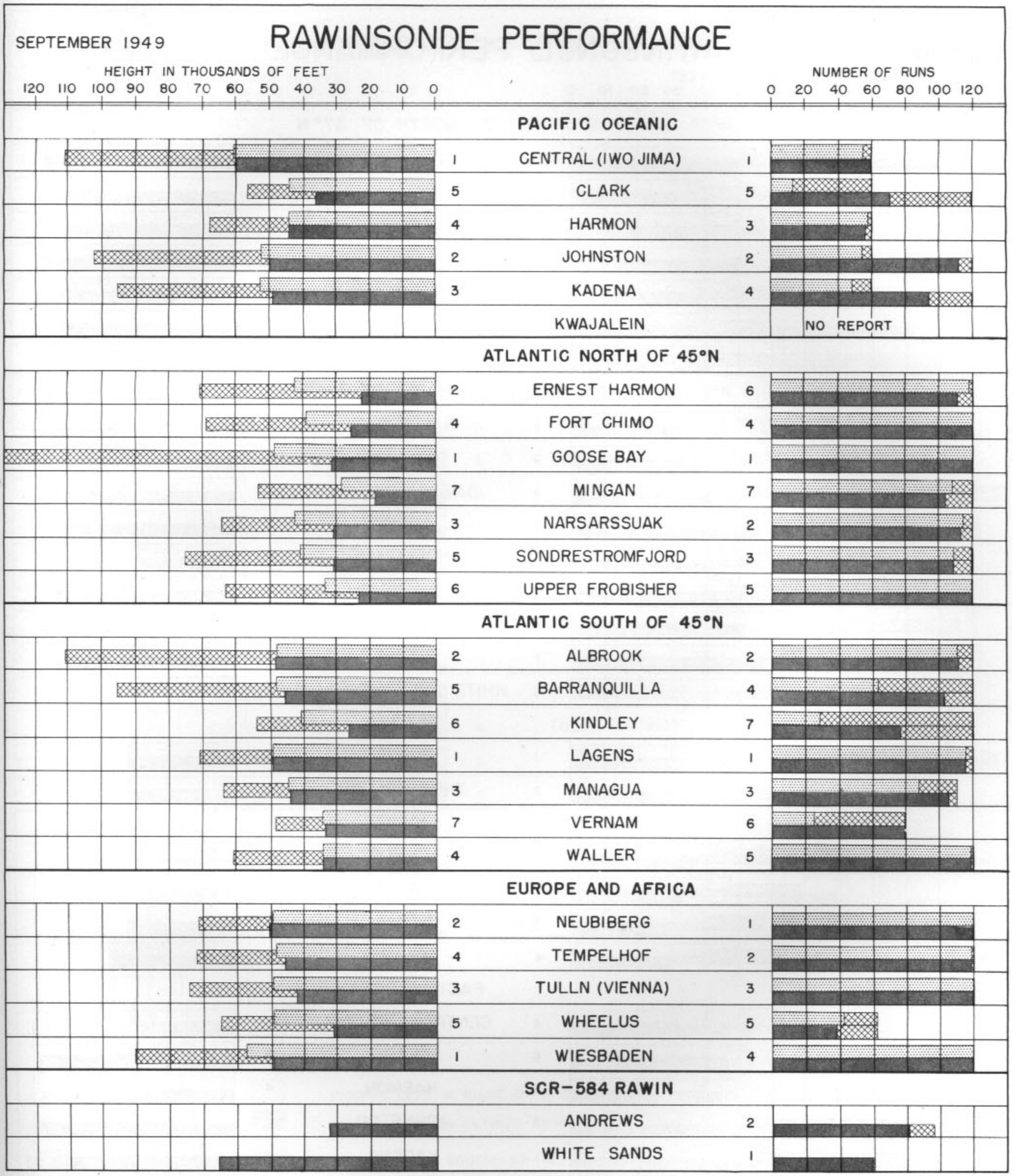
The figures for the period September through December 1949 show no significant trends, with the exception of average rawin heights which dropped approximately 9,000 feet during the period. Part of this drop is, of course, due to the onset of winter weather. Comparison of December figures for 1948 and 1949 indicates improvement over the past year in all phases of radiosonde operation for which figures are provided. This accomplishment reflects particular credit on "R" section personnel, many of whom probably achieved maximum results under occasionally difficult circumstances. The improved performance in the face of many difficulties gives promise of continued improvement during the next year as a result of delivery to many locations of new equipment, distribution of a revised and standardized operations manual, and an improved maintenance-personnel situation.

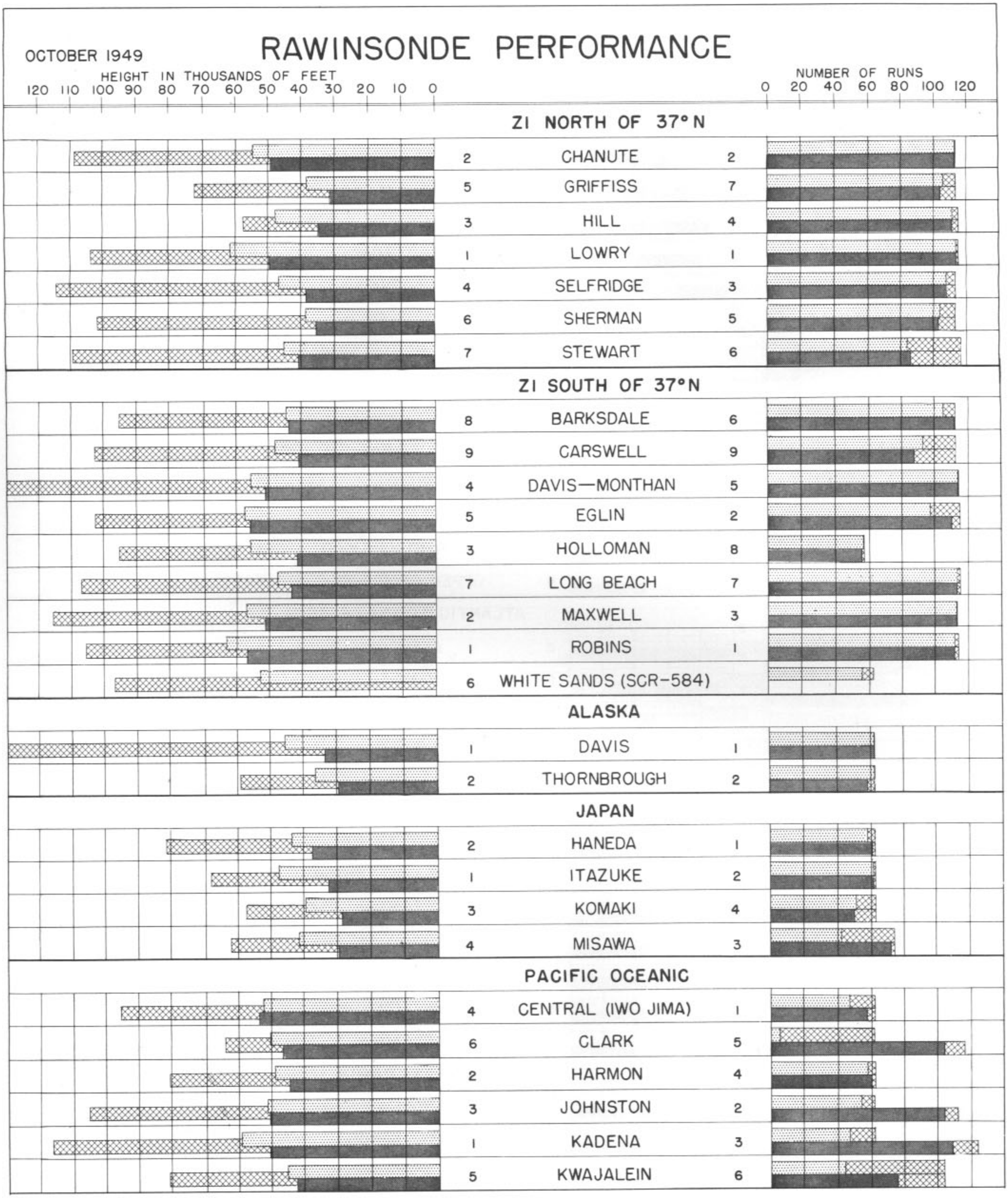
The over-all performance of several stations during the period was exceptional. That of Goose Bay, in particular, deserves special mention. Personnel at Goose Bay began a consecutive performance streak in June 1949 which was still running as of 31 December 1949, with 734 consecutive scheduled rawinsonde observations completed. At the same time the section ranked first in radiosonde performance in its regional group from September through December, and first in rawin performance for three months out of the four. Goose Bay, incidentally, has issued a challenge to any and all comers to match rawinsonde performance. The challenged party, it is presumed, can name its own conditions. Any section interested in a private rawinsonde performance duel with Goose Bay can forward acceptance of the challenge direct to the Station Weather Officer there. Headquarters, Air Weather Service, should be informed so that publicity can be given both the contest and the result.

Chanute and Davis-Monthan are other stations deserving special mention. Chanute's consecutive rawinsonde performance record equals that of Goose Bay and, like Goose Bay's, was still going strong as of 31 December 1949. Davis-Monthan compiled a consecutive rawin performance streak extending over eight months, from May 1949 to some time in December 1949. Their one missing radiosonde observation in July 1949 prevented establishment of an Air Weather Service rawinsonde record. Both Chanute and Davis-Monthan also ranked high within their respective regional groups in all four months, September through December 1949.

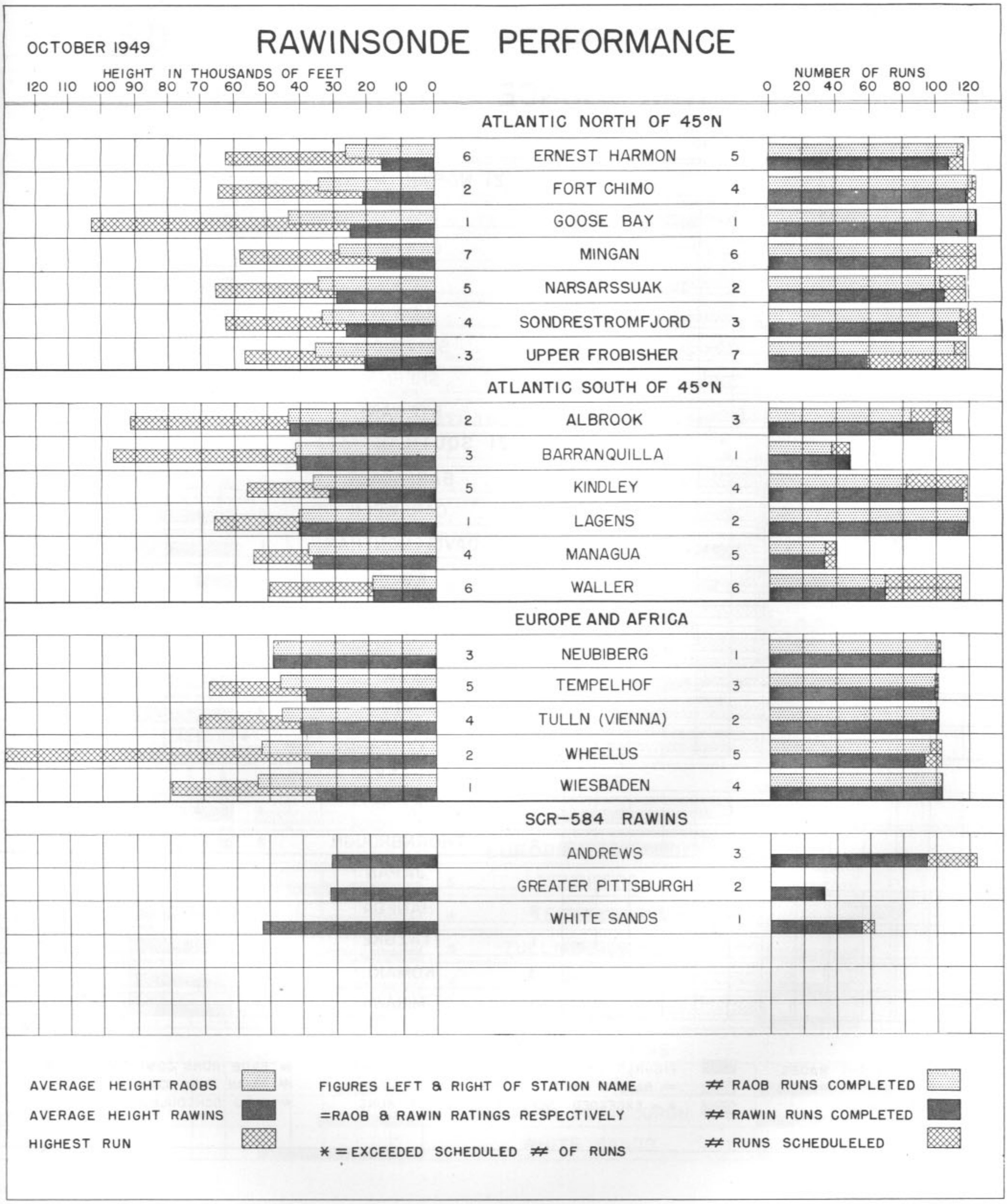
Rawinsonde error statistics, originally planned for publication in

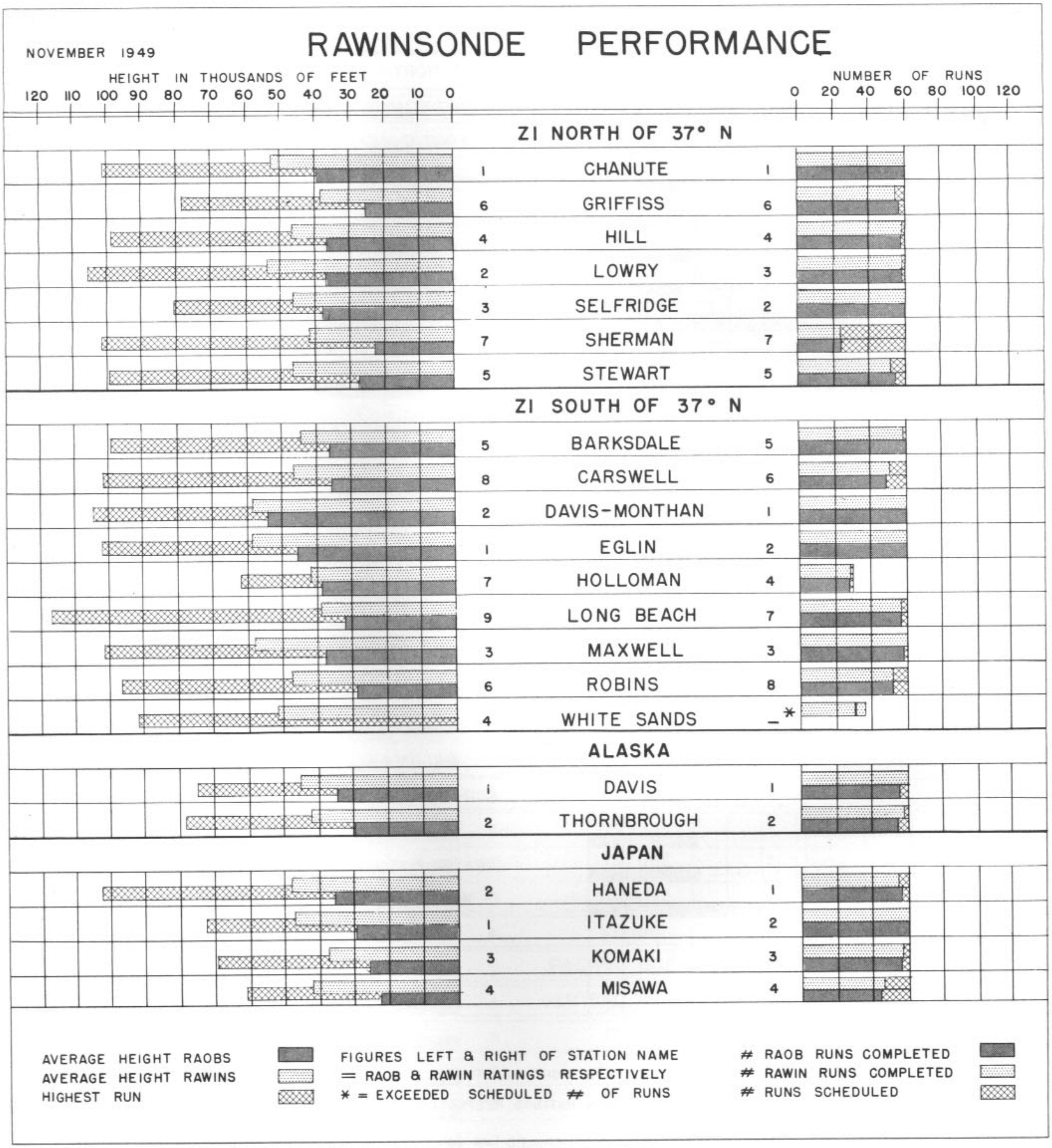

SEPTEMBER 1949
RAWINSONDE PERFORMANCE
HEIGHT IN THOUSANDS OF FEET
120 110 100 90 80 70 60 50 40 30 20 10 0
NUMBER OF RUNS
0 20 40 60 80 100 120
ZI NORTH OF 37°N
2 CHANUTE 1
7 CLINTON COUNTY 8
6 GRIFFISS 6
3 HILL 3
1 LOWRY 2
5 SELFRIDGE 3
8 SHERMAN 7
4 STEWART 5
ZI SOUTH OF 37°N
5 BARKSDALE 4
7 CARSWELL 5
3 DAVIS-MONTHAN 2
EGLIN
NO REPORT
1 HOLLOMAN 1
6 LONG BEACH 6
4 MAXWELL 3
8 ROBINS 7
2 WHITE SANDS
ALASKA
1 DAVIS 1
2 THORNBROUGH 2
JAPAN
2 HANEDA 2
1 ITAZUKE 1
3 KOMAKI 3
MISAWA
NO REPORT
AVERAGE HEIGHT RAOBS
AVERAGE HEIGHT RAWINS
HIGHEST RUN
FIGURES LEFT & RIGHT OF STATION NAME
= RAOB & RAWIN RATINGS RESPECTIVELY
* = EXCEEDED SCHEDULED # OF RUNS
# RAOB RUNS COMPLETED
# RAWIN RUNS COMPLETED
# RUNS SCHEDULED

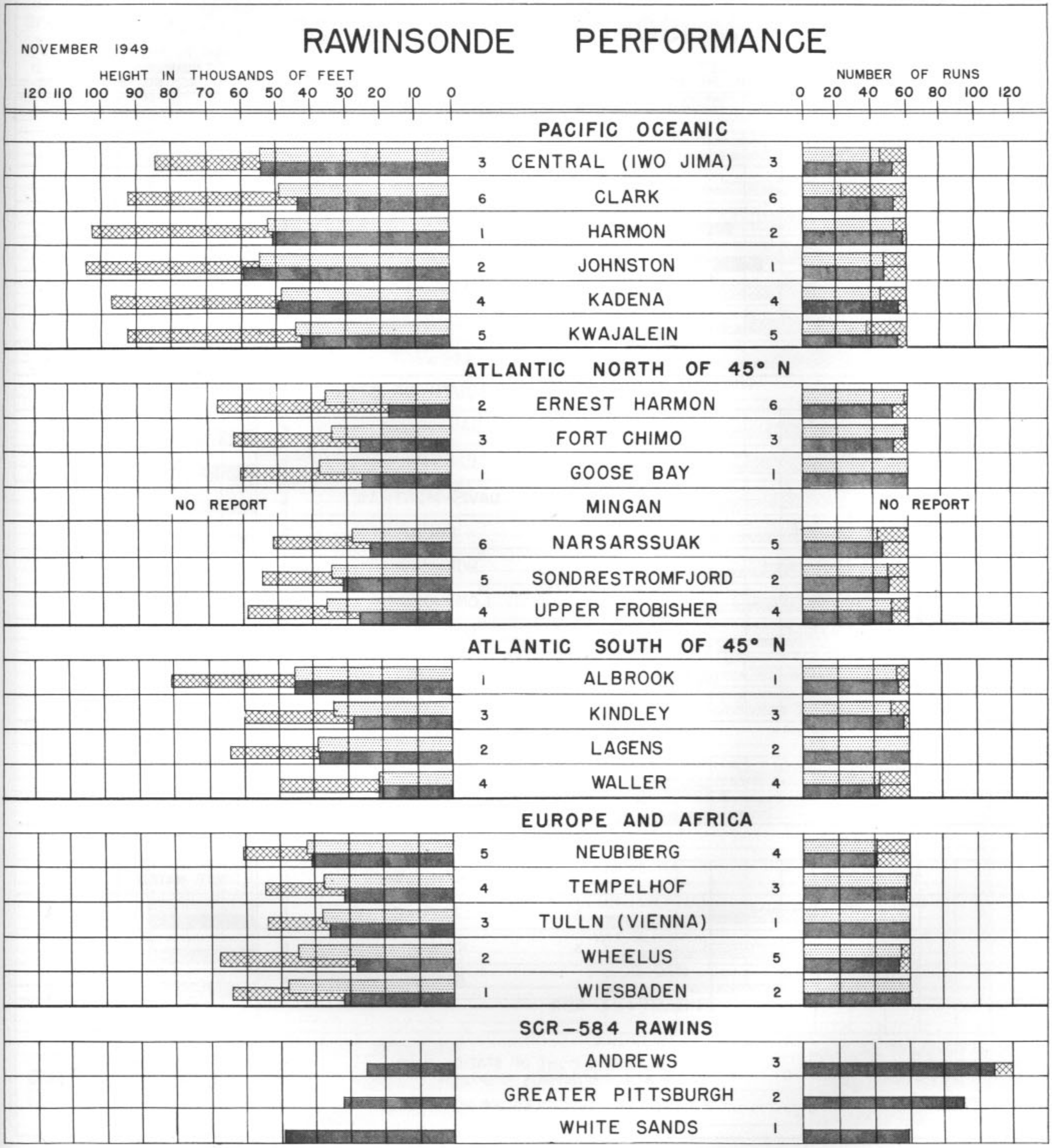

SEPTEMBER 1949
RAWINSONDE PERFORMANCE
HEIGHT IN THOUSANDS OF FEET
120 110 100 90 80 70 60 50 40 30 20 10 0
NUMBER OF RUNS
0 20 40 60 80 100 120
PACIFIC OCEANIC
1 CENTRAL (IWO JIMA) 1
5 CLARK 5
4 HARMON 3
2 JOHNSTON 2
3 KADENA 4
KWAJALEIN
NO REPORT
ATLANTIC NORTH OF 45°N
2 ERNEST HARMON 6
4 FORT CHIMO 4
1 GOOSE BAY 1
7 MINGAN 7
3 NARSARSSUAK 2
5 SONDRESTROMFJORD 3
6 UPPER FROBISHER 5
ATLANTIC SOUTH OF 45°N
2 ALBROOK 2
5 BARRANQUILLA 4
6 KINDLEY 7
1 LAGENS 1
3 MANAGUA 3
7 VERNAM 6
4 WALLER 5
EUROPE AND AFRICA
2 NEUBIBERG 1
4 TEMPELHOF 2
3 TULLN (VIENNA) 3
5 WHEELUS 5
1 WIESBADEN 4
SCR-584 RAWIN
ANDREWS 2
WHITE SANDS 1

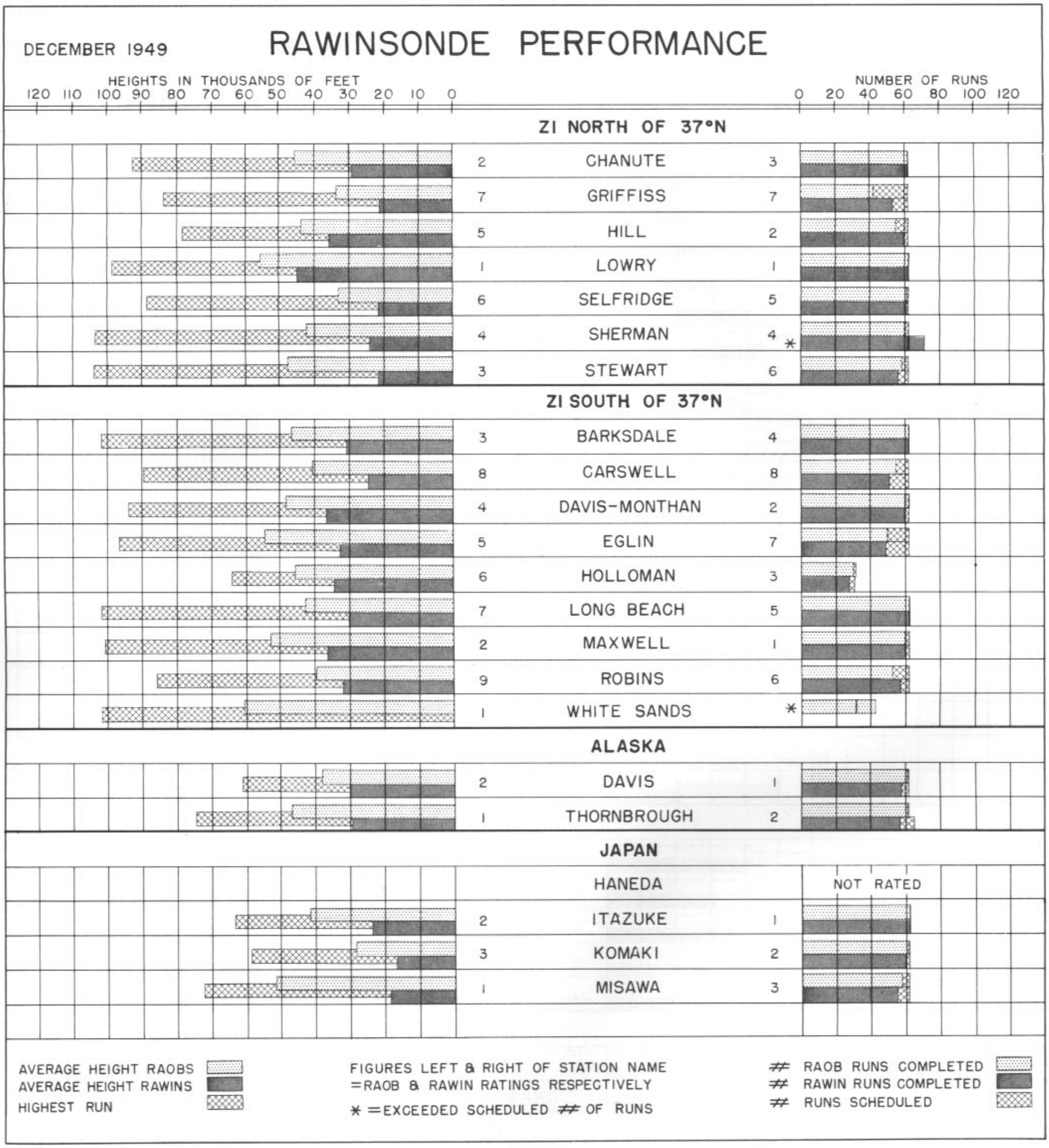


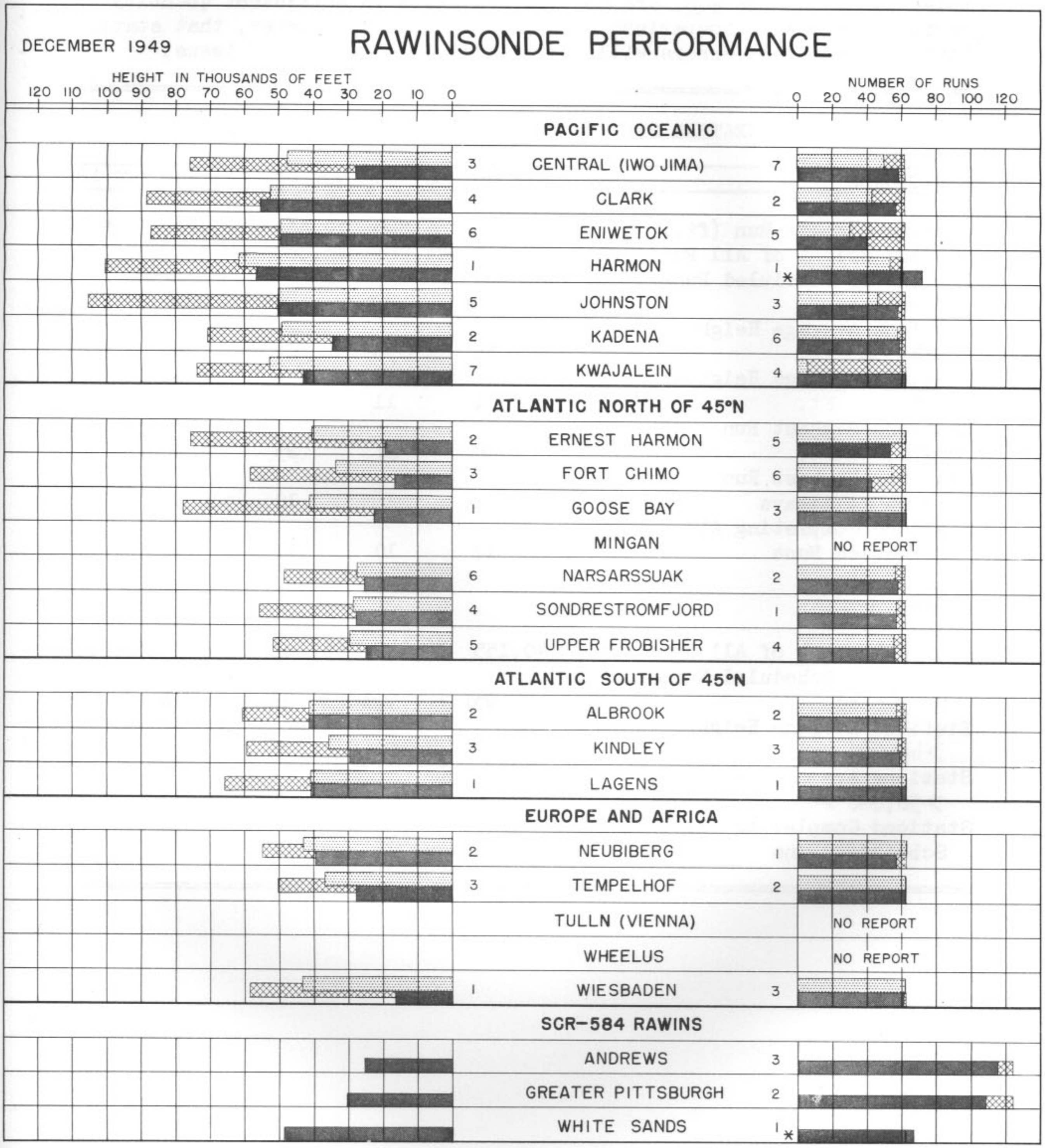
OCTOBER 1949
RAWINSONDE PERFORMANCE
HEIGHT IN THOUSANDS OF FEET
120 110 100 90 80 70 60 50 40 30 20 10 0
NUMBER OF RUNS
0 20 40 60 80 100 120
ZI NORTH OF 37° N
2 CHANUTE 2
5 GRIFFISS 7
3 HILL 4
1 LOWRY 1
4 SELFRIDGE 3
6 SHERMAN 5
7 STEWART 6
ZI SOUTH OF 37°N
8 BARKSDALE 6
9 CARSWELL 9
4 DAVIS—MONTHAN 5
5 EGLIN 2
3 HOLLOMAN 8
7 LONG BEACH 7
2 MAXWELL 3
1 ROBINS 1
6 WHITE SANDS (SCR-584)
ALASKA
1 DAVIS 1
2 THORNBROUGH 2
JAPAN
2 HANEDA 1
1 ITAZUKE 2
3 KOMAKI 4
4 MISAWA 3
PACIFIC OCEANIC
4 CENTRAL (IWO JIMA) 1
6 CLARK 5
2 HARMON 4
3 JOHNSTON 2
1 KADENA 3
5 KWAJALEIN 6


OCTOBER 1949
RAWINSONDE PERFORMANCE
HEIGHT IN THOUSANDS OF FEET
120 110 100 90 80 70 60 50 40 30 20 10 0
NUMBER OF RUNS
0 20 40 60 80 100 120
ATLANTIC NORTH OF 45°N
6 ERNEST HARMON 5
2 FORT CHIMO 4
1 GOOSE BAY 1
7 MINGAN 6
5 NARSARSSUAK 2
4 SONDRESTROMFJORD 3
3 UPPER FROBISHER 7
ATLANTIC SOUTH OF 45°N
2 ALBROOK 3
3 BARRANQUILLA 1
5 KINDLEY 4
1 LAGENS 2
4 MANAGUA 5
6 WALLER 6
EUROPE AND AFRICA
3 NEUBIBERG 1
5 TEMPELHOF 3
4 TULLN (VIENNA) 2
2 WHEELUS 5
1 WIESBADEN 4
SCR-584 RAWINS
ANDREWS 3
GREATER PITTSBURGH 2
WHITE SANDS 1
AVERAGE HEIGHT RAOBS
AVERAGE HEIGHT RAWINS
HIGHEST RUN
FIGURES LEFT & RIGHT OF STATION NAME
=RAOB & RAWIN RATINGS RESPECTIVELY
* = EXCEEDED SCHEDULED # OF RUNS
# RAOB RUNS COMPLETED
# RAWIN RUNS COMPLETED
# RUNS SCHEDULELED


NOVEMBER 1949
RAWINSONDE PERFORMANCE
HEIGHT IN THOUSANDS OF FEET
120 110 100 90 80 70 60 50 40 30 20 10 0
NUMBER OF RUNS
0 20 40 60 80 100 120
ZI NORTH OF 37° N
1 CHANUTE 1
6 GRIFFISS 6
4 HILL 4
2 LOWRY 3
3 SELFRIDGE 2
7 SHERMAN 7
5 STEWART 5
ZI SOUTH OF 37° N
5 BARKSDALE 5
8 CARSWELL 6
2 DAVIS-MONTHAN 1
1 EGLIN 2
7 HOLLOMAN 4
9 LONG BEACH 7
3 MAXWELL 3
6 ROBINS 8
4 WHITE SANDS _*
ALASKA
1 DAVIS 1
2 THORNBROUGH 2
JAPAN
2 HANEDA 1
1 ITAZUKE 2
3 KOMAKI 3
4 MISAWA 4
AVERAGE HEIGHT RAOBS
AVERAGE HEIGHT RAWINS
HIGHEST RUN
FIGURES LEFT & RIGHT OF STATION NAME
= RAOB & RAWIN RATINGS RESPECTIVELY
* = EXCEEDED SCHEDULED # OF RUNS
# RAOB RUNS COMPLETED
# RAWIN RUNS COMPLETED
# RUNS SCHEDULED


NOVEMBER 1949
RAWINSONDE PERFORMANCE
HEIGHT IN THOUSANDS OF FEET
120 110 100 90 80 70 60 50 40 30 20 10 0
NUMBER OF RUNS
0 20 40 60 80 100 120
PACIFIC OCEANIC
3 CENTRAL (IWO JIMA) 3
6 CLARK 6
1 HARMON 2
2 JOHNSTON 1
4 KADENA 4
5 KWAJALEIN 5
ATLANTIC NORTH OF 45° N
2 ERNEST HARMON 6
3 FORT CHIMO 3
1 GOOSE BAY 1
NO REPORT MINGAN NO REPORT
6 NARSARSSUAK 5
5 SONDRESTROMFJORD 2
4 UPPER FROBISHER 4
ATLANTIC SOUTH OF 45° N
1 ALBROOK 1
3 KINDLEY 3
2 LAGENS 2
4 WALLER 4
EUROPE AND AFRICA
5 NEUBIBERG 4
4 TEMPELHOF 3
3 TULLN (VIENNA) 1
2 WHEELUS 5
1 WIESBADEN 2
SCR-584 RAWINS
ANDREWS 3
GREATER PITTSBURGH 2
WHITE SANDS 1


DECEMBER 1949
RAWINSONDE PERFORMANCE
HEIGHTS IN THOUSANDS OF FEET
120 110 100 90 80 70 60 50 40 30 20 10 0
NUMBER OF RUNS
0 20 40 60 80 100 120
ZI NORTH OF 37°N
2 CHANUTE 3
7 GRIFFISS 7
5 HILL 2
1 LOWRY 1
6 SELFRIDGE 5
4 SHERMAN 4 *
3 STEWART 6
ZI SOUTH OF 37°N
3 BARKSDALE 4
8 CARSWELL 8
4 DAVIS-MONTHAN 2
5 EGLIN 7
6 HOLLOMAN 3
7 LONG BEACH 5
2 MAXWELL 1
9 ROBINS 6
1 WHITE SANDS *
ALASKA
2 DAVIS 1
1 THORNBROUGH 2
JAPAN
HANEDA NOT RATED
2 ITAZUKE 1
3 KOMAKI 2
1 MISAWA 3
AVERAGE HEIGHT RAOBS
AVERAGE HEIGHT RAWINS
HIGHEST RUN
FIGURES LEFT & RIGHT OF STATION NAME =RAOB & RAWIN RATINGS RESPECTIVELY
* =EXCEEDED SCHEDULED # OF RUNS
# RAOB RUNS COMPLETED
# RAWIN RUNS COMPLETED
# RUNS SCHEDULED


DECEMBER 1949
RAWINSONDE PERFORMANCE
HEIGHT IN THOUSANDS OF FEET
120 110 100 90 80 70 60 50 40 30 20 10 0
NUMBER OF RUNS
0 20 40 60 80 100 120
PACIFIC OCEANIC
3 CENTRAL (IWO JIMA) 7
4 CLARK 2
6 ENIWETOK 5
1 HARMON 1 *
5 JOHNSTON 3
2 KADENA 6
7 KWAJALEIN 4
ATLANTIC NORTH OF 45°N
2 ERNEST HARMON 5
3 FORT CHIMO 6
1 GOOSE BAY 3
MINGAN NO REPORT
6 NARSARSSUAK 2
4 SONDRESTROMFJORD 1
5 UPPER FROBISHER 4
ATLANTIC SOUTH OF 45°N
2 ALBROOK 2
3 KINDLEY 3
1 LAGENS 1
EUROPE AND AFRICA
2 NEUBIBERG 1
3 TEMPELHOF 2
TULLN (VIENNA) NO REPORT
WHEELUS NO REPORT
1 WIESBADEN 3
SCR-584 RAWINS
ANDREWS 3
GREATER PITTSBURGH 2
WHITE SANDS 1 *

this issue of the WSB, are not yet available in sufficient quantity to permit performance comparison. It is anticipated, however, that statistics on rawinsonde errors will be included in a subsequent issue.

AIR WEATHER SERVICE OVER-ALL PERFORMANCE FIGURES

RADIOSONDE	SEP 49	OCT 49	NOV 49	DEC 49	DEC 48
Average Highest Run (ft.)	88,676	85,390	79,339	78,920	68,528
Average Height of All Runs (ft.)	45,919	44,286	43,869	44,312	38,956
Percent of Scheduled Runs Completed	85%	88%	88%	88%	77%
Stations Average Height >40,000 Ft.	36	30	29	29	21
Stations Average Height >50,000 Ft.	11	11	9	11	2
Stations Highest Run >70,000 Ft.	28	27	25	27	10
Stations Highest Run to 10 Millibars	12	16	10	9	1
Stations Completing All Scheduled Runs	11	10	11	13	4
RAWIN					
Average Height of All Runs (ft.)	40,155	38,242	35,147	31,647	32,438
Percent of Scheduled Runs Completed	95%	94%	89%	94%	83%
Stations Average Height >40,000 Ft.	25	20	12	9	9
Stations Average Height >50,000 Ft.	9	7	4	3	1
Stations Completing All Scheduled Runs	11	13	10	12	6