Section 3.5.5 Corrections shown in red:

“As described above, the equation of state (3.6) is somewhat nonlinear in temperature, salinity and pressure. That is, the equation of state (EOS 80) includes products of salinity, temperature and pressure. Sometimes, for practical purposes, in theoretical and simple numerical models the equation of state is approximated as linear and its pressure dependence is ignored:

\[
\rho = \rho_0 + \alpha \rho (T-T_0) + \beta \rho (S-S_0); \tag{3.9}
\]
\[
\alpha = \frac{1}{\rho} \frac{\partial \rho}{\partial T} \quad \text{and} \quad \beta = \frac{1}{\rho} \frac{\partial \rho}{\partial S}
\]

where \(\rho_0\), \(T_0\) and \(S_0\) are arbitrary constant values of \(\rho\), \(T\) and \(S\); they are usually chosen as the mean values for the region being modeled. Here \(\alpha\) is the thermal expansion coefficient, which expresses the change in density for a given change in temperature (and should not be confused with specific volume, defined with the same symbol in section 3.5.3) and \(\beta\) is the haline contraction coefficient, also called the saline contraction coefficient, which is the change in density for a given change in salinity. The terms \(\alpha\) and \(\beta\) are nonlinear functions of salinity, temperature and pressure; their mean values are chosen for linear models. Full tables of values are given in UNESCO (1987). The value of \(\alpha\) (at the sea surface and at a salinity of 35 g kg\(^{-1}\)) ranges from 53 \(x\) \(10^{-6}\) K\(^{-1}\) at a temperature of 0°C to 257 \(x\) \(10^{-6}\) K\(^{-1}\) at a temperature of 20°C. The value of \(\beta\) (at the sea surface and at a salinity of 35 g kg\(^{-1}\)) ranges from 785 \(x\) \(10^{-6}\) kg g\(^{-1}\) (at a temperature of 0°C) to 744 \(x\) \(10^{-6}\) kg g\(^{-1}\) (at a temperature of 20°C).”