

## Notes on the function gsw\_beta(SA,CT,p)

This function, **gsw\_beta**(SA,CT,p), evaluates the saline contraction coefficient with respect to Absolute Salinity at constant Conservative Temperature from the 75-term polynomial function expression for specific volume **gsw\_specvol** (SA,CT,p). This 75-term polynomial expression for specific volume is discussed in Roquet *et al.* (2015) and in appendix A.30 and appendix K of the TEOS-10 Manual (IOC *et al.* (2010)).

The saline contraction coefficient  $\beta^\ominus$  is defined as

$$\beta^\ominus = \frac{1}{\rho} \left. \frac{\partial \rho}{\partial S_A} \right|_{\Theta, p}, \quad (1)$$

and when evaluated from the 75-term computationally-efficient expression for specific volume. In terms of the evaluation of density gradients, the haline contraction coefficient evaluated from Eqn. (K.3) is many times more accurate than the thermal expansion coefficient. Compared with the mean value of  $\beta^\ominus$ , this error is small compared with the ratio of the uncertainty in the thermal expansion coefficient to its mean value, and so the error in  $\beta^\ominus$  is negligible. Hence we may take the saline contraction coefficient  $\beta^\ominus$  evaluated from **gsw\_beta**(SA,CT,p) as essentially reflecting the full accuracy of TEOS-10. Exact values of  $\beta^\ominus$  may be evaluated using **gsw\_beta\_CT\_exact**(SA,CT,p).

Further comments on the 75-term computationally-efficient expression for specific volume may be found in the Help file of **gsw\_specvol**(SA,CT,p).

### References

- 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>
- Roquet, F., G. Madec, T. J. McDougall and P. M. Barker, 2015: Accurate polynomial expressions for the density and specific volume of seawater using the TEOS-10 standard. *Ocean Modelling*, 90, pp. 29-43. <http://dx.doi.org/10.1016/j.ocemod.2015.04.002>