

TEOS-10 GSW-Library check values

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Gibbs SeaWater (GSW) Oceanographic Toolbox of TEOS-10 version 3.03 (PHP)				
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These are the check values for the subset of functions that have been transcribed from Matlab, C or Fortran version to be implemented into PHP from the Gibbs SeaWater (GSW) Oceanographic Toolbox of TEOS-10 (version 3.03).				
<div>\$sp = 3.550e+1 \$sa = 3.570e+1 \$sstar = 3.550e+1 \$sr = 3.550e+1 \$t = 1.500e+1 \$ct = 2.000e+1 \$pt = 1.500e+1 \$p = 3.000e+2 \$p_bs = 5.000e+1 \$p_ref = 1.000e+2 \$lon = 2.600e+2 \$long_bs = 2.000e+1 \$lat = 1.600e+1 \$lat_bs = 6.000e+1 \$saturation_fraction = 5.000e-1 \$c = 4.360e+1</div>		<div>\$sa_profile[0] = 3.550e+1 \$sa_profile[1] = 3.570e+1 \$sa_profile[2] = 3.560e+1 \$ct_profile[0] = 1.250e+1 \$ct_profile[1] = 1.500e+1 \$ct_profile[2] = 1.000e+1 \$p_profile[0] = 0.000e+0 \$p_profile[1] = 5.000e+1 \$p_profile[2] = 1.000e+2 \$lat_profile[0] = 1.000e+1 \$lat_profile[1] = 1.000e+1 \$lat_profile[2] = 1.000e+1</div>		
Practical Salinity, PSS-78:				
Function	Calculated Value	Check Value	Difference	Acceptable Difference
\$TEOS10->gsw_sp_from_c(\$c,\$t,\$p)	35.500961780774	35.500961780774	0	1.2971934637562E-10
\$TEOS10->gsw_c_from_sp(\$sp,\$t,\$p)	43.59894560528	43.59894560528	0	6.1638161241717E-10
Absolute Salinity, Preformed Salinity and Conservative Temperature:				
Function	Calculated Value	Check Value	Difference	Acceptable Difference
\$TEOS10->gsw_sa_from_sp(\$sp,\$p,\$lon,\$lat)	35.671358392019	35.671358392019	7.105427357601E-15	1.3000800436203E-10
\$TEOS10->gsw_sstar_from_sp(\$sp,\$p,\$lon,\$lat)	35.666011477079	35.666011477079	0	1.3000089893467E-10
\$TEOS10->gsw_ct_from_t(\$sa,\$t,\$p)	14.930280459896	14.930280459896	3.5527136788005E-15	6.2611071882657E-10
Other conversions between temperatures, salinities, entropy, pressure and height:				
Function	Calculated Value	Check Value	Difference	Acceptable Difference
\$TEOS10->gsw_deltasa_from_sp(\$sp,\$p,\$lon,\$lat)	0.0039606777333532	0.0039606777333603	7.105427357601E-15	6.963318810449E-13
\$TEOS10->gsw_sr_from_sp(\$sp)	35.667397714286	35.667397714286	0	1.3032330770102E-10
\$TEOS10->gsw_sp_from_sr(\$sr)	35.333387933015	35.333387933015	0	1.2971224094827E-10
\$TEOS10->gsw_sp_from_sa(\$sa,\$p,\$lon,\$lat)	35.528504019167	35.528504019167	7.105427357601E-15	1.2971135276985E-10
\$TEOS10->gsw_sstar_from_sa(\$sa,\$p,\$lon,\$lat)	35.694648791861	35.694648791861	7.105427357601E-15	1.3000089893467E-10
\$TEOS10->gsw_sp_from_sstar(\$sstar,\$p,\$lon,\$lat)	35.334761242084	35.334761242084	0	1.2971224094827E-10
\$TEOS10->gsw_sa_from_sstar(\$sstar,\$p,\$lon,\$lat)	35.505322027121	35.505322027121	0	1.3002221521674E-10
\$TEOS10->gsw_pt_from_ct(\$sa,\$ct)	20.023899375975	20.023899375975	0	6.0540372714968E-10
\$TEOS10->gsw_t_from_ct(\$sa,\$ct,\$p)	20.079820359223	20.079820359223	3.5527136788005E-15	6.0001426049894E-10
\$TEOS10->gsw_ct_from_pt(\$sa,\$pt)	14.976021403958	14.976021403958	0	6.2611071882657E-10
\$TEOS10->gsw_pt0_from_t(\$sa,\$t,\$p)	14.954241363902	14.954241363902	3.5527136788005E-15	6.0540372714968E-10
\$TEOS10->gsw_pt_from_t(\$sa,\$t,\$p,\$p_ref)	14.969381237884	14.969381237884	1.7763568394003E-15	6.0540372714968E-10
\$TEOS10->gsw_z_from_p(\$p,\$lat)	-298.01615533164	-298.01615533164	5.6843418860808E-14	2.2872239213712E-8
\$TEOS10->gsw_entropy_from_t(\$sa,\$t,\$p)	212.30166821093	212.30166821093	2.8421709430404E-14	9.0281631059952E-9
\$TEOS10->gsw_adiabatic_lapse_rate_from_ct(\$sa,\$ct,\$p)	1.8779417441912E-8	1.8779417441912E-8	3.3087224502121E-24	5.699743845488E-19
Density and enthalpy, based on the 48-term expression for density:				
Function	Calculated Value	Check Value	Difference	Acceptable Difference
\$TEOS10->gsw_rho(\$sa,\$ct,\$p)	1026.4562376198	1026.4562376198	0	2.9456259653671E-10
\$TEOS10->gsw_alpha(\$sa,\$ct,\$p)	0.00026246055080678	0.00026246055080678	1.0842021724855E-19	8.2647139186629E-15
\$TEOS10->gsw_beta(\$sa,\$ct,\$p)	0.00072931445593446	0.00072931445593446	9.7578195523695E-19	1.8461794593083E-15
\$TEOS10->gsw_alpha_on_beta(\$sa,\$ct,\$p)	0.35987295832563	0.35987295832563	2.2204460492503E-16	1.0529077609789E-11
\$TEOS10->gsw_specvol(\$sa,\$ct,\$p)	0.0009742256545869	0.0009742256545869	0	2.8210940528073E-16
\$TEOS10->gsw_specvol_anom(\$sa,\$ct,\$p)	2.9094818120126E-6	2.9094818120126E-6	0	2.8102520310824E-16
\$TEOS10->gsw_sigma0(\$sa,\$ct)	25.165674636323	25.165674636323	0	2.9331204132177E-10
\$TEOS10->gsw_sigma1(\$sa,\$ct)	29.434338510753	29.434338510753	0	2.9990587790962E-10
\$TEOS10->gsw_sigma2(\$sa,\$ct)	33.609842926904	33.609842926904	0	3.0604496714659E-10
\$TEOS10->gsw_sigma3(\$sa,\$ct)	37.695147569372	37.695147569372	0	3.1195668270811E-10
\$TEOS10->gsw_sigma4(\$sa,\$ct)	41.693064726656	41.693064726656	0	3.1809577194508E-10
\$TEOS10->gsw_sound_speed(\$sa,\$ct,\$p)	1527.201177357	1527.201177357	6.821210263297E-13	2.5961526262108E-9
\$TEOS10->gsw_kappa(\$sa,\$ct,\$p)	4.1770248733494E-10	4.1770248733494E-10	0	1.7177439395429E-21
\$TEOS10->gsw_cabbeling(\$sa,\$ct,\$p)	9.4630533211291E-6	9.4630533211291E-6	0	1.634722766224E-16

\$TEOS10->gsw_thermobaric(\$sa,\$ct,\$p)	1.7390786620829E-12	1.7390786620829E-12	4.0389678347316E-28	4.8909073201115E-23
\$TEOS10->gsw_internal_energy(\$sa,\$ct,\$p)	79740.482561721	79740.482561721	0	2.4993423721753E-6
\$TEOS10->gsw_enthalpy(\$sa,\$ct,\$p)	82761.872939932	82761.872939932	0	2.4993569240905E-6
\$TEOS10->gsw_dynamic_enthalpy(\$sa,\$ct,\$p)	2924.5137975399	2924.5137975399	9.0949470177293E-13	2.2887547349305E-7
\$TEOS10->gsw_sa_from_rho(\$rho,\$ct,\$p)	35.700000000001	35.7	1.0658141036402E-12	2.9456259653671E-10
\$TEOS10->gsw_rho_first_derivatives(\$sa,\$ct,\$p,\$drho_dsa,\$drho_dct,\$drho_dp)				passed
Water column properties, based on the 48-term expression for density:				
Function	Calculated Value	Check Value	Difference	Acceptable Difference
\$TEOS10->gsw_nsquared(\$sa_profile,\$ct_profile,\$p_profile,\$lat_profile,\$nz,\$n2,\$p_mid_n2)				passed
\$TEOS10->gsw_turner_rsubrho(\$sa_profile,\$ct_profile,\$p_profile,\$nz,\$tu,\$rsubrho,\$p_mid_tursr)				passed
\$TEOS10->gsw_ipv_vs_fnsquared_ratio(\$sa_profile,\$ct_profile,\$p_profile,\$nz,\$ipvfn2,\$p_mid_ipvfn2)				passed
Freezing temperatures:				
Function	Calculated Value	Check Value	Difference	Acceptable Difference
\$TEOS10->gsw_ct_freezing(\$sa,\$p,\$saturation_fraction)	-2.1801450326175	-2.1801450326175	4.4408920985006E-16	2.2571278179839E-11
\$TEOS10->gsw_t_freezing(\$sa,\$p,\$saturation_fraction)	-2.1765521998024	-2.1765521998024	8.8817841970013E-16	2.1578294706615E-11
Isobaric melting enthalpy and isobaric evaporation enthalpy:				
Function	Calculated Value	Check Value	Difference	Acceptable Difference
\$TEOS10->gsw_latentheat_melting(\$sa,\$p)	329330.54839618	329330.54839618	0	6.2864273786545E-8
\$TEOS10->gsw_latentheat_evap_ct(\$sa,\$ct)	2450871.0228524	2450871.0228524	0	1.455657184124E-6
\$TEOS10->gsw_latentheat_evap_t(\$sa,\$t)	2462848.2895523	2462848.2895523	4.6566128730774E-10	1.4430843293667E-6
Basic thermodynamic properties in terms of in-situ t, based on the exact Gibbs function:				
Function	Calculated Value	Check Value	Difference	Acceptable Difference
\$TEOS10->gsw_rho_t_exact(\$sa,\$t,\$p)	1027.7128170207	1027.7128170207	0	2.9444890969899E-10
\$TEOS10->gsw_pot_rho_t_exact(\$sa,\$t,\$p,\$p_ref)	1026.8362655887	1026.8362655887	2.2737367544323E-13	2.929709808086E-10
\$TEOS10->gsw_alpha_wrt_t_exact(\$sa,\$t,\$p)	0.00021906695241073	0.00021906695241073	0	8.5948568683165E-15
\$TEOS10->gsw_beta_const_t_exact(\$sa,\$t,\$p)	0.00074474484164873	0.00074474484164873	1.0842021724855E-19	1.8048713565366E-15
\$TEOS10->gsw_specvol_t_exact(\$sa,\$t,\$p)	0.00097303447367616	0.00097303447367616	0	2.8189256484623E-16
\$TEOS10->gsw_sound_speed_t_exact(\$sa,\$t,\$p)	1512.2053940303	1512.2053940303	0	2.5902409106493E-9
\$TEOS10->gsw_kappa_t_exact(\$sa,\$t,\$p)	4.2550695338661E-10	4.2550695338661E-10	5.1698788284564E-26	1.712677458291E-21
\$TEOS10->gsw_enthalpy_t_exact(\$sa,\$t,\$p)	62520.680485511	62520.680485511	1.4551915228367E-11	2.4993496481329E-6
\$TEOS10->gsw_cp_t_exact(\$sa,\$t,\$p)	3982.7832563441	3982.7832563441	0	2.8139766072854E-9
\$TEOS10->gsw_sa_from_rho_t_exact(\$rho,\$t,\$p)	35.7	35.7	1.5631940186722E-13	2.8139766072854E-9
sa 35.7 rho 1027.7128170207 t 15 p 300 calc 35.7				
Library functions of the GSW toolbox:				
Function	Calculated Value	Check Value	Difference	Acceptable Difference
\$GSW_saar->gsw_deltasatlas(\$p,\$lon,\$lat)	0.0038766037301629	0.0038766037301629	0	6.9455140423724E-13
\$TEOS10->gsw_fdelta(\$p,\$lon,\$lat)	0.00014991625692416	0.00014991625692416	0	2.7029390553025E-14
\$TEOS10->gsw_sa_from_sp_baltic(\$sp,\$long_bs,\$lat_bs)	35.666154857143	35.666154857143	7.105427357601E-15	1.3000800436203E-10
\$TEOS10->gsw_sp_from_sa_baltic(\$sa,\$long_bs,\$lat_bs)	35.53376984575	35.53376984575	7.105427357601E-15	1.2971135276985E-10

Unacceptable Differences are marked red.

Gibbs SeaWater (GSW) Oceanographic Toolbox is installed.