MMM SEMINAR SERIES

An optimal linear transformation for data assimilation

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Linear transformations are widely used in data assimilation for covariance modeling, for reducing dimensionality (such as averaging dense observations to form ``superobs''), and for managing sampling error in ensemble techniques. I will discuss a linear transformation that is optimal for data assimilation in the sense that, in the transformed coordinates, the state variables and observations have uncorrelated errors, and a diagonal gain matrix in the update step. In those coordinates, the update step is completely determined by scalars, termed canonical observation operators (COOs), that relate pairs of transformed observations and state variables and rank-order those pairs by their influence in the update. I'll provide numerical evidence for the conjecture that the transformation provides an optimal approach to covariance localization for ensemble filters, and discuss in detail the update step in the transformed coordinates. This shows how the COOs completely determine important properties of the update step, such as observation-state mutual information, signal-to-noise and degrees of freedom for signal, and so give new insights, including relations among reduced-rank approximations to variational schemes, particle-filter weight degeneracy, and the local ensemble transform Kalman filter.

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For Zoom information, please contact
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Seminar will also be live webcast
https://operations.ucar.edu/live-mmm