# AEROLOGICAL OBSERVATIONS

[Aerological Division, D. M. LITTLE, in charge]

By L. T. SAMUELS

At those stations with a sufficient period of record for the determination of approximate normals, upper air temperatures during January averaged below normal except at Boston and San Diego where the departures were positive. (See table 1.) The largest departures from normal occurred at Omaha. The means at Seattle are based on only eight observations and are therefore not representative. It will be noted from table 1 that the temperature at 5 kilometers averaged considerably lower at Fargo than in the eastern and western sections of the country at the same latitude.

Upper-air relative humidity departures were negative at Washington and Pensacola notwithstanding the fact that temperatures at those stations were below normal. At Omaha, however, where the largest negative temperature departures occurred, the relative humidities averaged considerably above normal.

The direction of the upper-air wind resultants were remarkably close to normal over the entire country (table 2). Resultant velocities were generally above normal except over the northeast and extreme western part of the country where negative departures occurred. In a number of cases both the positive and negative departures exceeded 3.0 meters per second.

TABLE 1.—*Mean free-air temperatures and relative humidities obtained by airplanes during January 1936*

TEMPERATURE (°C.)

| Stations | Altitude (meters) m. s. l. | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Surface | | 500 | | 1,000 | | 1,500 | | 2,000 | | 2,500 | | 3,000 | | 4,000 | | 5,000 | | Number of observations |
| | Mean | Departure from normal | Mean | Departure from normal | Mean | Departure from normal | Mean | Departure from normal | Mean | Departure from normal | Mean | Departure from normal | Mean | Departure from normal | Mean | Departure from normal | Mean | Departure from normal | |
| Barksdale Field (Shreveport), La.[1] (52 m) | 3.6 | | 6.6 | | 7.6 | | 7.0 | | 4.7 | | 2.6 | | 0.2 | | −4.8 | | −11.0 | | 28 |
| Billings, Mont.[2] (1088 m) | −6.6 | | | | | | −3.5 | | −5.7 | | −8.4 | | −12.4 | | −18.5 | | −25.2 | | 30 |
| Boston, Mass.[1] (5 m) | −0.4 | +1.3 | −1.5 | +1.9 | −3.1 | +1.7 | −3.6 | +1.9 | −4.2 | +2.6 | −6.2 | +2.5 | −8.8 | +2.1 | −13.6 | +2.5 | −20.7 | +1.3 | 16 |
| Cheyenne, Wyo.[2] (1873 m) | −5.7 | | | | | | | | −5.2 | | −6.8 | | −9.2 | | −16.0 | | −23.6 | | 30 |
| El Paso, Tex.[3] (1194 m) | 3.5 | | | | | | 6.8 | | 5.3 | | 3.1 | | 0.3 | | −4.8 | | −11.0 | | 31 |
| Fargo, N. Dak.[2] (274 m) | −22.1 | | −20.1 | | −17.2 | | −15.0 | | −14.7 | | −15.8 | | −18.0 | | −23.7 | | −30.7 | | 30 |
| Kelly Field (San Antonio), Tex.[1] (206 m) | 3.6 | | 8.2 | | 10.1 | | 9.6 | | 7.9 | | 5.5 | | 2.6 | | −2.9 | | −10.2 | | 25 |
| Lakehurst, N. J.[3] (39 m) | −3.7 | | −4.3 | | −5.6 | | −6.2 | | −8.2 | | −9.7 | | −12.4 | | −19.1 | | | | 21 |
| Maxwell Field (Montgomery), Ala.[1] (52 m) | 6.8 | | 6.4 | | 6.5 | | 5.1 | | 3.2 | | 1.7 | | −0.6 | | −6.9 | | −13.6 | | 22 |
| Mitchel Field (Hempstead, L. I.), N. Y.[1] (29 m) | −3.7 | | −4.8 | | −6.2 | | −6.9 | | −9.0 | | −10.2 | | −12.6 | | −18.0 | | −23.2 | | 23 |
| Murfreesboro, Tenn.[2] (174 M) | −1.9 | | −1.2 | | −1.3 | | −1.2 | | −2.2 | | −4.2 | | −6.5 | | −10.8 | | −16.6 | | 29 |
| Norfolk, Va.[3] (10 m) | 1.0 | −4.0 | 1.0 | −3.5 | −0.5 | −3.6 | −1.3 | −3.1 | −2.0 | −2.5 | −3.8 | −2.5 | −6.1 | −2.9 | −10.6 | −2.7 | −17.2 | −2.7 | 17 |
| Oklahoma City, Okla.[2] (391 m) | −2.0 | | −1.4 | | 1.5 | | 1.1 | | 0.1 | | −2.0 | | −4.9 | | −11.3 | | −17.2 | | 26 |
| Omaha, Nebr.[3] (300 m) | −13.9 | −7.0 | −12.5 | −6.8 | −8.6 | −5.8 | −6.6 | −5.1 | −7.4 | −5.0 | −9.6 | −5.0 | −12.1 | −4.9 | −18.0 | −4.8 | −24.2 | −4.4 | 29 |
| Pensacola, Fla.[3] (24 m) | 8.9 | −1.4 | 9.1 | −1.3 | 8.3 | −1.0 | 6.9 | −1.1 | 5.2 | −1.1 | 3.4 | −0.9 | 1.4 | −0.7 | −4.0 | −0.7 | −10.8 | −1.8 | 27 |
| San Diego, Calif.[3] (10 m) | 9.2 | −2.2 | 13.1 | +0.8 | 11.5 | +0.7 | 9.7 | +1.0 | 7.5 | +1.1 | 5.4 | +1.3 | 3.1 | +1.4 | −2.7 | +1.8 | −9.0 | +2.0 | 31 |
| Scott Field (Belleville), Ill.[1] (135 m) | −8.1 | | −6.2 | | −4.4 | | −4.5 | | −6.7 | | −9.0 | | −11.1 | | −16.8 | | −22.9 | | 17 |
| Seattle, Wash.[3] (25 m) | 6.0 | +0.1 | 3.8 | −1.8 | 2.4 | −1.9 | 1.1 | −1.0 | −1.3 | −0.5 | −4.0 | −0.1 | −6.4 | +0.4 | −12.7 | +0.3 | −20.2 | +0.1 | 8 |
| Spokane, Wash.[3] (596 m) | −0.9 | | | | 0.1 | | −0.8 | | −2.9 | | −5.6 | | −8.7 | | −15.8 | | −22.6 | | 29 |
| Washington, D. C.[3] (13 m) | −2.7 | −2.5 | −3.6 | −3.4 | −4.6 | −3.4 | −5.2 | −3.0 | −6.6 | −3.2 | −8.5 | −3.7 | −10.2 | −3.5 | −14.7 | −3.8 | −19.5 | −3.4 | 23 |
| Wright Field (Dayton), Ohio[1] (244 m) | −5.8 | | −5.3 | | −6.2 | | −6.5 | | −7.5 | | −9.8 | | −12.1 | | −17.8 | | −25.7 | | 21 |

RELATIVE HUMIDITY (PERCENT)

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Barksdale Field (Shreveport), La. | 78 | | 60 | | 46 | | 39 | | 39 | | 34 | | 33 | | 29 | | 27 | | |
| Billings, Mont. | 60 | | | | | | 53 | | 54 | | 58 | | 64 | | 67 | | 70 | | |
| Boston, Mass. | 74 | +2 | 76 | +5 | 74 | +3 | 63 | −3 | 53 | −10 | 52 | −8 | 54 | −5 | 50 | −7 | 50 | −6 | |
| Cheyenne, Wyo. | 70 | | | | | | | | 68 | | 66 | | 66 | | 63 | | 60 | | |
| El Paso, Tex. | 51 | | | | | | 44 | | 41 | | 40 | | 40 | | 37 | | 31 | | |
| Fargo, N. Dak. | 78 | | 78 | | 74 | | 70 | | 68 | | 60 | | 57 | | 52 | | 50 | | |
| Kelly Field (San Antonio), Tex. | 78 | | 59 | | 48 | | 38 | | 32 | | 27 | | 25 | | 22 | | 20 | | |
| Lakehurst, N. J. | 75 | | 70 | | 69 | | 61 | | 56 | | 48 | | 46 | | 46 | | | | |
| Maxwell Field (Montgomery), Ala. | 70 | | 62 | | 49 | | 44 | | 38 | | 36 | | 33 | | 33 | | 31 | | |
| Mitchel Field (Hempstead, L. I.), N. Y. | 76 | | 75 | | 71 | | 66 | | 63 | | 55 | | 52 | | 51 | | 54 | | |
| Murfreesboro, Tenn. | 83 | | 79 | | 75 | | 68 | | 57 | | 53 | | 50 | | 45 | | 46 | | |
| Norfolk, Va. | 77 | +4 | 69 | +1 | 62 | −1 | 53 | −4 | 47 | −4 | 41 | −5 | 43 | 0 | 50 | +5 | 58 | +8 | |
| Oklahoma City, Okla. | 73 | | 70 | | 59 | | 54 | | 50 | | 47 | | 45 | | 44 | | 44 | | |
| Omaha, Nebr. | 82 | 0 | 79 | +1 | 73 | +6 | 68 | +9 | 66 | +13 | 64 | +12 | 63 | +11 | 60 | +11 | 58 | +12 | |
| Pensacola, Fla. | 81 | 0 | 74 | 0 | 66 | −2 | 58 | −4 | 51 | −5 | 47 | −5 | 43 | −5 | 38 | −4 | 39 | +2 | |
| San Diego, Calif. | 86 | +14 | 65 | +4 | 54 | +1 | 43 | −4 | 40 | −2 | 39 | +1 | 39 | +4 | 38 | +5 | 39 | +7 | |
| Scott Field (Belleville), Ill. | 78 | | 68 | | 54 | | 48 | | 48 | | 42 | | 37 | | 42 | | 46 | | |
| Seattle, Wash. | 79 | −4 | 74 | 0 | 67 | −2 | 57 | −8 | 58 | −7 | 57 | −5 | 49 | −8 | 47 | −8 | 45 | −10 | |
| Spokane, Wash. | 86 | | | | 81 | | 70 | | 66 | | 64 | | 61 | | 60 | | 55 | | |
| Washington, D. C. | 68 | −2 | 56 | −5 | 55 | −2 | 47 | −6 | 43 | −6 | 41 | −5 | 38 | −4 | 42 | −2 | 46 | −2 | |
| Wright Field (Dayton), Ohio | 79 | | 78 | | 75 | | 67 | | 62 | | 63 | | 64 | | 66 | | 60 | | |

Observations taken about 4 a. m., 75th meridian time, except along the Pacific coast and Hawaii where they are taken at dawn.

[1] Army.
[2] Weather Bureau.
[3] Navy.

NOTE.—The departures are based on "normals" covering the following total number of observations made during the same month in previous years, including the current month: Boston, 73; Norfolk, 96; Omaha, 148; Pensacola, 155; San Diego, 182; Seattle, 30; Washington, 153.

TABLE 2.—*Free-air resultant winds (meters per second) based on pilot-balloon observations made near 5 a. m. (E. S. T.) during January 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 | 6 | 0.7 | 292 | 2.2 | 266 | 3.6 | 281 | 3.4 | 275 | 5.3 | 272 | 1.5 | 254 | 1.5 | 252 | 2.3 | 328 | 2.0 | 356 | 0.8 | 104 | 2.1 | 152 | 0.7 | 297 | 0.9 |
| 500 | ----- | ----- | 286 | 4.2 | ----- | ----- | 288 | 7.9 | ----- | ----- | 290 | 2.4 | 248 | 6.1 | 270 | 4.2 | 340 | 3.9 | 251 | 2.4 | 128 | 5.1 | 139 | 1.1 | 277 | 3.2 |
| 1,000 | ----- | ----- | 282 | 9.1 | ----- | ----- | 290 | 8.2 | ----- | ----- | 267 | 6.9 | 260 | 10.0 | 281 | 7.4 | 310 | 3.2 | 258 | 4.5 | 156 | 4.0 | 191 | 2.2 | 278 | 6.2 |
| 1,500 | ----- | ----- | 285 | 10.9 | 267 | 10.2 | 283 | 8.8 | ----- | ----- | 267 | 8.1 | 265 | 12.6 | 266 | 8.2 | 305 | 5.5 | 270 | 6.5 | 198 | 2.7 | 202 | 3.9 | 286 | 9.7 |
| 2,000 | 304 | 3.9 | 286 | 11.4 | 282 | 11.1 | 277 | 8.1 | 278 | 7.9 | 281 | 11.8 | 262 | 10.7 | 264 | 8.7 | 298 | 7.4 | 270 | 10.0 | 222 | 3.6 | 269 | 4.3 | 286 | 12.8 |
| 2,500 | 300 | 7.9 | 281 | 13.2 | 285 | 11.8 | 266 | 7.7 | 292 | 14.1 | 284 | 14.8 | ----- | ----- | ----- | ----- | 300 | 8.9 | 265 | 11.4 | 240 | 3.5 | 311 | 5.8 | 287 | 13.5 |
| 3,000 | 301 | 11.2 | 271 | 13.2 | 286 | 12.9 | 259 | 6.0. | 301 | 14.1 | 295 | 12.6 | ----- | ----- | ----- | ----- | 288 | 8.5 | 268 | 15.4 | 251 | 3.9 | 322 | 8.8 | 289 | 11.9 |
| 4,000 | 296 | 16.5 | ----- | ----- | 301 | 16.2 | ----- | ----- | 308 | 11.4 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 274 | 16.9 | 256 | 8.1 | ----- | ----- | ----- | ----- |
| 5,000 | 291 | 17.5 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |

| 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 | 280 | 2.1 | 54 | 0.3 | 309 | 0.6 | 343 | 1.4 | 61 | 1.7 | 25 | 2.8 | 288 | 2.4 | 162 | 2.7 | 65 | 1.2 | 52 | 1.4 | 168 | 1.9 | 212 | 1.7 | 295 | 2.8 |
| 500 | 301 | 6.1 | 13 | 2.0 | 213 | 2.1 | 327 | 3.7 | 92 | 3.6 | 339 | 1.8 | 277 | 5.8 | ----- | ----- | 10 | 0.9 | 4 | 2.0 | 185 | 3.8 | ----- | ----- | 293 | 7.3 |
| 1,000 | 298 | 8.2 | 3 | 2.2 | 247 | 6.8 | 306 | 9.1 | 68 | 3.7 | 265 | 5.1 | 279 | 10.2 | ----- | ----- | 350 | 1.5 | 322 | 5.0 | 204 | 4.4 | 213 | 2.9 | 285 | 8.1 |
| 1,500 | 287 | 8.9 | 344 | 1.6 | 269 | 7.3 | 299 | 11.0 | 75 | 3.5 | 269 | 7.4 | 292 | 11.7 | 183 | 3.3 | 317 | 3.2 | 311 | 6.8 | 218 | 4.3 | 236 | 4.3 | 288 | 9.6 |
| 2,000 | 271 | 11.9 | 310 | 1.9 | 275 | 10.2 | 298 | 13.1 | 59 | 4.3 | 282 | 10.1 | 293 | 13.3 | 213 | 2.5 | 314 | 4.4 | 284 | 6.6 | 217 | 4.6 | 267 | 3.7 | 279 | 9.3 |
| 2,500 | 282 | 12.2 | 308 | 3.2 | 283 | 12.1 | 304 | 15.5 | 42 | 3.8 | 274 | 11.7 | 295 | 13.8 | 268 | 3.8 | 316 | 5.8 | 277 | 8.5 | 226 | 3.9 | 287 | 4.6 | 263 | 10.5 |
| 3,000 | ----- | ----- | 318 | 5.1 | 291 | 12.3 | 294 | 14.7 | 13 | 3.3 | 265 | 13.4 | 293 | 13.8 | 290 | 6.0 | 305 | 5.6 | 277 | 10.7 | ----- | ----- | 279 | 6.7 | ----- | ----- |
| 4,000 | ----- | ----- | 253 | 1.1 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 310 | 9.8 | 297 | 9.2 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 5,000 | ----- | ----- | 120 | 0.6 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 251 | 9.6 | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- |

[1] Navy stations.

# RIVERS AND FLOODS

[River and Flood Division, MONTROSE W. HAYES, in charge]

By W. J. MOXOM

In the southeastern part of the country there were two flood periods; the first was from the 3d to the 13th, and the second from the 19th to the 27th. Crest stages were only moderately high, except in the second overflow of the Roanoke River (Virginia and North Carolina) where they were the highest since March 1912.

Flood losses in the Southeastern States amounted to approximately $270,000. Considerable damage was done to farm lands by erosion, and many highway bridges over the small streams were undermined and weakened by high water.

Flood stages were also reached in the Little Kanawha River in West Virginia and in the Ohio River at Evansville, Ind., but the losses were comparatively small.

On the Pacific Slope drainage, moderate floods occurred in the Sacramento and Willamette Rivers, with losses of approximately $68,000 to immovable property.

Warnings of the overflows were issued well in advance and resulted in large savings in movable property and livestock.

*Table of flood stages in January 1936*

[All dates in January unless otherwise specified]

| River and station | Flood stage | Above flood stages—dates | | Crest | |
|---|---|---|---|---|---|
| | | From— | To— | Stage | Date |
| ATLANTIC SLOPE DRAINAGE | *Feet* | | | *Feet* | |
| Delaware: Trenton, N. J. | 12 | 3 | 3 | 16.1 | 3 |
| James: | | | | | |
| Columbia, Va. | 10 | 3 | 14 | 26.65 | 4 |
| | | 16 | 16 | 10.0 | 16 |
| | | 18 | 24 | 27.35 | 20 |
| Richmond, Va. | 8 | 3 | 6 | 15.7 | 5 |
| | | 10 | 11 | 8.3 | 11 |
| | | 19 | 22 | 15.9 | 21 |
| | | 31 | (1) | ----- | ----- |
| Dan: | | | | | |
| Danville, Va. | 11 | 4 | 4 | 12.3 | 4 |
| | | 19 | 21 | 17.2 | 20 |
| Clarksville, Va. | 13 | 4 | 6 | 14.4 | 5 |
| | | 20 | 22 | 17.0 | 22 |
| Roanoke: | | | | | |
| Randolph, Va. | 18 | 3 | 8 | 26.9 | 5 |
| | | 10 | 11 | 20.7 | 10 |
| | | 20 | 22 | 28.6 | 21 |

[1] Continued into February.