

International Temperature Scales of 1948, 1968 and 1990

The Practical Salinity Scale 1978 (PSS-78) and the 1980 International Equation of State of Seawater (EOS-80) are based on measurements which are in turn based on the International Practical Temperature Scale 1968 (IPTS-68) (Barber, 1969).

The International Committee for Weights and Measures adopted a new International Temperature Scale (ITS-90) during its meetings in September 1989. This temperature scale should be used for all reported oceanographic data as of January 1990. It is of great importance that all data reports indicate specifically whether data are reported on the older International Practical Temperature Scales of 1948 or 1968 (IPTS-48, IPTS-68) or on the ITS-90 scale. The introduction of this new temperature scale has significant effects on the calculation of seawater properties of seawater based on the International Equation of State of Seawater (EOS-80) (Unesco, 1981a, 1981b).

The Joint Panel on Oceanographic Tables and Standards (JPOTS) supports the recommendation of Saunders (1990) with regard to the conversions of ITS-90 to IPTS-68 through the linear relationship:

$$t_{68} = 1.00024 * t_{90}$$

Temperatures t_{48} based on a previous temperature scale (IPTS-48), can be converted to IPTS-68 (Fofonoff and Bryden, 1975) using the formula:

$$t_{68} = t_{48} - 4.4 \times 10^{-6} * t_{48} (100 - t_{48})$$

(where t_{48} and t_{68} represent the temperature (°C) on the 1948 and 1968 scales respectively.)

The use of temperature scales previous to IPTS-48 has not been documented and therefore the conversion cannot be certain.

After conversion to t_{68} the algorithms for the computation of practical salinity (PSS-78), the density of seawater, and its derived properties (EOS-80) can be used directly, as can the algorithms developed by Fofonoff and Millard (Unesco, 1983) for the computation of seawater properties.

Of importance to note are the following:

1. Temperature differences between IPTS-68 and ITS-90 (Saunders, 1990):

$t_{90}/^{\circ}\text{C}$	-10	0	10	20	30	40
$(t_{90} - t_{68})/^{\circ}\text{C}$	0.002	0.000	-0.002	-0.005	-0.007	-0.010

2. The conversion from t_{48} to t_{68} is valid in the range -2°C to 30°C , which gives the maximal difference in temperatures of 0.009°C . This difference leads to an uncertainty of 0.003 kg/m^3 in density, at 30°C .

3. Failure to make corrections to IPTS-68 prior to the use of the algorithms will significantly affect salinity values derived from CTDs (valid only for correction from ITS-90 as CTDs were uncommon prior to 1968). It will have a lesser effect on estimated densities (mostly noticeable at higher temperatures), but will have only insignificant effects on other properties, e.g. compressibilities, adiabatic lapse rates, and potential temperatures. (See also Fofonoff and Millard, 1991). After conversions of IPTS-90 to IPTS-68 the errors in all computations become minimal and within the precision of PSS-78 and EOS-80.

References

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