Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Balanced and Unbalanced Components of Atmospheric Flows with Phase Changes of Water[1] LESLIE SMITH, UW-Madison — Atmospheric variables (temperature, velocity, etc.) are often decomposed into balanced and unbalanced components that represent low-frequency and high-frequency waves, respectively. Such decompositions can be defined, for instance, in terms of eigenmodes of a linear operator. Traditionally these decompositions do not account for phase changes of water since the latter create a piecewise-linear operator that differs in different phases (cloudy versus non-cloudy). Here we demonstrate how a balanced–unbalanced decomposition can be performed in the presence of phase changes, by including a slow thermodynamic variable involving total water in addition to a slow potential vorticity variable, which are both associated with the nullspace of the linear operator with phase changes. Evolution of the fast and slow components of water is illustrated in simulations of moist Boussinesq dynamics, as well an in a turbulent steady-state of the idealized Weather Research Forecasting (WRF) model.

[1]NSF AGS 1443325

Leslie Smith
UW-Madison

Date submitted: 30 Jul 2019 Electronic form version 1.4