Boulder Fluid and Thermal Sciences Seminar Series

Tuesday, November 13, 2018
3:30pm-4:30pm (refreshments at 3:15pm)
Mechanical Engineering Conference Rooms in the Engineering Center
University of Colorado, Boulder

Developing Scale-Aware Algorithms for the Ensemble Filtering of Geophysical Flows

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Geophysical flows typically contain multiple scales of motion. The larger scales tend to have slower and more linear error growth than the smaller scales. With smaller scales being resolved in numerical models as computational resources increase, their nonlinear behavior poses a challenge to linear ensemble filters. In this seminar, I will discuss several issues that occur when applying an ensemble filter to a multiscale dynamical system and explores potential remedies. The sensitivity of the best Gaspari-Cohn (GC) localization radius to changes in model resolution, ensemble size and observing networks is systematically evaluated with assimilation experiments using a two-layer quasi-geostrophic (QG) model. Results demonstrate the scale dependency of the best localization radius for the QG flow. The best localization radius is sensitive to the underlying physical correlation length scale but is much less sensitive to model resolution as long as the key physical process is well represented by a truncated model. The GC localization is problematic when dealing with nonlocal cross-variable correlations, which motivates the use of localization functions that respect the dynamic relations between variables. The impact of varying observing network density on the best choice of localization is also discussed.

Biography: Dr. Michael Ying is a Postdoctoral Fellow in the Advanced Study Program at National Center for Atmospheric Research. He received his BS in atmospheric sciences in 2009 and MS in meteorology in 2012 from Peking University, China, and his PhD in meteorology from Penn State University this May. His research interest is in multiscale dynamical systems, to study their predictability and develop adaptive data assimilation algorithms to improve their prediction skill.