SATURATION VAPOR PRESSURE TABLES

Resolution 164 of the Twelfth Conference of Directors of the International Meteorological Organization (Washington, 1947) adopted the *Goff-Gratch*[1] *formulation* for the saturation vapor pressure in the pure phase over plane surfaces of pure water and pure ice:

$$\log_{10} e_w = -7.90298\left(\frac{T_s}{T}-1\right) + 5.02808\log_{10}\left(\frac{T_s}{T}\right) - 1.3816\times 10^{-7}\left(10^{11.344\left(1-T/T_s\right)}-1\right) + 8.1328\times 10^{-3}\left(10^{-3.19149\left(T_s/T-1\right)}-1\right) + \log_{10} e_{ws}, \quad (1)$$

and

$$\log_{10} e_i = -9.09718\left(\frac{T_0}{T}-1\right) - 3.56654\log_{10}\left(\frac{T_0}{T}\right) + 0.876793\left(1-\frac{T}{T_0}\right) + \log_{10} e_{i0}, \quad (2)$$

where:

e_w = saturation vapor pressure over a plane surface of pure ordinary liquid water (mb.),
e_i = saturation vapor pressure of a plane surface of pure ordinary water ice (mb.),
T = absolute (thermodynamic) temperature (°K.),
T_s = steam-point temperature (373.16 °K.),
T_0 = ice-point temperature (273.16 °K.),
e_{ws} = saturation pressure of pure ordinary liquid water at steam-point temperature (1 standard atmosphere = 1013.246 mb.),
e_{i0} = saturation pressure of pure ordinary water ice at ice-point temperature (0.0060273 standard atmosphere = 6.1071 mb.).

The Goff-Gratch formulas are based on integration of the Clausius-Clapeyron equation considering the deviations from a perfect gas, and on modern experimental data. The stated range of validity of (1) is 0° to 100 °C. Since there is a dearth of experimental data on vapor pressure over supercooled water and the necessary thermodynamic data for an exact integration of the Clausius-Clapeyron equation do not exist, no completely satisfactory formula exists for the vapor pressure over liquid water at temperatures below 0 °C. However, direct extrapolation of (1) gives values of e_w in the middle of the range suggested by other investigators and has been adopted for the range 0° to − 50 °C. pending further research.

Values for each half degree centigrade and whole degree Fahrenheit were computed from (1) and (2), and values for each 0.1° were obtained by interpolation (Newton's method); with the exception of the few values in Table 94 for $T > 100$ °C., which were computed from Keyes[2] formula:

$$\log_{10} e_w \text{ (mm. of mercury)} = -2892.3693/T - 2.892736\log_{10} T - 4.9369728\times 10^{-3}T + 5.606905\times 10^{-6}T^2 - 4.645869\times 10^{-9}T^3 + 3.7874\times 10^{-12}T^4 + 19.3011421.$$

The small difference between e_w and e_i at 0 °C. (32 °F.) arises from the fact that the triple point for water is 0.01 °C.

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[1] Goff, J. A., and Gratch, S., Trans. Amer. Soc. Heat. and Vent. Eng., vol. 52, p. 95, 1946. Also see Tables 84-92.
[2] Keyes, F. G., Journ. Chem. Phys., vol. 15, No. 8, pp. 602-12, 1947.

SATURATION VAPOR PRESSURE OVER WATER

(Explanation on p. 350.)

Metric units

Temperature	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
°C.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
−50	0.06356									
−49	0.07124	0.07044	0.06964	0.06885	0.06807	0.06730	0.06654	0.06578	0.06503	0.06429
−48	0.07975	0.07886	0.07797	0.07710	0.07624	0.07538	0.07453	0.07370	0.07287	0.07205
−47	0.08918	0.08819	0.08722	0.08625	0.08530	0.08435	0.08341	0.08248	0.08156	0.08065
−46	0.09961	0.09852	0.09744	0.09637	0.09531	0.09426	0.09322	0.09220	0.09118	0.09017
−45	0.1111	0.1099	0.1087	0.1075	0.1063	0.1052	0.1041	0.1030	0.1018	0.1007
−44	0.1239	0.1226	0.1213	0.1200	0.1187	0.1174	0.1161	0.1149	0.1136	0.1123
−43	0.1379	0.1364	0.1350	0.1335	0.1321	0.1307	0.1293	0.1279	0.1266	0.1252
−42	0.1534	0.1518	0.1502	0.1486	0.1470	0.1455	0.1440	0.1424	0.1409	0.1394
−41	0.1704	0.1686	0.1669	0.1651	0.1634	0.1617	0.1600	0.1583	0.1567	0.1550
−40	0.1891	0.1872	0.1852	0.1833	0.1815	0.1796	0.1777	0.1759	0.1740	0.1722
−39	0.2097	0.2076	0.2054	0.2033	0.2013	0.1992	0.1971	0.1951	0.1931	0.1911
−38	0.2323	0.2299	0.2276	0.2253	0.2230	0.2207	0.2185	0.2162	0.2140	0.2119
−37	0.2571	0.2545	0.2520	0.2494	0.2469	0.2444	0.2419	0.2395	0.2371	0.2347
−36	0.2842	0.2814	0.2786	0.2758	0.2730	0.2703	0.2676	0.2649	0.2623	0.2597
−35	0.3139	0.3108	0.3077	0.3047	0.3017	0.2987	0.2957	0.2928	0.2899	0.2870
−34	0.3463	0.3429	0.3396	0.3362	0.3330	0.3297	0.3265	0.3233	0.3201	0.3170
−33	0.3818	0.3781	0.3745	0.3708	0.3673	0.3637	0.3602	0.3567	0.3532	0.3497
−32	0.4205	0.4165	0.4125	0.4085	0.4046	0.4007	0.3968	0.3930	0.3893	0.3855
−31	0.4628	0.4584	0.4541	0.4497	0.4454	0.4412	0.4370	0.4328	0.4287	0.4246
−30	0.5088	0.5040	0.4993	0.4946	0.4899	0.4853	0.4807	0.4762	0.4717	0.4672
−29	0.5589	0.5537	0.5485	0.5434	0.5383	0.5333	0.5283	0.5234	0.5185	0.5136
−28	0.6134	0.6077	0.6021	0.5966	0.5911	0.5856	0.5802	0.5748	0.5694	0.5642
−27	0.6727	0.6666	0.6605	0.6544	0.6484	0.6425	0.6366	0.6307	0.6249	0.6191
−26	0.7371	0.7304	0.7238	0.7172	0.7107	0.7042	0.6978	0.6914	0.6851	0.6789
−25	0.8070	0.7997	0.7926	0.7854	0.7783	0.7713	0.7643	0.7574	0.7506	0.7438
−24	0.8827	0.8748	0.8671	0.8593	0.8517	0.8441	0.8366	0.8291	0.8217	0.8143
−23	0.9649	0.9564	0.9479	0.9396	0.9313	0.9230	0.9148	0.9067	0.8986	0.8906
−22	1.0538	1.0446	1.0354	1.0264	1.0173	1.0084	0.9995	0.9908	0.9821	0.9734
−21	1.1500	1.1400	1.1301	1.1203	1.1106	1.1009	1.0913	1.0818	1.0724	1.0631
−20	1.2540	1.2432	1.2325	1.2219	1.2114	1.2010	1.1906	1.1804	1.1702	1.1600
−19	1.3664	1.3548	1.3432	1.3318	1.3204	1.3091	1.2979	1.2868	1.2758	1.2648
−18	1.4877	1.4751	1.4627	1.4503	1.4381	1.4259	1.4138	1.4018	1.3899	1.3781
−17	1.6186	1.6051	1.5916	1.5783	1.5650	1.5519	1.5389	1.5259	1.5131	1.5003
−16	1.7597	1.7451	1.7306	1.7163	1.7020	1.6879	1.6738	1.6599	1.6460	1.6323
−15	1.9118	1.8961	1.8805	1.8650	1.8496	1.8343	1.8191	1.8041	1.7892	1.7744
−14	2.0755	2.0586	2.0418	2.0251	2.0085	1.9921	1.9758	1.9596	1.9435	1.9276
−13	2.2515	2.2333	2.2153	2.1973	2.1795	2.1619	2.1444	2.1270	2.1097	2.0925
−12	2.4409	2.4213	2.4019	2.3826	2.3635	2.3445	2.3256	2.3069	2.2883	2.2698
−11	2.6443	2.6233	2.6024	2.5817	2.5612	2.5408	2.5205	2.5004	2.4804	2.4606
−10	2.8627	2.8402	2.8178	2.7956	2.7735	2.7516	2.7298	2.7082	2.6868	2.6655
− 9	3.0971	3.0729	3.0489	3.0250	3.0013	2.9778	2.9544	2.9313	2.9082	2.8854
− 8	3.3484	3.3225	3.2967	3.2711	3.2457	3.2205	3.1955	3.1706	3.1459	3.1214
− 7	3.6177	3.5899	3.5623	3.5349	3.5077	3.4807	3.4539	3.4272	3.4008	3.3745
− 6	3.9061	3.8764	3.8468	3.8175	3.7883	3.7594	3.7307	3.7021	3.6738	3.6456
− 5	4.2148	4.1830	4.1514	4.1200	4.0888	4.0579	4.0271	3.9966	3.9662	3.9361
− 4	4.5451	4.5111	4.4773	4.4437	4.4103	4.3772	4.3443	4.3116	4.2791	4.2468
− 3	4.8981	4.8617	4.8256	4.7897	4.7541	4.7187	4.6835	4.6486	4.6138	4.5794
− 2	5.2753	5.2364	5.1979	5.1595	5.1214	5.0836	5.0460	5.0087	4.9716	4.9347
− 1	5.6780	5.6365	5.5953	5.5544	5.5138	5.4734	5.4333	5.3934	5.3538	5.3144
− 0	6.1078	6.0636	6.0198	5.9759	5.9325	5.8894	5.8466	5.8040	5.7617	5.7197

TABLE 94 (CONTINUED)

SATURATION VAPOR PRESSURE OVER WATER

Metric units

Temperature	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
°C.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
0	6.1078	6.1523	6.1971	6.2422	6.2876	6.3333	6.3793	6.4256	6.4721	6.5190
1	6.5662	6.6137	6.6614	6.7095	6.7579	6.8066	6.8556	6.9049	6.9545	7.0044
2	7.0547	7.1053	7.1562	7.2074	7.2590	7.3109	7.3631	7.4157	7.4685	7.5218
3	7.5753	7.6291	7.6833	7.7379	7.7928	7.8480	7.9036	7.9595	8.0158	8.0724
4	8.1294	8.1868	8.2445	8.3026	8.3610	8.4198	8.4789	8.5384	8.5983	8.6586
5	8.7192	8.7802	8.8416	8.9033	8.9655	9.0280	9.0909	9.1542	9.2179	9.2820
6	9.3465	9.4114	9.4766	9.5423	9.6083	9.6748	9.7416	9.8089	9.8765	9.9446
7	10.013	10.082	10.151	10.221	10.291	10.362	10.433	10.505	10.577	10.649
8	10.722	10.795	10.869	10.943	11.017	11.092	11.168	11.243	11.320	11.397
9	11.474	11.552	11.630	11.708	11.787	11.867	11.947	12.027	12.108	12.190
10	12.272	12.355	12.438	12.521	12.606	12.690	12.775	12.860	12.946	13.032
11	13.119	13.207	13.295	13.383	13.472	13.562	13.652	13.742	13.833	13.925
12	14.017	14.110	14.203	14.297	14.391	14.486	14.581	14.678	14.774	14.871
13	14.969	15.067	15.166	15.266	15.365	15.466	15.567	15.669	15.771	15.874
14	15.977	16.081	16.186	16.291	16.397	16.503	16.610	16.718	16.826	16.935
15	17.044	17.154	17.264	17.376	17.487	17.600	17.713	17.827	17.942	18.057
16	18.173	18.290	18.407	18.524	18.643	18.762	18.882	19.002	19.123	19.245
17	19.367	19.490	19.614	19.739	19.864	19.990	20.117	20.244	20.372	20.501
18	20.630	20.760	20.891	21.023	21.155	21.288	21.422	21.556	21.691	21.827
19	21.964	22.101	22.240	22.379	22.518	22.659	22.800	22.942	23.085	23.229
20	23.373	23.518	23.664	23.811	23.959	24.107	24.256	24.406	24.557	24.709
21	24.861	25.014	25.168	25.323	25.479	25.635	25.792	25.950	26.109	26.269
22	26.430	26.592	26.754	26.918	27.082	27.247	27.413	27.580	27.748	27.916
23	28.086	28.256	28.428	28.600	28.773	28.947	29.122	29.298	29.475	29.652
24	29.831	30.011	30.191	30.373	30.555	30.739	30.923	31.109	31.295	31.483
25	31.671	31.860	32.050	32.242	32.434	32.627	32.821	33.016	33.212	33.410
26	33.608	33.807	34.008	34.209	34.411	34.615	34.820	35.025	35.232	35.440
27	35.649	35.859	36.070	36.282	36.495	36.709	36.924	37.140	37.358	37.576
28	37.796	38.017	38.239	38.462	38.686	38.911	39.137	39.365	39.594	39.824
29	40.055	40.287	40.521	40.755	40.991	41.228	41.466	41.705	41.945	42.187
30	42.430	42.674	42.919	43.166	43.414	43.663	43.913	44.165	44.418	44.672
31	44.927	45.184	45.442	45.701	45.961	46.223	46.486	46.750	47.016	47.283
32	47.551	47.820	48.091	48.364	48.637	48.912	49.188	49.466	49.745	50.025
33	50.307	50.590	50.874	51.160	51.447	51.736	52.026	52.317	52.610	52.904
34	53.200	53.497	53.796	54.096	54.397	54.700	55.004	55.310	55.617	55.926
35	56.236	56.548	56.861	57.176	57.492	57.810	58.129	58.450	58.773	59.097
36	59.422	59.749	60.077	60.407	60.739	61.072	61.407	61.743	62.081	62.421
37	62.762	63.105	63.450	63.796	64.144	64.493	64.844	65.196	65.550	65.906
38	66.264	66.623	66.985	67.347	67.712	68.078	68.446	68.815	69.186	69.559
39	69.934	70.310	70.688	71.068	71.450	71.833	72.218	72.605	72.994	73.385
40	73.777	74.171	74.568	74.966	75.365	75.767	76.170	76.575	76.982	77.391
41	77.802	78.215	78.630	79.046	79.465	79.885	80.307	80.731	81.157	81.585
42	82.015	82.447	82.881	83.316	83.754	84.194	84.636	85.079	85.525	85.973
43	86.423	86.875	87.329	87.785	88.243	88.703	89.165	89.629	90.095	90.564
44	91.034	91.507	91.981	92.458	92.937	93.418	93.901	94.386	94.874	95.363
45	95.855	96.349	96.845	97.343	97.844	98.347	98.852	99.359	99.869	100.38
46	100.89	101.41	101.93	102.45	102.97	103.50	104.03	104.56	105.09	105.62
47	106.16	106.70	107.24	107.78	108.33	108.88	109.43	109.98	110.54	111.10
48	111.66	112.22	112.79	113.36	113.93	114.50	115.07	115.65	116.23	116.81
49	117.40	117.99	118.58	119.17	119.77	120.37	120.97	121.57	122.18	122.79
50	123.40	124.01	124.63	125.25	125.87	126.49	127.12	127.75	128.38	129.01

TABLE 96 (CONCLUDED)

SATURATION VAPOR PRESSURE OVER ICE

Metric units

Temperature °C.	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
Unit:	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
−50	0.03935	0.03887	0.03839	0.03792	0.03745	0.03699	0.03653	0.03608	0.03564	0.03520
−49	0.04449	0.04395	0.04341	0.04289	0.04236	0.04185	0.04134	0.04083	0.04033	0.03984
−48	0.05026	0.04965	0.04905	0.04846	0.04788	0.04730	0.04673	0.04616	0.04560	0.04504
−47	0.05671	0.05603	0.05536	0.05470	0.05405	0.05340	0.05276	0.05212	0.05150	0.05087
−46	0.06393	0.06317	0.06242	0.06168	0.06095	0.06022	0.05950	0.05879	0.05809	0.05740
−45	0.07198	0.07113	0.07030	0.06947	0.06865	0.06784	0.06704	0.06625	0.06547	0.06469
−44	0.08097	0.08003	0.07909	0.07817	0.07725	0.07635	0.07546	0.07457	0.07370	0.07283
−43	0.09098	0.08993	0.08889	0.08786	0.08684	0.08584	0.08484	0.08386	0.08289	0.08192
−42	0.1021	0.1010	0.09981	0.09866	0.09753	0.09641	0.09530	0.09420	0.09312	0.09204
−41	0.1145	0.1132	0.1119	0.1107	0.1094	0.1082	0.1070	0.1057	0.1045	0.1033
−40	0.1283	0.1268	0.1254	0.1240	0.1226	0.1212	0.1198	0.1185	0.1171	0.1158
−39	0.1436	0.1420	0.1404	0.1389	0.1373	0.1358	0.1343	0.1328	0.1313	0.1298
−38	0.1606	0.1588	0.1571	0.1553	0.1536	0.1519	0.1502	0.1485	0.1469	0.1452
−37	0.1794	0.1774	0.1755	0.1736	0.1717	0.1698	0.1679	0.1661	0.1642	0.1624
−36	0.2002	0.1980	0.1959	0.1938	0.1917	0.1896	0.1875	0.1855	0.1834	0.1814
−35	0.2233	0.2209	0.2185	0.2161	0.2138	0.2115	0.2092	0.2069	0.2047	0.2024
−34	0.2488	0.2461	0.2435	0.2409	0.2383	0.2357	0.2332	0.2307	0.2282	0.2257
−33	0.2769	0.2740	0.2711	0.2682	0.2653	0.2625	0.2597	0.2569	0.2542	0.2515
−32	0.3079	0.3047	0.3014	0.2983	0.2951	0.2920	0.2889	0.2859	0.2828	0.2799
−31	0.3421	0.3385	0.3350	0.3315	0.3280	0.3246	0.3212	0.3178	0.3145	0.3112
−30	0.3798	0.3759	0.3720	0.3681	0.3643	0.3605	0.3567	0.3530	0.3494	0.3457
−29	0.4213	0.4170	0.4127	0.4084	0.4042	0.4000	0.3959	0.3918	0.3877	0.3838
−28	0.4669	0.4621	0.4574	0.4527	0.4481	0.4435	0.4390	0.4345	0.4300	0.4256
−27	0.5170	0.5118	0.5066	0.5014	0.4964	0.4913	0.4863	0.4814	0.4765	0.4717
−26	0.5720	0.5663	0.5606	0.5549	0.5493	0.5438	0.5383	0.5329	0.5276	0.5222
−25	0.6323	0.6260	0.6198	0.6136	0.6075	0.6015	0.5955	0.5895	0.5836	0.5778
−24	0.6985	0.6916	0.6848	0.6780	0.6713	0.6646	0.6580	0.6515	0.6450	0.6386
−23	0.7709	0.7634	0.7559	0.7485	0.7412	0.7339	0.7267	0.7195	0.7125	0.7055
−22	0.8502	0.8419	0.8338	0.8257	0.8176	0.8097	0.8018	0.7940	0.7862	0.7785
−21	0.9370	0.9280	0.9190	0.9101	0.9013	0.8926	0.8840	0.8754	0.8669	0.8585
−20	1.032	1.022	1.012	1.002	0.9928	0.9833	0.9739	0.9645	0.9553	0.9461
−19	1.135	1.124	1.114	1.103	1.092	1.082	1.072	1.062	1.052	1.042
−18	1.248	1.236	1.225	1.213	1.201	1.190	1.179	1.168	1.157	1.146
−17	1.371	1.358	1.345	1.333	1.320	1.308	1.296	1.284	1.272	1.260
−16	1.506	1.492	1.478	1.464	1.451	1.437	1.424	1.410	1.397	1.384
−15	1.652	1.637	1.622	1.607	1.592	1.577	1.562	1.548	1.534	1.520
−14	1.811	1.795	1.778	1.762	1.746	1.730	1.714	1.698	1.683	1.667
−13	1.984	1.966	1.948	1.930	1.913	1.895	1.878	1.861	1.844	1.827
−12	2.172	2.153	2.133	2.114	2.095	2.076	2.057	2.039	2.020	2.002
−11	2.376	2.355	2.334	2.313	2.292	2.271	2.251	2.231	2.211	2.191
−10	2.597	2.574	2.551	2.529	2.506	2.484	2.462	2.440	2.419	2.397
− 9	2.837	2.812	2.787	2.763	2.739	2.715	2.691	2.667	2.644	2.620
− 8	3.097	3.070	3.043	3.017	2.991	2.965	2.939	2.913	2.888	2.862
− 7	3.379	3.350	3.321	3.292	3.264	3.236	3.208	3.180	3.152	3.124
− 6	3.685	3.653	3.622	3.591	3.560	3.529	3.499	3.468	3.438	3.409
− 5	4.015	3.981	3.947	3.913	3.879	3.846	3.813	3.781	3.748	3.717
− 4	4.372	4.335	4.298	4.262	4.226	4.190	4.154	4.119	4.084	4.049
− 3	4.757	4.717	4.678	4.638	4.600	4.561	4.523	4.485	4.447	4.409
− 2	5.173	5.130	5.087	5.045	5.003	4.961	4.920	4.878	4.838	4.797
− 1	5.623	5.577	5.530	5.485	5.439	5.394	5.349	5.305	5.260	5.217
− 0	6.107	6.057	6.007	5.958	5.909	5.860	5.812	5.764	5.717	5.670