TABLE 2.—*Free-air resultant winds (meters per second) based on pilot-balloon observations made near 5 a. m. (E. S. T.) during November 1936*

[Wind from N=360°, E=90°, etc.]

Altitude (m) m. s. l.	Albuquerque, N. Mex. (1,554 m)		Atlanta, Ga. (309 m)		Billings, Mont. (1,088 m)		Boston, Mass. (15 m)		Cheyenne, Wyo. (1,873 m)		Chicago, Ill. (192 m)		Cincinnati, Ohio (153 m)		Detroit, Mich. (204 m)		Fargo, N. Dak. (274 m)		Houston, Tex. (21 m)		Key West, Fla. (11 m)		Medford, Oreg. (410 m)		Murfreesboro, Tenn. (180 m)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°		°	
Surface	12	1.3	333	2.1	241	5.5	273	2.9	291	3.4	270	2.2	261	1.0	266	3.0	317	2.0	19	2.3	35	3.5	138	0.4	213	1.0
500	-----	-----	322	4.6	-----	-----	283	9.4	-----	-----	274	6.2	263	4.0	276	6.7	318	6.1	66	2.7	55	7.2	23	0.2	248	3.4
1,000	-----	-----	306	6.3	-----	-----	281	10.2	-----	-----	277	8.7	267	8.4	286	8.4	325	8.5	326	0.7	71	5.4	128	2.0	259	6.4
1,500	-----	-----	290	7.4	273	9.7	285	9.2	-----	-----	271	11.1	275	11.6	282	10.5	313	9.1	297	1.8	80	2.6	141	2.5	267	6.9
2,000	334	0.9	292	9.4	299	10.2	282	11.0	295	7.0	278	12.5	280	10.9	287	8.3	313	11.8	292	3.5	18	0.7	187	1.3	290	8.2
2,500	292	1.7	296	8.7	297	11.2	-----	-----	311	9.6	284	13.4	299	11.7	295	11.3	321	11.5	286	4.3	356	1.2	251	0.7	292	10.1
3,000	284	2.4	280	7.5	302	11.2	-----	-----	318	8.6	291	11.6	293	11.0	294	12.3	-----	-----	285	5.1	308	1.6	290	1.3	296	7.8
4,000	269	4.2	273	10.4	315	10.5	-----	-----	314	8.4	-----	-----	-----	-----	-----	-----	-----	-----	279	5.8	291	4.8	213	3.4	-----	-----
5,000	335	1.3	-----	-----	335	11.2	-----	-----	360	5.7	-----	-----	-----	-----	-----	-----	-----	-----	278	4.7	-----	-----	340	3.2	-----	-----

Altitude (m) m. s. l.	Newark, N. J. (14 m)		Oakland, Calif. (8 m)		Oklahoma City, Okla. (402 m)		Omaha, Nebr. (306 m)		Pearl Harbor, Territory of Hawaii [1] (68 m)		Pensacola, Fla.[1] (24 m)		St. Louis, Mo. (170 m)		Salt Lake City, Utah (1,294 m)		San Diego, Calif. (15 m)		Sault Ste. Marie, Mich. (198 m)		Seattle, Wash. (14 m)		Spokane, Wash. (603 m)		Washington, D. C. (10 m)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°		°	
Surface	287	2.4	92	1.1	278	1.0	307	1.6	-----	-----	13	3.5	268	2.3	161	1.5	67	0.6	286	0.8	126	0.5	77	1.4	295	1.1
500	282	7.3	48	2.4	267	1.9	296	3.4	-----	-----	24	2.9	281	5.5	-----	-----	51	1.7	278	2.0	274	.7	-----	-----	283	7.2
1,000	285	10.0	50	2.8	311	4.4	308	8.0	-----	-----	310	2.7	293	8.9	-----	-----	53	2.0	316	5.4	239	2.2	131	1.5	282	9.9
1,500	276	11.0	72	2.7	310	5.1	308	8.0	-----	-----	306	4.0	300	10.2	189	0.9	69	3.7	312	7.7	219	3.2	231	2.4	292	11.9
2,000	275	12.1	114	1.4	295	4.0	308	9.5	-----	-----	315	6.3	292	10.1	215	1.0	64	4.2	331	7.9	238	4.0	270	3.9	286	13.3
2,500	282	15.4	164	4.8	300	4.8	297	9.8	-----	-----	299	6.9	293	9.4	284	1.5	57	4.5	314	10.4	257	4.7	272	6.1	291	14.5
3,000	278	15.0	187	4.0	303	5.6	293	9.4	-----	-----	293	10.6	300	7.9	322	3.8	42	4.7	332	12.1	274	5.5	280	7.7	-----	-----
4,000	-----	-----	195	2.4	296	5.6	281	10.5	-----	-----	273	9.2	304	4.4	307	4.5	32	2.5	-----	-----	-----	-----	294	8.4	-----	-----
5,000	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1	7.7	93	1.5	-----	-----	-----	-----	-----	-----	-----	-----

[1] Navy stations.

RIVERS AND FLOODS

[River and Flood Division, W. J. MOXOM, temporarily in charge]

By BENNETT SWENSON

During the month, which was otherwise quite dry, a period of excessive rainfall occurred from the 1st to the 4th in the lower Missouri Basin, the middle Mississippi Basin, the Ohio Basin, and the Lake region. The heaviest rain fell in Indiana and in parts of Illinois and Ohio.

As a result of this rainfall, stages that were quite low at the beginning of the month rose considerably to stages slightly above flood stage, principally in the Wabash River Basin and in tributaries of the middle and lower Mississippi River.

The official in charge of the Weather Bureau office at Indianapolis, Ind., reports as follows on the floods in the Wabash River Basin:

All river stages were very low at the beginning of the month, but a period of excessive rainfall, beginning at most places during the day of November 1 and continuing until the morning of the 3rd caused rapid rises in parts of the upper stretches, and rather slower rises in the lower channels. By far the greater proportion of the excessive rainfall occurred for the most part during the 24-hour period ending at 7 a. m. C. S. T. on November 3. Reports on the morning of November 3 showed excessive rainfall averaging from 3 to 4 inches over the various subdivisions of the basin.

In the recollection of the writer, this flood period was the only one of substantial changes from low to flood or comparatively high stages since his taking charge of the Indianapolis River district in 1914, that occurred throughout the basin, and ran its full course, on a single period of excessive rainfall.

The following account of an unusual rise in the lower Missouri River at Hermann, Mo., where the river rose from 2.1 feet at 7 a. m. of the 2d to 14.1 feet at 7 a. m. of the 3d, was received from the Weather Bureau office, St. Louis, Mo.:

The remarkable rise of 12 feet in 24 hours at Hermann, Mo., November 2–3, equals the previous record for greatest 24-hour rise. It occurred only once before, viz, February 19–20, 1882.

The 24-hour rise of 8.1 feet at St. Louis, Mo., November 3–4, was also quite unusual; but it has been exceeded several times. The greatest 24-hour rise recorded at St. Louis was 13.2 feet on January 3–4, 1897.

Doubtless, greater 24-hour changes would be shown if the 24-hour periods could be taken from any time of day and not confined to the period 7 a. m. to 7 a. m.

Moderate rises occurred in the lower Ohio and middle Mississippi Rivers as a result of the excessive rainfall. The mean stage at Cairo, Ill., on the Ohio River, was 17.4 feet as compared to a 60-year normal of 13.4 feet for the month.

The Santee River in South Carolina was near, at, or slightly above flood stage most of the month. There were heavy rains in South Carolina on the 13th, but most of the excess water was a result of floods during October. As there is a gradual run-off in the low, swamp area of that section.

The amount of loss or damage from the floods of the month was small because the farm crops had been, in the main, harvested.

Stages in the Columbia River Basin were exceptionally low during the month due to the dry summer and fall

season in that area. The Weather Bureau office, Portland, Oreg., reports as follows:

The month was the driest November of record at Portland, Oreg., and from reports this condition was general over the entire Northwest. It is thought that the period July to November 1929 was slightly drier than for the same period this year.

The stages of the Columbia River and its tributaries were very low at the end of November. Except in one or two instances, the monthly averages were slightly above those in 1929 as shown in following table:

Station	Number of years record	November average	November 1929 average	November 1936 average
Albany, Oreg.	42	4.1	0.5	0.4
Bonners Ferry, Idaho	31	1.6	−.9	−.8
Eugene, Oreg.	35	2.7	−1.8	−2.3
Eula, Oreg.	13	2.8	1.6	1.1
Jefferson, Oreg.	30	3.4	.6	−.3
Lewiston, Idaho	32	2.3	1.9	[1] 1.0
Kelso, Wash.	13	5.4	2.7	2.8
Mehama, Oreg.	14	3.3	1.4	1.5
Oregon City, Oreg.	25	4.7	1.3	2.6
Salem, Oreg.	36	3.0	[2]−2.7	[2]−4.1
The Dalles, Oreg.	39	3.4		−1.5
Umatilla, Oreg.	39	2.9		.6
Vancouver, Wash.	32	2.9	.1	−.1
Waterloo, Oreg.	14	4.0	2.0	2.1
Weiser, Idaho	29	4.1	[3] 4.4	[3] 3.4
Portland, Oreg.	58	3.9	.7	.8

[1] 0.9 foot in 1931 and 1934.
[2] Low stages recent years due to dredging.
[3] 2.9 feet in 1931 and 1934.

Table of flood stages during November 1936

[All dates in November unless otherwise specified]

River and station	Flood stage	Above flood stages—dates From—	Above flood stages—dates To—	Crest Stage	Crest Date
ST. LAWRENCE DRAINAGE					
Lake Erie					
St. Joseph:	*Feet*			*Feet*	
Fort Wayne, Ind.	12	4	4	12.0	4
Montpelier, Ohio	10	5	5	10.0	5
ATLANTIC SLOPE DRAINAGE	*Feet*			*Feet*	
Santee:		Oct. 2	2	17.6	Oct. 22
		4	8	13.1	7
Rimini, S. C.	12	12	16	13.3	15
		18	22	12.9	22
		25	[1]	12.8	27
		Oct. 5	9	14.0	Oct. 23, 24
Ferguson, S. C.	12	13	17	12.5	16
		19	23	12.5	22
		26	[1]	12.4	29
MISSISSIPPI SYSTEM					
Missouri Basin					
Osage: Osceola, Mo.	20	4	4	20.6	4
Ohio Basin					
Kiskiminetas: Saltsburg, Pa.	8	5	5	10.5	5
West Fork of White:					
Anderson, Ind.	8	3	3	8.2	3
Elliston, Ind.	18	4	8	22.2	7
Edwardsport, Ind.	12	4	10	17.6	8, 9
East Fork of White: Seymour, Ind.	14	4	7	16.4	6
White:					
Petersburg, Ind.	16	8	11	17.3	11
Hazleton, Ind.	16	8	13	17.6	11
Wabash:					
La Fayette, Ind.	11	3	8	19.7	4
Covington, Ind.	16	3	9	23.2	6
Terre Haute, Ind.	14	4	12	18.2	9
Vincennes, Ind.	14			13.7	13
White Basin					
Black: Black Rock, Ark.	14	3	3	14.2	3
Arkansas Basin					
Petit Jean: Danville, Ark.	20	4	5	20.3	5
Lower Mississippi Basin					
St. Francis:					
Fisk, Mo.	20	4	8	23.3	6
St. Francis, Ark.	18	10	13	19.1	12

[1] Continued into December.

WEATHER ON THE ATLANTIC AND PACIFIC OCEANS

[The Marine Division, I. R. TANNEHILL in charge]

NORTH ATLANTIC OCEAN, NOVEMBER 1936

By H. C. HUNTER

Atmospheric pressure.—The average pressure for November shows substantially the same contrasts with the normal that were displayed during the preceding month. Averages lower than normal were indicated for north-central and northeastern portions, while over and for a considerable distance around the Azores, pressure exceeded the normal, the average at Horta having a positive departure of practically a fifth of an inch.

The extremes of pressure found in vessel reports are 30.64 and 28.34 inches. The higher of these readings was noted on the American steamship *Dryden*, at 11 a. m., the 30th, at latitude 45°48′ N., longitude 18° W. The lower mark was recorded on the Danish steamship *Kentucky*, at 10 a. m., the 12th, at 53°30′ N., 39°10′ W.

TABLE 1.—*Averages, departures, and extremes of atmospheric pressure (sea level) at selected stations for the North Atlantic Ocean and its shores, November 1936*

Stations	Average pressure	Departure	Highest	Date	Lowest	Date
	Inches	*Inch*	*Inches*		*Inches*	
Julianehaab, Greenland	29.44	−0.12	30.04	11, 30	28.34	17
Reykjavik, Iceland	29.55	−.07	30.27	24	28.68	19
Lerwick, Shetland Islands	29.69	−.01	30.48	22	28.79	8
Valencia, Ireland	29.91	+.02	30.51	20, 21	28.55	7
Lisbon, Portugal	30.10	+.06	30.42	14	29.71	25
Madeira	30.08	+.07	30.33	11, 14, 15	29.77	19, 25, 26
Horta, Azores	30.32	+.19	30.48	2	29.92	27
Belle Isle, Newfoundland	29.81	+.04	30.64	3	28.76	17
Halifax, Nova Scotia	29.91	−.04	30.56	6	29.20	16
Nantucket	30.01	−.04	30.61	6	29.33	15
Hatteras	30.11	.00	30.49	11	29.58	15
Bermuda	30.11	+.03	30.38	2	29.68	16
Turks Island	29.98	−.01	30.08	28	29.84	4
Key West	30.04	+.02	30.32	28	29.83	5
New Orleans	30.19	+.09	30.48	27	29.89	30

NOTE.—All data based on a. m. observations only, with departures compiled from best available normals related to time of observation, except Hatteras, Key West, Nantucket, and New Orleans, which are 24-hour corrected means.