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DEFLECTIONS OF THE VERTICAL

in the

UNITED STATES

(Supplement to USC&GS Spec. Pub. 229)

U. S. Department of Commerce
Coast and Geodetic Survey
1954

National Oceanic and Atmospheric Administration

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Introduction

In 1941 this Bureau published in Special Publication No. 229 the deflections of the vertical at 742 stations in the United States. These deflections are based on the North American Datum of 1927. At 375 of these stations both components of the deflection of the vertical are given, at 279 the deflection is given in the meridian only, and at 87 stations the deflection is given in the prime vertical only. All of the stations are of first or second-order accuracy, the probable error in either component very seldom exceeding 0".35. All latitude and longitude observations were made with some type of meridian transit instrument. The deflections were published to the nearest 0".01 for both components.

In the present supplement 228 deflection stations are added, of which 140 are complete stations. For 61 stations only the meridian component, and for 27 stations only the prime vertical component, are available and listed. Stations for which the deflections are listed to the nearest 0".01 are first or second-order stations, with accuracy comparable to those published in Special Publication No. 229.

The deflections published to the nearest tenth of a second are of a lower order of accuracy. The astronomic latitudes and longitudes at 20 lower-order stations in New Mexico were determined by measuring zenith distances in the meridian and in the prime vertical with a Wild T-3 theodolite. This type of measurement is subject to larger refraction errors than the standard meridian transit observations. For some of these Wild T-3 stations, geodetic coordinates are given to the nearest tenth of a second because rigidly adjusted positions are not yet available. All other stations for which the geodetic latitudes and longitudes are listed to the nearest tenth of a second were reduced to the North American Datum of 1927 by use of local datum corrections in the absence of a direct geodetic tie. For these stations the deflections are listed to the nearest tenth of a second, regardless of accuracy of the astronomic position.

DEFLECTIONS OF THE VERTICAL IN THE

UNITED STATES, NORTH AMERICAN 1927 DATUM

Supplement to Sp. Pub. No. 229

Name of Station	Year	Geodetic Latitude	Geodetic Longitude	Defl. in Meridian	Defl. in P.V.
		ALABAMA			
Anderson S.E. Base	1944	31°44'01".268	85°50'33".558		+3".63
		ARIZONA			
Globe	1947	33 24 12.118	110 46 16.373	-4".57	+7.02
Sunset West Base	1948	32 33 26.205	110 12 32.688	-1.59	+3.70
		ARKANSAS			
Ecore	1941	33 36 20.278	92 54 25.369	+0.90	+3.13
Little Rock, Long.	1893	34 44 51.45	92 16 25.43	+4.84	+1.03
Wills	1935	36 26 41.236	94 28 43.603	+3.99	+3.42
		CALIFORNIA			
Almond (1932)	1951	35 33 06.456	120 27 07.504	-0.97	+5.14
Avila, 1871	1874	35 10 39.3	120 43 16.0	-6.6	
Biddle	1951	35 09 40.515	120 28 26.259	-7.29	+8.40
Bodega Lat. Sta.	1853	38 18 28.7	123 03 14.4	-8.6	
Cape Mendocino Lat. Station	1869	40 26 19.9	124 24 10.3	-3.7	
Corral	1944	37 37 34.209	121 27 13.320	+7.87	
Crescent City Azimuth	1853	41 44 48.7	124 12 59.5	-5.3	
Jensen	1944	37 16 09.030	121 07 49.667	-0.68	-4.27
Kneeland U.S.G.S.	1942	40 43 36.372	123 58 25.168	-2.24	+19.04
Mare Island Naval Observatory	1908	38 06 01.3	122 16 14.4		+8.0
McClure S.W. Base	1951	35 47 19.669	120 06 41.500	+3.11	-9.09
Mendocino City Lat. Station	1853	39 18 12.2	123 48 15.4	-6.7	
Point Conception	1850	34 26 68.6	120 26 44.0	-12.3	

Name of Station	Year	Geodetic Latitude	Geodetic Longitude	Defl. in Meridian	Defl. in P.V.
		CALIFORNIA			
Point Reyes Lat. Station	1853	37°59'43".2	122°58'33".0	-9".6	
Red Bluff Lat. Sta.	1854	40 44 43.0	124 12 55.6	-2.8	
San Diego Lat. Sta.	1851	32 41 63.4	117 14 29.7	-5.8	
San Diego Long. Sta.	1892	32 43 29.4	117 09 27.0	-8.7	+11".9
San Francisco					
Lafayette Park	1891-92	37 47 30.8	122 25 36.0	-2.5	+5.5
Presidio Magnetic Station	1852	37 47 38.1	122 27 12.3	-2.2	
Presidio Long. Sta.	1896	37 47 50.3	122 27 04.0	-2.0	+6.5
Washington Square	1887	37 48 03.6	122 24 30.3		+5.0
San Luis Obispo					
Latitude Sta.	1852	35 10 42.6	120 44 44.0	-5.4	
San Simeon	1874	35 38 32.9	121 11 50.5	-13.3	
Santa Barbara Lat. Sta.	1852	34 24 40.3	119 41 23.2	-15.6	
Santa Cruz Warehouse Flagstaff	1852	36 57 39.1	122 01 27.4	-11.5	
Ukiah courthouse cupola flagstaff	1897	39 09 01.1	123 12 25.4	-3.1	+5.1
		COLORADO			
Cval	1935	37 33 15.768	106 13 27.819	+2.22	-5.86
Steamboat South Base	1939	40 21 23.294	106 49 41.022	-0.30	+15.61
		DELAWARE			
Dover Court House cupola	1897	39 09 20.9	75 31 25.4	-6.9	-4.4
		DIST. of COLUMBIA			
Causten	1851	38 55 34.96	77 04 23.98	-2.60	
Georgetown College Observatory Dome	1846	38 54 29.61	77 04 39.21	-3.82	
Seaton	1850	38 53 28.63	76 59 59.70	-3.51	-5.42

Name of Station	Year	Geodetic Latitude	Geodetic Longitude	Defl. in Meridian	Defl. in P.V.
		DIST. OF COLUMBIA			
U.S.C.& G Office, flag-staff in main bldg.	1891-92-94	38°53'13".2	77°00'31".2	-4".5	-5".2
U.S. Naval Observatory new site center of small dome	1897	38 55 14.999	77 03 58.901	-2.96	-4.37
		FLORIDA			
Apalachicola	1860	29 43 12.6	84 59 07.7	+1.0	+1.6
Barkley Point 2	1861	30 24 30.7	87 12 26.9	+1.9	+4.7
Belleview	1907	27 56 33.9	82 48 43.2		-4.2
Central (1950)	1951	28 29 32.364	80 34 38.770	+1.48	-1.10
Clearwater Harbor Astro. Sta.	1873	27 56 36.4	82 48 40.3	+4.1	
Davis Point 2	1871	30 07 13.8	85 41 11.0	+3.0	
Depot Key	1852	29 07 26.9	83 01 55.0	+3.2	
Esperanza	1873	29 22 15.147	81 05 38.231	+2.41	
Fernandina Astro. Sta.	1856	30 40 17.1	81 27 49.3	+0.4	
Fort Marion N.E. Tower	1882	29 53 52.8	81 18 40.7		-4.7
Key Biscayne S.B.	1849	25 39 54.567	80 09 21.927	-2.26	
Punta Rasa	1866	26 29 11.8	82 00 48.2	+3.7	
Punta Rasa Astro. Sta.	1874	26 29 13.4	82 00 46.1		-2.6
St. Marks Long.	1907	30 09 27.4	84 12 17.6		+0.2
Titusville, Indian Head Hotel flagstaff	1906	28 36 39.7	80 48 23.4	0.0	
Way Key N.B.	1874	29 08 12.5	83 01 43.6		+1.8
		GEORGIA			
Butler	1872-73	31 17 39.2	81 20 49.0	+8.0	
Savannah Exchange Spire	1851	32 04 51.3	81 05 28.7	+1.9	-5.5

Name of Station	Year	Geodetic Latitude	Geodetic Longitude	Defl. in Meridian	Defl. in P.V.
		IDAHO			
Penn West Base	1946	45°57'41".340	116°17'51".865	-0".49	+3".83
Miller East Base	1946	42 34 15.612	114 34 08 743	+1.15	+5.93
Huckleberry	1944	47 44 51.551	116 35 48.255	-1.72	+7.52
Idaho Falls N.E. Base	1946	43 39 01.483	111 55 30.344	+0.10	+5.57
Stanley	1941	44 13 35.334	114 56 34.072	-1.82	+8.94
		INDIANA			
Deer	1946	37 57 47.550	86 39 42.947	+5.24	-4.70
Eel	1948	40 54 42.100	85 53 20.681	-2.25	+0.54
Goodell	1948	41 02 55.780	86 52 38.106	+1.48	-0.27
Terre N. Base	1948	39 28 27.183	87 19 58.978	+2.48	-1.78
		IOWA			
Dahlman	1934	42 35 01.009	96 09 16.264	-2.73	-1.74
		KANSAS			
Erwin	1935	37 55 17.126	96 52 13.148	+0.91	-2.46
Meades Ranch	1948	39 13 26.686	98 32 30.506	-1.02	-1.79
		KENTUCKY			
Coyle	1950	38 10 26.730	83 49 54.012	+3.96	+5.01
Cumming	1936	36 39 12.875	85 14 04.421	+2.08	+2.19
Warfield	1950	38 13 39.617	84 55 55.094	+0.15	-0.59
		LOUISIANA			
Blue Buck Ridge W.B.	1883	29 45 43.6	93 44 27.4	+5.2	
Catahoula	1941	31 31 27.995	92 01 01.886	-3.62	+0.32
Chenier Tigre W.B.	1889	29 34 22.2	92 11 06.8	+5.5	
Natchitoches	1941	31 44 55.305	93 05 42.331	-1.32	+1.95
Timbalier light house	1921	29 02 50.3	90 21 18.4	+3.3	

Name of Station	Year	Geodetic Latitude	Geodetic Longitude	Defl. in Meridian	Defl. in P.V.
		MAINE			
Calais Observatory	1857	45°11'04".9	67°16'52".6	+4".5	+3".7
Cape Small	1851	43 46 42.574	69 50 44.103	+0.93	
Knowles Corner	1941	46 12 17.381	68 20 28.896	-2.99	+1.23
Thomas Hill Observ.	1857	44 48 15.5	68 47 00.0	-2.6	+1.8
		MASSACHUSETTS			
Duxbury Long. Sta.	1870	42 02 54.58	70 40 11.02		+1.37
		MARYLAND			
Rockville Astronomic Lat. Station	1891-92	39 05 10.88	77 09 36.82	-0.46	
		MICHIGAN			
Escanaba, Lt. Ho.	1865	45 44 40.944	87 02 39.377	-5.92	
Fort Gratiot Lighthouse (USLS)	1858	43 00 22.63	82 25 21.16	-0.83	
Monroe court house (USLS)	1868	41 54 52.59	83 23 49.09	-3.97	
Verona	1939	46 29 46.939	89 58 00.208	-4.24	+0.06
		MINNESOTA			
Berg	1941	47 45 04.430	95 37 17.776	-1.32	-3.08
Hubbard Hill	1939	46 50 55.209	94 54 37.945	+0.03	-1.14
		MISSISSIPPI			
East Pascagoula	1847	30 20 35.3	88 32 45.7	+5.6	
Holling	1945	31 36 16.479	90 16 19.342	-0.96	+0.07
State	1935	33 27 30.666	88 47 52.160	-2.18	-1.03

Name of Station	Year	Geodetic Latitude	Geodetic Longitude	Defl. in Meridian	Defl. in P.V.
		MISSOURI			
Arcadia	1935	37°38'08".423	94°35'46".794	+2".39	-0".10
Dixon E. Base	1947	37 59 51.897	92 05 16.418	+0.90	+1.22
Medlock	1946	38 38 13.335	92 20 13.473	+3.04	+2.51
		MONTANA			
Bear	1935	47 56 52.415	106 14 46.802	+2.88	+2.07
Crow	1935	47 00 31.505	106 05 19.407	+1.80	+1.00
Jette	1939	47 46 25.039	114 16 04.071	+1.27	+4.92
Leroy	1949	47 53 07.215	109 22 25.456	-1.28	+1.90
Martin	1935	45 58 57.025	106 15 00.905	-0.06	-0.43
Missoula West Base	1935	46 56 55.921	114 07 41.184	-2.94	+6.78
Moats	1949	46 34 21.536	108 55 57.374	-2.81	-3.37
Muggins	1935	46 32 35.395	107 41 11.729	+2.68	+1.25
Pilgrim	1949	45 30 52.352	105 07 05.076	+4.45	+1.44
Tallow	1935	47 57 56.050	107 34 55.269	+1.31	+3.04
		NEBRASKA			
Ashby	1946	42 01 29.532	102 00 05.293		-0.56
Helvey	1935	40 15 45.947	97 13 19.388	-0.75	+1.82
Hoskins	1935	42 05 47.561	97 16 13.897		+1.12
Isinglass	1935	42 54 44.730	102 57 24.183	-2.36	+0.60
Lamb	1935	42 39 59.833	99 32 15.557	+5.20	-2.98
Omaha Long. Sta.	1869	41 15 36.365	95 56 35.011	+7.58	-2.79
Redwood	1934	40 00 02.275	95 52 26.695	-1.54	-5.16
		NEVADA			
BM J33	1939	38 42 28.966	115 30 43.271	-7.38	+12.11
BM Z67	1935	41 32 52.795	118 25 20.278	-1.61	+3.25
Dry Lake	1944	37 36 54.717	114 50 27.469	-5.33	+7.41
Fallon	1935	39 29 22.758	118 45 05.564	-3.19	+3.82
Hot Springs	1947	41 59 40.396	114 21 53.058	-4.86	+7.85
Reed	1935	37 45 07.389	116 07 38.419	-2.39	+2.78
Sage	1941	40 53 41.100	115 26 53.086	-3.97	+7.39

Name of Station	Year	Geodetic Latitude	Geodetic Longitude	Defl. in Meridian	Defl. in P.V.
		NEW JERSEY			
Barnegat Inlet	1907	39°45'53".2	74°06'24".7	-5".0	
		NEW MEXICO			
Atom (HAFB)	1952	33 44 21.9	106 21 50.6	-5.8	+16".0
Beacontrol (HAFB)	1952	32 49 49.4	105 53 24.7	+0.2	+30.3
Bursum	1952	33 48 53.732	106 28 11.225	-2.97	+13.87
Citoval	1946	36 08 10.691	106 20 27.195	+2.32	-3.57
Coy	1952	33 10 28.098	105 58 25.103	-4.1	+19.6
Crater S. Base	1952	33 35 10.304	106 30 16.731	+0.5	+10.2
D-10 (WSPG)	1952	33 37 01.4	106 09 24.8	-4.2	+6.0
4-F-944	1952	33 38 47.259	106 22 21.570	-2.7	+12.9
Gap	1952	33 32 47.4	106 26 10.9	-0.3	+5.8
Jarilla 2	1952	32 23 59.593	106 06 44.770	-3.8	+7.4
Jarilla Forest (USGS) 1943	1952	32 26 08.103	106 07 03.288	-0.3	+11.8
Kent	1952	32 30 27.080	106 28 58.695	-8.8	-5.1
Phillips	1952	33 26 39.349	106 07 59.145	-3.4	+15.6
Rose	1952	33 25 45.643	105 59 17.755	-3.5	+18.9
Sac	1952	32 47 16.338	105 49 13.475	-5.5	+25.1
Salinas	1952	33 17 53.741	106 31 50.635	-6.9	-4.4
San Andreas	1952	32 40 33.3	106 32 10.6	-2.3	-3.8
Sands N.E. Base	1952	32 43 38.201	106 12 36.855	-1.25	+7.24
Sands S.W. Base	1952	32 28 61.624	106 24 05.729	-4.74	+0.09
Seeborn (WSPG)	1952	32 45 20.7	106 29 12.2	+1.3	-7.9
Sierra Blanca	1952	33 22 27.279	105 48 29.481	-3.7	+10.9
Skillet Knob (HAFB)	1952	33 13 49.2	106 38 21.2	-4.0	-1.3
Slash	1952	33 37 51.313	106 49 05.982	-1.87	+2.86
Storm	1952	33 53 39.7	106 37 23.9	-2.1	+4.3
Tower	1952	33 12 07.2	106 29 27.1	-8.2	-3.2
Trujillo	1946	36 51 15.723	105 43 22.455	-2.12	-0.60

Name of Station	Year	Geodetic Latitude	Geodetic Longitude	Defl. in Meridian	Defl. in P.V.
		NEW YORK			
Avoca	1939	42°24'46".824	77°22'23".456	+2".69	-1".77
Beech Hill	1943	43 50 37.230	75 21 40.062	-0.24	+9.81
Far Rockaway	1914	40 35 59.8	73 44 58.8	-5.2	+1.8
Holley	1941	42 11 54.490	75 02 27.493	+4.41	+4.02
Rutherford's Observatory	1858	40 43 51.0	73 59 14.6	-2.5	+4.7
Troy University	1871	42 43 45.742	73 41 00.406	+1.48	
		NORTH CAROLINA			
Fort Johnson Flagstaff	1859	33 54 62.8	78 01 01.5	-4.4	
Hog Island	1876	35 21 49.2	76 03 40.8	+2.7	
Knott Island north end	1887	36 33 57.2	75 55 18.8	-2.2	
Long Shoal Point	1876	35 34 34.0	75 46 55.0	+2.2	
Ocracoke N.E. Base	1873	35 04 01.4	76 03 09.6	+1.5	
Sand Island	1876	35 50 24.6	75 40 07.8	+0.7	
Sanford	1950	35 27 05.797	79 10 25.744	-2.71	-4.97
Shellbank	1847	36 03 21.3	75 44 27.5	-1.3	
Spinola 2	1866	35 05 20.8	77 01 50.8	-3.7	
Stevenson's Point Azimuth	1847	36 06 18.6	76 11 25.1	-2.6	
		NORTH DAKOTA			
Balta No. Base	1946	48 10 10.849	100 02 30.239	-0.59	-0.29
Hurd	1941	47 27 20.125	99 54 16.182		-0.45
Little Forks	1941	47 33 22.221	97 30 17.713	+0.24	-2.76
Stanley So. Base	1946	48 06 18.635	102 21 10.903	+0.68	-1.41

Name of Station	Year	Geodetic Latitude	Geodetic Longitude	Defl. in Meridian	Defl. in P.V.
		OHIO			
Alverno	1947	39°05'15".964	84°36'30".276	-0".21	
Bethel	1945	39 25 50.242	81 31 51.885	-0.70	+0".59
Davis	1934	40 03 20.127	81 31 07.042	-2.09	-0.57
Doyle	1945	40 58 33.655	81 41 29.137		+0.76
		OKLAHOMA			
Millerton NW Base	1950	33 59 08.220	95 01 01.510	+13.40	+6.30
		OREGON			
Madras S.W. Base	1946	44 34 41.974	121 11 24.932	+4.16	+8.85
Prairie City, N.Base	1946	44 26 41.545	118 42 09.436	-3.22	+6.22
Sherar	1947	45 14 20.762	121 48 47.580	-5.75	+7.44
Zumwalt	1944	45 36 14.306	116 58 54.158		+4.74
		PENNSYLVANIA			
Womelsdorf	1908	40 19 27.959	76 11 44.841	+1.40	
		SOUTH CAROLINA			
Breach Inlet	1849	32 46 20.2	79 48 56.9	-0.9	
		SOUTH DAKOTA			
Bald	1935	44 50 51.995	98 39 16.428		+0.44
Lemler	1935	45 11 40.179	100 09 34.022		+1.63
Orr LaPlace	1935	42 52 04.473	96 55 44.159		+3.81
Walsh	1939	45 06 27.715	101 31 49.490	-1.72	-3.75
		TEXAS			
Bartley	1948	33 12 08.318	101 40 44.216	+1.40	
Bristol	1948	32 27 34.352	96 34 04.649	+0.45	+6.02
Bynum	1948	32 19 15.696	101 00 00.213		+0.35
Dollar Point	1848	29 25 59.2	94 53 26.3	+2.7	
Galveston Island East Base	1853	29 12 49.3	94 55 49.3	+3.5	

Name of Station	Year	Geodetic Latitude	Geodetic Longitude	Defl. in Meridian	Defl. in P.V.
		TEXAS			
Galveston, Cathedral north spire	1895	29°18'14".0	94°47'25".5		+1".3
Jupiter	1853	28 54 44.5	95 20 32.9	+4".4	
Lacasa	1950	32 39 05.092	98 41 29.752	+4.28	+1.37
Lavaca	1868	28 37 33.9	96 37 17.7	+3.0	
Range	1945	25 57 49.201	97 14 38.604	+4.47	+4.98
Rio Grande Observ.	1853	25 57 17.3	97 08 48.2	+4.3	
Roby	1948-50	32 44 35.521	100 22 45.768	+2.96	-2.48
Sears	1948-50	32 33 30.649	100 02 16.359		-0.32
Topo	1905	26 45 18.3	97 28 18.4	+5.2	
Wilkins E. Base	1950	32 33 04.135	94 59 25.209	+1.81	+1.45
Wilkins W. Base	1950	32 34 37.874	95 04 28.872	+1.34	+2.18
Yoakum S.W. Base	1944	29 19 04.811	97 08 41.743	-1.54	+0.71
		UTAH			
Buckhorn	1947	39 12 36.818	110 56 28.236	-6.97	-6.04
		VIRGINIA			
North End Knott Isl.	1873	36 33 57.2	75 55 18.8	-1.8	
Staunton Lat. Sta.	1869	38 08 46.195	79 04 19.291	+4.5	
Tangier Island	1871	37 47 57.3	75 59 15.2	-0.8	
Wallace	1934	38 19 25.999	77 27 46.453	-2.82	-3.24
Wolftrap	1871	37 24 04.3	76 14 43.3	-2.3	
		WASHINGTON			
Bahokus	1942	48 22 18.648	124 40 27.205		+13.83
Bald (U.S.G.S.)	1935	46 38 01.390	117 05 13.858	+1.26	+8.14
Bromley USGS	1948	47 27 52.639	120 12 30.893	-11.12	+8.59
Grey Back	1947	45 59 27.701	121 04 57.582	-3.36	+8.87
Kalama Astro.	1873	46 00 24.620	122 50 25.139	-6.83	+6.72
Lummi Island Lat. Sta.	1853	48 44 04.4	122 41 15.8	-2.6	
Point Hudson	1852	48 07 02.8	122 44 51.6	+3.0	

Name of Station	Year	Geodetic Latitude	Geodetic Longitude	Defl. in Meridian	Defl. in P.V.
		WASHINGTON			
Seattle Long. Sta.	1888	47°36'31".1	122°20'00".9	+4".0	+3".0
Univ. of Washington	1925	47 39 38.0	122 18 29.2		+1.8
		WEST VIRGINIA			
Findley	1941	39 03 31.087	79 59 58.400	+4.18	+4.16
Mabe	1950	37 23 44.273	81 19 12.936	+1.08	+0.31
		WISCONSIN			
Archibald	1935	45 15 46.465	88 35 12.695		-3.67
Babe	1928	45 08 44.078	88 28 19.133		-3.09
Dale	1928	44 01 30.043	90 12 14.445	-0.26	-6.50
Long	1928	45 58 27.598	91 35 37.696		-6.94
Manawa	1928	44 27 04.068	88 54 27.084		+0.59
Massive	1922	45 28 33.751	91 06 43.533	-1.44	-0.25
Night	1922	44 24 16.052	89 50 00.683	-0.36	-5.29
Owen	1922	44 57 02.171	90 33 48.547	-10.02	-5.10
Pingle	1935	45 10 43.536	91 35 24.305		+0.11
Prentice	1922	45 32 21.051	90 17 17.615	-2.03	-2.08
Rhinelander	1922	45 38 52.827	89 24 36.570	-3.32	-7.90
Spooner	1935	45 49 38.289	91 53 46.857		-10.51
Staadt	1935	44 46 35.967	90 06 51.857		-6.55
Wabeno	1928	45 26 22.692	88 39 43.986	-9.35	-5.56
		WYOMING			
Sinclair E. Base	1949	41 45 57.651	106 58 03.024	+6.52	+0.91