

EGU22-8869

<https://doi.org/10.5194/egusphere-egu22-8869>

EGU General Assembly 2022

© Author(s) 2022. This work is distributed under the Creative Commons Attribution 4.0 License.



## Ensemble Kalman Filter based Data Assimilation for Tropical Waves in the MJO Skeleton Model

Tabea Gleiter<sup>1</sup>, Tijana Janjic<sup>1</sup>, and Nan Chen<sup>2</sup>

<sup>1</sup>Ludwig Maximilians University Munich, Munich, Germany (tijana.pfander@lmu.de)

<sup>2</sup>University of Wisconsin-Madison, Madison, Wisconsin, USA

The Madden-Julian oscillation (MJO) is the dominant component of tropical intraseasonal variability with wide reaching impacts even on extratropical weather and climate patterns. However, predicting the MJO is challenging. One reason are suboptimal state estimates obtained with standard data assimilation (DA) approaches. Those are typically based on filtering methods with Gaussian approximations and do not consider physical properties that are specifically important for the MJO.

In our recent paper (Gleiter et al. 2022), a constrained ensemble DA method is applied to study the impact of different physical constraints on the state estimation and prediction of the MJO with the Skeleton model. The utilized quadratic programming ensemble (QPEnS) algorithm extends the standard stochastic ensemble Kalman filter (EnKF) with specifiable constraints on the updates of all ensemble members. This allows to recover physically more consistent states and to respect possible associated non-Gaussian statistics. Our results demonstrate an overall improvement in the filtering and forecast skill when the model's total energy is conserved in the initial condition. The degree of benefit is found to be dependent on the observational setup and the strength of the model's nonlinear dynamics. It is also shown that even in cases where the statistical error in some waves remains comparable to the stochastic EnKF during the DA stage, their prediction is remarkably improved when using the initial state resulting from the QPEnS.

**Gleiter, T., T. Janjic, N. Chen, 2022, Ensemble Kalman Filter based Data Assimilation for Tropical Waves in the MJO Skeleton Model, QJR Meteorol Soc., <https://doi.org/10.1002/qj.4245>**