Gibbs SeaWater (GSW) Oceanographic Toolbox of TEOS–10

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_pt_from_t	potential temperature
gsw_pt0_from_t	potential temperature with reference pressure of 0 dbar
gsw_t_from_pt0	in-situ temperature from potential temperature with p_ref of 0 dbar
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_entropy_from_t	entropy from in-situ temperature
gsw_t_from_entropy	in-situ temperature from entropy
gsw_adiabatic_lapse_rate_from_CT	adiabatic lapse rate from Conservative Temperature
gsw_adiabatic_lapse_rate_from_t	adiabatic lapse rate from in-situ temperature
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, $\hat{\rho}(S_A, \Theta, p)$

gsw_rho	in-situ density and potential density
gsw_alpha	thermal expansion coefficient with respect to CT
gsw_beta	saline contraction coefficient at constant CT
gsw_rho_alpha_beta	in-situ density, thermal expansion and saline contraction coefficients
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 (approximate, with r.m.s. error of 0.067 m/s)
gsw_kappa	isentropic compressibility
gsw_cabbeling	cabbeling coefficient
gsw_thermobaric	thermobaric coefficient
gsw_SA_from_rho	Absolute Salinity from density
gsw_CT_from_rho	Conservative Temperature from density
gsw_CT_maxdensity	Conservative Temperature of maximum density of seawater
gsw_internal_energy	internal energy
gsw_enthalpy	enthalpy
gsw_enthalpy_diff	difference of enthalpy between two pressures
gsw_dynamic_enthalpy	dynamic enthalpy
gsw_enthalpy_first_derivatives	first derivatives of enthalpy
gsw_enthalpy_second_derivatives	second derivatives of enthalpy

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

gsw_Nsquared	buoyancy (Brunt-Väisälä) 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 properties, based on the 48-term expression for density, $\hat{\rho}(S_A, \Theta, p)$

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 entropy, CT and pt

gsw_CT_first_derivatives	first derivatives of Conservative Temperature
gsw_CT_second_derivatives	second derivatives of Conservative Temperature
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

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

gsw_rho_CT_exact	in-situ density and potential density
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 and saline contraction coefficients
gsw_alpha_on_beta_CT_exact	alpha divided by beta
gsw_rho_first_derivatives_CT_exact	first derivatives of density
gsw_specvol_CT_exact	specific volume
gsw_specvol_anom_CT_exact	specific volume anomaly
gsw_sigma0_CT_exact	sigma0 with reference pressure of 0 dbar
gsw_sigma1_CT_exact	sigma1 with reference pressure of 1000 dbar
gsw_sigma2_CT_exact	sigma2 with reference pressure of 2000 dbar
gsw_sigma3_CT_exact	sigma3 with reference pressure of 3000 dbar
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gsw_sound_speed_CT_exact	sound speed
gsw_kappa_CT_exact	isentropic compressibility
gsw_cabbeling_CT_exact	cabbeling coefficient
gsw_thermobaric_CT_exact	thermobaric coefficient
gsw_SA_from_rho_CT_exact	Absolute Salinity from density
gsw_CT_from_rho_exact	Conservative Temperature from density
gsw_CT_maxdensity_exact	Conservative Temperature of maximum density of seawater
gsw_internal_energy_CT_exact	internal energy
gsw_enthalpy_CT_exact	enthalpy
gsw_enthalpy_diff_CT_exact	difference of enthalpy between two pressures
gsw_dynamic_enthalpy_CT_exact	dynamic enthalpy
gsw_enthalpy_first_derivatives_CT_exact	first derivatives of enthalpy
gsw_enthalpy_second_derivatives_CT_exact	second derivatives of enthalpy

laboratory functions, for use with densimeter measurements

gsw_SA_from_rho_t_exact	Absolute Salinity from density
gsw_deltaSA_from_rho_t_exact	Absolute Salinity Anomaly from density
gsw_rho_t_exact	in-situ density

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

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