

This directory contains three files:

- 1) gsw_oceanographic_toolbox.f90
- 2) gsw_data_v3_0.dat
- 3) gsw_check_function.f90

File 1 gsw_oceanographic_toolbox.f90

Contains the subset of the Gibbs SeaWater (GSW) Oceanographic Toolbox of TEOS-10 (version 3.03) that has been rewritten in Fortran 90, as follows

Gibbs SeaWater (GSW) Oceanographic Toolbox of TEOS-10 version 3.02 (Fortran)

Practical Salinity, PSS-78

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|----------------|--|
| gsw_sp_from_c | - Practical Salinity from conductivity (inc. for SP < 2) |
| gsw_c_from_sp | - conductivity from Practical Salinity (inc. for SP < 2) |
| gsw_sp_from_sk | - Practical Salinity from Knudsen Salinity |

salinity and temperature conversions

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|----------------------------------|---|
| gsw_sa_from_sp | - Absolute Salinity from Practical Salinity |
| gsw_sstar_from_sp | - Preformed Salinity from Practical Salinity |
| gsw_ct_from_t | - Conservative Temperature from in-situ temperature |
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| gsw_deltasa_from_sp | - Absolute Salinity Anomaly from Practical Salinity |
| gsw_sr_from_sp | - Reference Salinity from Practical Salinity |
| gsw_sp_from_sr | - Practical Salinity from Reference Salinity |
| gsw_sp_from_sa | - Practical Salinity from Absolute Salinity |
| gsw_sstar_from_sa | - Preformed Salinity from Absolute Salinity |
| gsw_sp_from_sstar | - Practical Salinity from Preformed Salinity |
| gsw_sa_from_sstar | - Absolute Salinity from Preformed Salinity |
| gsw_pt_from_ct | - potential temperature from Conservative Temperature |
| gsw_t_from_ct | - in-situ temperature from Conservative Temperature |
| gsw_ct_from_pt | - Conservative Temperature from potential temperature |
| gsw_pt0_from_t | - potential temperature with reference pressure of 0 dbar |
| gsw_pt_from_t | - potential temperature |
| gsw_z_from_p | - height from pressure |
| gsw_entropy_from_t | - entropy from in-situ temperature |
| gsw_adiabatic_lapse_rate_from_ct | - adiabatic lapse rate from CT |

density and enthalpy, based on the 48-term expression for density

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|---------------------------|--|
| gsw_rho | - in-situ density from CT, and potential density |
| gsw_alpha | - thermal expansion coefficient with respect to CT |
| gsw_beta | - saline contraction coefficient at constant CT |
| gsw_alpha_on_beta | - alpha divided by beta |
| gsw_rho_first_derivatives | - first derivatives of density |
| gsw_specvol | - specific volume |
| gsw_specvol_anom | - specific volume anomaly |
| gsw_sigma0 | - sigma0 with reference pressure of 0 dbar |
| gsw_sigma1 | - sigma1 with reference pressure of 1000 dbar |
| gsw_sigma2 | - sigma2 with reference pressure of 2000 dbar |
| gsw_sigma3 | - sigma3 with reference pressure of 3000 dbar |
| gsw_sigma4 | - sigma4 with reference pressure of 4000 dbar |
| gsw_sound_speed | - sound speed |
| gsw_kappa | - isentropic compressibility |
| gsw_cabbeling | - cabbeling coefficient |
| gsw_thermobaric | - thermobaric coefficient |
| gsw_internal_energy | - internal energy |
| gsw_enthalpy | - enthalpy |
| gsw_dynamic_enthalpy | - dynamic enthalpy |
| gsw_sa_from_rho | - Absolute Salinity from density |

water column properties, based on the 48-term expression for density

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|----------------------------|--|
| gsw_nsquared | - buoyancy (Brunt-Vaisala) frequency squared (N^2) |
| gsw_turner_rsubrho | - Turner angle & R_{subrho} |
| gsw_ipv_vs_fnsquared_ratio | - ratio of the vertical gradient of potential density (with reference pressure, p_{ref}), to the vertical gradient of locally-referenced potential density |

freezing temperatures

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| gsw_ct_freezing | - Conservative Temperature freezing temperature of seawater |
| gsw_t_freezing | - in-situ temperature freezing temperature of seawater |

isobaric melting enthalpy and isobaric evaporation enthalpy

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|------------------------|---|
| gsw_latentheat_melting | - latent heat of melting |
| gsw_latentheat_evap_ct | - latent heat of evaporation with CT as input temperature |
| gsw_latentheat_evap_t | - latent heat of evaporation, with in-situ temperature as input |

planet Earth properties

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| gsw_grav | - gravitational acceleration |
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basic thermodynamic properties in terms of in-situ t , based on the exact Gibbs function

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|------------------------|---|
| gsw_rho_t_exact | - in-situ density |
| gsw_pot_rho_t_exact | - potential density |
| gsw_alpha_wrt_t_exact | - thermal expansion coefficient with respect to in-situ temperature |
| gsw_beta_const_t_exact | - saline contraction coefficient at constant in-situ temperature |
| gsw_specvol_t_exact | - specific volume |

gsw_sound_speed_t_exact - sound speed
 gsw_kappa_t_exact - isentropic compressibility
 gsw_enthalpy_t_exact - enthalpy

library functions of the GSW toolbox

gsw_gibbs - the TEOS-10 Gibbs function and its derivatives
 gsw_saar - Absolute Salinity Anomaly Ratio (excluding the Baltic Sea)
 gsw_deltasa_atlas - Absolute Salinity Anomaly atlas value (excluding the Baltic Sea)
 gsw_fdelta - ratio of Absolute to Preformed Salinity, minus 1
 gsw_sa_from_sp_baltic - Absolute Salinity from Practical Salinity in the Baltic Sea
 gsw_sp_from_sa_baltic - Practical Salinity from Absolute Salinity in the Baltic Sea
 gsw_entropy_part - entropy minus the terms that are a function of only SA
 gsw_entropy_part_zerop - entropy_part evaluated at 0 dbar
 gsw_gibbs_pt0_pt0 - gibbs(0,2,0,SA,t,0)
 gsw_specvol_sso_0_p - specvol_CT at (35.16504,0,p)
 gsw_enthalpy_sso_0_p - enthalpy_CT at (35.16504,0,p)
 gsw_hill_ratio_at_sp2 - Hill ratio at a Practical Salinity of 2

File 2 gsw_data_v3_0.dat

Contains the global data set of Absolute Salinity Anomaly Ratio R^δ , and the global data set of Absolute Salinity Anomaly atlas. δS_A^{atlas} .

The data set gsw_data_v3_0.dat must not be tampered with.

File 3 gsw_check_function.f90

Contains the check functions. We suggest that after downloading, unzipping and installing the toolbox the user runs this program to ensure that the toolbox is installed correctly and there are no conflicts.

Installation.

This toolbox has been tested to compile and run with gfortran.

Compile and run commands, in gfortran:

```
gfortran gsw_oceanographic_toolbox.f90 -c
gfortran gsw_check_functions.f90 -c
gfortran gsw_oceanographic_toolbox.o gsw_check_functions.o -o gsw
./gsw
```

Note that gfortran is the name of the GNU Fortran project, developing a free Fortran 95/2003/2008 compiler for GCC, the GNU Compiler Collection. It is available from

<http://gcc.gnu.org/fortran/>