Model Parameter Estimation with Data Assimilation using NICAM-LETKF

Shunji Kotsuki[1], Yousuke Sato[2], Koji Terasaki[1], Hisashi Yashiro[1], Hirofumi Tomita[1], Masaki Satoh[3,4], and Takemasa Miyoshi[1,4,5]

1. RIKEN Center for Computational Science, Japan
2. Graduate School of Engineering, Nagoya University, Japan
3. Atmosphere and Ocean Research Institute, the University of Tokyo, Japan
4. Japan Agency for Marine-Earth Science and Technology, Japan
5. Department of Atmospheric and Oceanic Science, University of Maryland, U. S.

Email: shunji.kotsuki@riken.jp

Abstract

This study aims to improve forecasts of numerical weather prediction (NWP) models by optimizing model parameters with data assimilation. Kotsuki et al. (2018a, JGR) succeeded in improving global precipitation forecasts at 112-km-resolution NICAM (Nonhydrostatic ICosahedral Atmospheric Model) by estimating a parameter called B1 of Berry (1967)'s large-scale condensation scheme using satellite-observed precipitation data and the Local Ensemble Transform Kalman Filter (LETKF).

Extending the previous study, this study explores to improve the forecasts further using other satellite observations. This study estimates the parameter B1 as a global-constant parameter with cloud liquid water (CLW) data observed by GCOM-W/AMSR2. The parameter estimation successfully reduces excessive bias in CLW (Figs. 1 a, b, d) although precipitation forecasts are degraded. In addition, this study extends to estimate spatial distributions of the B1 parameter. The spatially-varying B1 parameter shows the best agreement to the spatial pattern of observed LWP (Figs. 1 c, d). This presentation will include the most recent progress up to the time of the workshop.

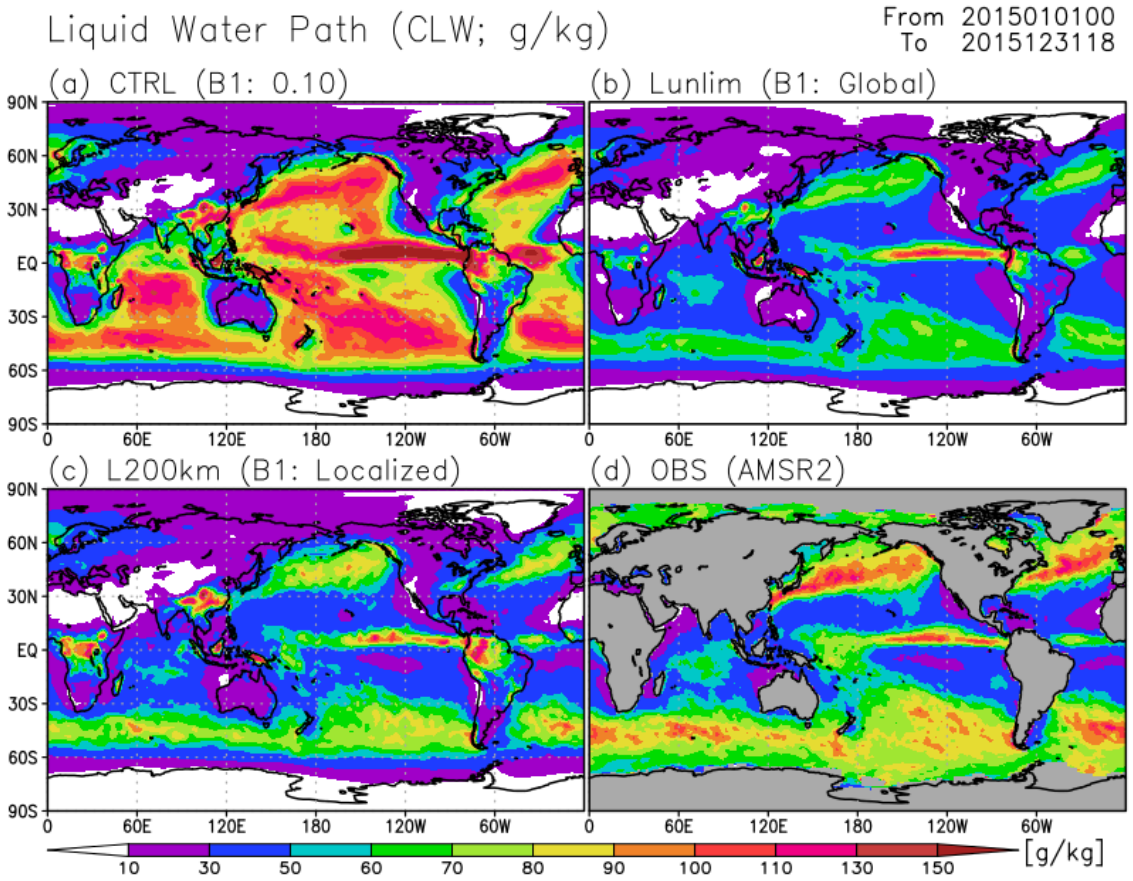

Fig. 1 Global patterns of the time-mean liquid water path (LWP; g kg-1) for (a) control experiment without parameter estimation, (b) parameter estimation as a global-constant parameter, (c) parameter estimation as spatially-varying parameter, and (d) GCOM-W/AMSR2 observation, averaged over 12 months from January to December 2015. According to Kotsuki et al. (2018b)

References:

Kotsuki, S., K. Terasaki, H. Yashiro, H. Tomita, M. Satoh, and T. Miyoshi (2018a): Online Model Parameter Estimation with Ensemble Data Assimilation in the Real Global Atmosphere: A Case with the Nonhydrostatic Icosahedral Atmospheric Model (NICAM) and the Global Satellite Mapping of Precipitation Data. *J. Geophys. Res.* 123, 7375-7392.

Kotsuki, S., Y. Sato, and T. Miyoshi (2018b): Localizing parameterization with data assimilation: A case with Berry's large scale condensation scheme. (in preparation)