

A new analysis on fall-rate coefficients in historical XBT data based on side-by-side comparisons

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We collect a data-base of over 5000 side-by-side deployments of XBTs and Conductivity-Temperature-Depth (CTD) sensor data used to estimate depth biases and thermal biases in historical XBT data from the 1970's to the present based on the method of Cheng et al. 2011. The large number of assembled pairs allows small biases to be detected in the face of considerable drop-to-drop noise. The time evolution of the fall-rate coefficients are diagnosed and a consistently warm pure temperature bias is found in all instruments and probe types examined. Besides, two correlations of A/B and A/Offset are found ($\text{depth} = At - Bt^2 - \text{Offset}$), showing the possible causes of recording system and wire. The differences between TSK and Sippican are also carefully analysed, introducing a new insight to the XBT biases. The analyses of fall-rate coefficients improve our understanding on the physics of the probe falling in the water.