2.20 Isobaric heat capacity

The specific isobaric heat capacity \( c_p \) is the rate of change of specific enthalpy with temperature at constant Absolute Salinity \( S_A \) and pressure \( p \), so that

\[
c_p = c_p(S_A, T, p) = \frac{\partial h}{\partial T}_{S_A, p} = -(T_0 + t)g_{TT}.
\]  

(2.20.1)

The isobaric heat capacity \( c_p \) varies over the \( S_A - \Theta \) plane at \( p = 0 \) by approximately 5\%, as illustrated in Figure 4.

![Figure 4. Contours of isobaric specific heat capacity \( c_p \) of seawater (in J kg\(^{-1}\) K\(^{-1}\)), Eqn. (2.20.1), at \( p = 0 \).](image)

The isobaric heat capacity \( c_p \) has units of J kg\(^{-1}\) K\(^{-1}\) in both the SIA and GSW computer software libraries.

2.21 Isochoric heat capacity

The specific isochoric heat capacity \( c_v \) is the rate of change of specific internal energy \( u \) with temperature at constant Absolute Salinity \( S_A \) and specific volume, \( v \), so that

\[
c_v = c_v(S_A, T, p) = \frac{\partial u}{\partial T}_{S_A, v} = -(T_0 + t)\left(g_{TT}g_{PP} - g_{TT}^2\right)g_{PP}.
\]  

(2.21.1)

Note that the isochoric and isobaric heat capacities are related by

\[
c_v = c_p - \frac{(T_0 + t)(\alpha')^2}{\rho K'}, \quad \text{and by} \quad c_v = c_p \frac{K}{\rho K'}.
\]  

(2.21.2)

The isochoric heat capacity \( c_v \) has units of J kg\(^{-1}\) K\(^{-1}\) in both the SIA and GSW computer software libraries.