Refractivity Data Fusion

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A hybrid method for fusing refractivity information derived from electromagnetic sensors with background fields from a numerical weather prediction (NWP) model is described. Refractivity defined in Cartesian coordinates is mapped into a space of "diagnostic" parameters that coincide with those that have been used in inversion algorithms such as refractivity-from-clutter. These correspond to parameter surfaces over the domain of the NWP model. A 2DVAR is performed in the diagnostic space.

The method is developed using data from the Wallops 2000 Microwave Propagation Measurement Experiment. The Coupled Ocean/Atmospheric Mesoscale Prediction System (COAMPS) Ensemble Kalman Filter is used to generate 32-member ensembles for a 4-day period with a variety of ducting conditions. Parameters diagnosed from the ensembles are used to calibrate an elliptical Gaussian decay model from which time-and-space invariant background covariance is calculated. Radar data from the Space Range Radar (SPANDAR) is used as input to a refractivity-from-clutter (RFC) algorithm to provide posterior probability densities for the diagnostic parameters. The variant of RFC has been climatologically tuned to the Wallops environment.

The resulting analysis is then mapped into Cartesian coordinates. Metrics and qualitative comparisons are used to evaluate the goodness of the data fused output vis-a'-vis COAMPS and RFC. The results are compared to both *in situ* meteorology and with *in situ* propagation loss determined using NSWD-DD's Microwave Propagation Measurement System (MPMS).