Notes on the function gsw_CT_from_rho_exact(rho,SA,p)

Notes written 16th April 2011

This function, **gsw_CT_from_rho_exact**(rho,SA,p) calculates the Conservative Temperature corresponding to the input values of *in situ* density, rho, Absolute Salinity, SA, and pressure, p. The function returns NaNs if

(i) the input density is too small (which would require the *in situ* temperature to exceed 40 °C), if

(ii) the input density exceeds the density at the temperature of maximum density, or if

(iii) the temperature is less than the freezing temperature.

This function uses the full TEOS-10 Gibbs function $g(S_A, t, p)$ of IOC *et al*. (2010), being the sum of the IAPWS-09 and IAPWS-08 Gibbs functions.

This function is essentially the following three calls to two other GSW functions.

```
[t,t_multiple] = gsw_t_from_rho_exact(rho,SA,p);

CT = gsw_CT_from_t(SA,t,p);

CT_multiple = gsw_CT_from_t(SA,t_multiple,p);
```

The function **gsw_CT_from_rho_exact**(rho,SA,p) is called as

```
[CT,CT_multiple] = gsw_CT_from_rho_exact(rho,SA,p)
```

and if there is a valid second solution, it is returned as CT_multiple. When there is only one solution, CT_multiple is a Nan. When there are no solutions, both CT and CT_multiple are Nans.

References

IAPWS, 2008: Release on the IAPWS Formulation 2008 for the Thermodynamic Properties of Seawater. The International Association for the Properties of Water and Steam. Berlin, Germany, September 2008, available from www.iapws.org. This Release is referred to in the text as **IAPWS-08**.

IAPWS, 2009: Supplementary Release on a Computationally Efficient Thermodynamic Formulation for Liquid Water for Oceanographic Use. The International Association for the Properties of Water and Steam. Doorwerth, The Netherlands, September 2009, available from http://www.iapws.org. This Release is referred to in the text as **IAPWS-09**.

IOC, SCOR and IAPSO, 2010: *The international thermodynamic equation of seawater – 2010: Calculation and use of thermodynamic properties*. Intergovernmental Oceanographic Commission, Manuals and Guides No. 56, UNESCO (English), 196 pp. Available from http://www.TEOS-10.org