The U.S. Navy's Global Ocean Temperature and Salinity Climatology

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The U.S. Navy has maintained a monthly, global ocean temperature and salinity climatology for more than a decade. Traditionally, ocean climatologies have low resolution with unrealistically shallow mixed layers and smoothed vertical gradients. To improve upon these shortcomings, the Naval Research Laboratory has revised the Generalized Digital Environmental Model (GDEM). The latest version has monthly temperature and salinity values at 78 depth levels to 6600 m on a global ¼° regular grid. Using all available *in situ* profile observations of temperature and salinity, the climatology is constructed using a two step least-squares minimization technique that is designed in particular to preserves the observed vertical gradients. Observations consist of all available historical ocean temperature and salinity profiles. Salinity data comes primarily from CTDs and Argo profiling floats. The data quality control procedures include substantial manual editing with the use of a computer program that includes a graphical user interface. Profiles are viewed in 10° by 10° regions to identify outliers. As a result of manual editing, the exclusion of mechanical bathy thermographs (MBTs), and other quality control checks, 47% of all available profiles were removed leaving 4.4 million temperature and 1.9 million salinity profiles to be used for GDEM. Of those, 1.7 million are XBTs, either airplane or ship deployed. The climatology is constructed by first gridding data horizontally at every depth level, minimizing the analysis squared slope and data misfit. Next, a correction is applied that minimizes the difference between the analysis and observed vertical gradients. The vertical gradient correction is particularly important in regions of sampling irregularities such as near the coast or regions of sloping bathymetry. For example, when there are more deep observations offshore where the water is cooler, an artificial vertical gradient can result from depth independent gridding techniques. The vertical gradient correction eliminates artificial gradients while preserving strong gradients where they actually occur, such as below the ocean mixed layer. The addition of the vertical gradient correction reduces the global mixed layer depth shallow bias. More accurate vertical gradients are particularly important for acoustic applications.