Notes on the function [SA_final, CT_final, w_Ih_final] = gsw_melting_ice_into_seawater(SA, CT, p, w_Ih, t_Ih)

This function, **gsw_melting_ice_into_seawater**(SA, CT, p, w_Ih, t_Ih), evaluates the final interstitial seawater Absolute Salinity, interstitial seawater Conservative Temperature, and the final ice mass fraction of the seawater and frazil mixture that exists at the equilibrium freezing temperature for given input values of the input variables which are the properties $\left(S_A, \Theta, p\right)$ of seawater (not at the freezing temperature), the mass fraction of ice w_Ih that is added to the seawater, and the temperature of the ice, t_Ih. Neither the seawater nor the ice that is brought into thermodynamic equilibrium by this code need be at the freezing temperature. The seawater may be warmer than the freezing temperature and the initial temperature of the ice may be cooler than the freezing temperature.

The code is essentially three lines, copied below. The code works by first calculating the bulk Absolute Salinity, SA_bulk, and the bulk enthalpy, h_bulk (these are calculated in the first two lines of the code reproduced below). The third (and last) line of the code copied here called the GSW function `gsw_frazil_properties(SA_bulk,h_bulk,p)` to find the three outputs `SA_final, CT_final, w_Ih_final`.

```
SA_bulk = (1 - w_Ih).*SA;
h_bulk = (1 - w_Ih).*gsw_enthalpy_CT_exact(SA,CT,p) + w_Ih.*gsw_enthalpy_ice(t_Ih,p);
[SA_final, CT_final, w_Ih_final] = gsw_frazil_properties(SA_bulk,h_bulk,p);
```

The total enthalpy per unit mass of the ice-seawater mixture at any stage is the weighted sum of the specific enthalpies of the two phases, called the "bulk enthalpy", h_bulk, defined by

$$h^B \equiv \left(1 - w^{Ih}\right) h \; + \; w^{Ih} h^{Ih}, \tag{1}$$

while the "bulk salinity", that is, the "Absolute Salinity of the mixture", SA_bulk, is defined by

$$S_A^B \equiv \left(1 - w^{Ih}\right) S_A. \tag{2}$$

When the output ice mass fraction w_Ih_final is zero, the final state is pure seawater that is warmer than the freezing temperature and which contains no frazil ice component.