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The impact of non-parametric statistics and data binning on error analyses of an assimilative ocean prediction system

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The impact of non-parametric statistics and data binning on error analyses is evaluated using two components of the U.S. Navy's operational global ocean forecast system. The Naval Research Laboratory (NRL) Layered Ocean Model (NLOM) dynamically interpolates along-track altimeter observations to produce a time-series of high-resolution (eddy-resolving) sea surface height anomaly (SSHA). The NLOM SSHA is combined with separate sea surface temperature analyses in the Modular Ocean Data Assimilation System (MODAS), which projects the surface information into global synthetic profiles of temperature and salinity. The NLOM SSHA fields and the synthetic profiles are evaluated relative to independently observed ocean temperature and salinity profiles for 2001 through 2003. Comparisons are done point-for-point and for regions that are binned and linearly fit over two month periods. Statistical evaluations are done with traditional parametric statistics and also with robust non-parametric statistics, producing a set of four error assessments. Data outliers, which violate the Gaussian data distribution that is assumed for traditional statistics, artificially inflate the error estimates when computed using traditional statistics. Representation errors, which are likely mitigated with the data-binning procedure, artificially inflate the error estimates when using the point-for-point comparison framework. The impact of the statistical methods is larger than the comparison frameworks. The findings show the efficacy of non-parametric statistical and data-binning methods when evaluating oceanographic forecasts.