Gibbs SeaWater (GSW) Oceanographic Toolbox of TEOS–10

documentation set

gsw_front_page	front page to the GSW Oceanographic Toolbox
gsw_contents	contents of the GSW Oceanographic Toolbox
gsw_check_functions	checks that all the GSW functions work correctly
gsw_demo	demonstrates many GSW functions and features

Practical Salinity (SP), PSS-78

gsw_SP_from_C	Practical Salinity from conductivity, C (incl. for SP < 2)
gsw_C_from_SP	conductivity, C, from Practical Salinity (incl. for SP < 2)
gsw_SP_from_R	Practical Salinity from conductivity ratio, R (incl. for SP < 2)
gsw_R_from_SP	conductivity ratio, R, from Practical Salinity (incl. for SP < 2)
gsw_SP_salinometer	Practical Salinity from a laboratory salinometer (incl. for SP < 2)
gsw_SP_from_SK	Practical Salinity from Knudsen Salinity

Absolute Salinity (SA), Preformed Salinity (Sstar) and Conservative Temperature (CT)

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

Absolute Salinity – Conservative Temperature plotting function

gsw_SA_CT_plot	function to plot Absolute Salinity – Conservative Temperature profiles on the SA-CT diagram, including the freezing line and selected potential density contours

other conversions between temperatures, salinities, entropy, pressure and height

gsw_deltaSA_from_SP	Absolute Salinity Anomaly from Practical Salinity
gsw_SA_Sstar_from_SP	Absolute Salinity & Preformed Salinity 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_SA_from_Sstar	Absolute Salinity from Preformed Salinity
gsw_SP_from_Sstar	Practical 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_pot_enthalpy_from_pt	potential enthalpy from potential temperature
gsw_pt0_from_t	potential temperature with reference pressure of 0 dbar
gsw_pt_from_t	potential temperature
gsw_t90_from_t48	ITS-90 temperature from IPTS-48 temperature
gsw_t90_from_t68	ITS-90 temperature from IPTS-68 temperature
gsw_z_from_p	height from pressure
gsw_p_from_z	pressure from height
gsw_z_from_depth	height from depth
gsw_depth_from_z	depth from height
gsw_Abs_Pressure_from_p	Absolute Pressure, P, from sea pressure, p
gsw_p_from_Abs_Pressure	sea pressure, p, from Absolute Pressure, P
gsw_entropy_from_CT	entropy from Conservative Temperature
gsw_CT_from_entropy	Conservative Temperature from entropy
gsw_entropy_from_pt	entropy from potential temperature
gsw_pt_from_entropy	potential temperature from entropy
gsw_molality_from_SA	molality of seawater
gsw_ionic_strength_from_SA	ionic strength of seawater

density and enthalpy, based on the 48-term expression for density, $\hat{\rho}(S_A, \Theta, p)$

The functions in this group ending in "_CT" may also be called without "_CT".

gsw_rho_CT	in-situ density, and potential density
gsw_alpha_CT	thermal expansion coefficient with respect to CT
gsw_beta_CT	saline contraction coefficient at constant CT
gsw_rho_alpha_beta_CT	in-situ density, thermal expansion & saline contraction coefficients
gsw_specvol_CT	specific volume
gsw_specvol_anom_CT	specific volume anomaly
gsw_sigma0_CT	sigma0 from CT with reference pressure of 0 dbar
gsw_sigma1_CT	sigma1 from CT with reference pressure of 1000 dbar
gsw_sigma2_CT	sigma2 from CT with reference pressure of 2000 dbar
gsw_sigma3_CT	sigma3 from CT with reference pressure of 3000 dbar
gsw_sigma4_CT	sigma4 from CT with reference pressure of 4000 dbar
gsw_sound_speed_CT	sound speed (approximate, with r.m.s. error of 0.067 m/s)
gsw_internal_energy_CT	internal energy
gsw_enthalpy_CT	enthalpy
gsw_enthalpy_diff_CT	difference of enthalpy between two pressures
gsw_dynamic_enthalpy_CT	dynamic enthalpy
gsw_SA_from_rho_CT	Absolute Salinity from density
gsw_CT_from_rho	Conservative Temperature from density
gsw_CT_maxdensity	Conservative Temperature of maximum density of seawater

water column properties, based on the 48-term expression for density, $\hat{\rho}(S_A, \Theta, p)$

gsw_Nsquared	buoyancy (Brunt-Väisäla) frequency squared (N^2)
gsw_Turner_Rsubrho	Turner angle & Rsubrho
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

neutral and non-linear properties, based on the 48-term expression for density, $\hat{\rho}(S_A, \Theta, p)$

gsw_cabbeling	cabbeling coefficient
gsw_thermobaric	thermobaric coefficient
gsw_isopycnal_slope_ratio	ratio of the slopes of isopycnals on the SA-CT diagram for p & p_ref
gsw_ntp_pt_vs_CT_ratio	ratio of gradients of pt & CT in a neutral tangent plane
gsw_isopycnal_vs_ntp_CT_ratio	ratio of the gradient of CT in a potential density surface to that in the neutral tangent plane

geostrophic streamfunctions, based on the 48-term expression for density, $\hat{\rho}(S_A, \Theta, p)$

gsw_geo_strf_dyn_height	dynamic height anomaly
gsw_geo_strf_dyn_height_pc	dynamic height anomaly for piecewise constant profiles
gsw_geo_strf_isopycnal	approximate isopycnal geostrophic streamfunction
gsw_geo_strf_isopycnal_pc	approximate isopycnal geostrophic streamfunction for piecewise constant profiles
gsw_geo_strf_Cunningham	Cunningham geostrophic streamfunction
gsw_geo_strf_Montgomery	Montgomery geostrophic streamfunction

geostrophic velocity

gsw_geostrophic_velocity	geostrophic velocity

derivatives of enthalpy, entropy, CT and pt

gsw_CT_first_derivatives	first derivatives of Conservative Temperature
gsw_CT_second_derivatives	second derivatives of Conservative Temperature
gsw_enthalpy_first_derivatives	first derivatives of enthalpy
gsw_enthalpy_second_derivatives	second derivatives of enthalpy
gsw_entropy_first_derivatives	first derivatives of entropy
gsw_entropy_second_derivatives	second derivatives of entropy
gsw_pt_first_derivatives	first derivatives of potential temperature
gsw_pt_second_derivatives	second derivatives of potential temperature

freezing temperatures

gsw_CT_freezing	Conservative Temperature freezing temperature of seawater
gsw_t_freezing	in-situ freezing temperature of seawater
gsw_brineSA_CT	Absolute Salinity of seawater at the freezing point (for given CT)
gsw_brineSA_t	Absolute Salinity of seawater at the freezing point (for given t)

isobaric melting enthalpy and isobaric evaporation enthalpy

gsw_latentheat_melting	latent heat of melting of ice into seawater (isobaric melting enthalpy)
gsw_latentheat_evap_CT	latent heat of evaporation of water from seawater (isobaric evaporation enthalpy) with CT as input temperature
gsw_latentheat_evap_t	latent heat of evaporation of water from seawater (isobaric evaporation enthalpy) with in-situ temperature, t, as input

planet Earth properties

gsw_f	Coriolis parameter
gsw_grav	gravitational acceleration
gsw_distance	spherical earth distance between points in the ocean

steric height

gsw_steric_height	dynamic height anomaly divided by 9.7963 m s^{-2}

TEOS–10 constants

gsw_T0	Celsius zero point; 273.15 K
gsw_P0	one standard atmosphere; 101 325 Pa
gsw_SSO	Standard Ocean Reference Salinity; 35.165 04 g/kg
gsw_uPS	unit conversion factor for salinities; (35.165 04/35) g/kg
gsw_cp0	the “specific heat” for use with CT; 3991.867 957 119 63 (J/kg)/K
gsw_C3515	conductivity of SSW at SP=35, t_68=15, p=0; 42.9140 mS/cm
gsw_SonCl	ratio of SP to Chlorinity; 1.80655 $(g/kg)^{-1}$
gsw_valence_factor	valence factor of sea salt; 1.2452898
gsw_atomic_weight	mole-weighted atomic weight of sea salt; 31.4038218... g/mol

The GSW Toolbox is available from
www.TEOS–10.org

density and enthalpy in terms of CT, based on the exact Gibbs function

gsw_rho_CT_exact	in-situ density from CT, and potential density from CT
gsw_alpha_CT_exact	thermal expansion coefficient with respect to CT
gsw_beta_CT_exact	saline contraction coefficient at constant CT
gsw_rho_alpha_beta_CT_exact	density, thermal expansion & saline contraction coefficients from CT
gsw_specvol_CT_exact	specific volume from CT
gsw_specvol_anom_CT_exact	specific volume anomaly from CT
gsw_sigma0_CT_exact	sigma0 from CT with reference pressure of 0 dbar
gsw_sigma1_CT_exact	sigma1 from CT with reference pressure of 1000 dbar
gsw_sigma2_CT_exact	sigma2 from CT with reference pressure of 2000 dbar
gsw_sigma3_CT_exact	sigma3 from CT with reference pressure of 3000 dbar
gsw_sigma4_CT_exact	sigma4 from CT with reference pressure of 4000 dbar
gsw_sound_speed_CT_exact	sound speed from CT
gsw_internal_energy_CT_exact	internal energy from CT
gsw_enthalpy_CT_exact	enthalpy from CT
gsw_enthalpy_diff_CT_exact	difference of enthalpy from CT between two pressures
gsw_dynamic_enthalpy_CT_exact	dynamic enthalpy from CT
gsw_SA_from_rho_CT_exact	Absolute Salinity from density & CT
gsw_CT_from_rho_exact	Conservative Temperature from density
gsw_CT_maxdensity_exact	Conservative Temperature of maximum density of seawater

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

gsw_rho_t_exact	in-situ density
gsw_pot_rho_t_exact	potential density
gsw_sigma0_pt0_exact	sigma0 from pt0 with reference pressure of 0 dbar
gsw_alpha_wrt_CT_t_exact	thermal expansion coefficient with respect to CT
gsw_alpha_wrt_pt_t_exact	thermal expansion coefficient with respect to pt
gsw_alpha_wrt_t_exact	thermal expansion coefficient with respect to t
gsw_beta_const_CT_t_exact	saline contraction coefficient at constant CT
gsw_beta_const_pt_t_exact	saline contraction coefficient at constant pt
gsw_beta_const_t_exact	saline contraction coefficient at constant t
gsw_specvol_t_exact	specific volume
gsw_specvol_anom_t_exact	specific volume anomaly
gsw_sound_speed_t_exact	sound speed
gsw_kappa_t_exact	isentropic compressibility
gsw_kappa_const_t_exact	isothermal compressibility
gsw_internal_energy_t_exact	internal energy
gsw_enthalpy_t_exact	enthalpy
gsw_dynamic_enthalpy_t_exact	dynamic enthalpy
gsw_SA_from_rho_t_exact	Absolute Salinity from density
gsw_t_from_rho_exact	in-situ temperature from density
gsw_t_maxdensity_exact	in-situ temperature of maximum density of seawater
gsw_entropy_t_exact	entropy
gsw_cp_t_exact	isobaric heat capacity
gsw_isochoric_heat_cap_t_exact	isochoric heat capacity of seawater
gsw_chem_potential_relative_t_exact	relative chemical potential
gsw_chem_potential_water_t_exact	chemical potential of water in seawater
gsw_chem_potential_salt_t_exact	chemical potential of salt in seawater
gsw_Helmholtz_energy_t_exact	Helmholtz energy
gsw_adiabatic_lapse_rate_t_exact	adiabatic lapse rate
gsw_osmotic_coefficient_t_exact	osmotic coefficient of seawater
gsw_osmotic_pressure_t_exact	osmotic pressure of seawater