Experimental Settings

KIAPS 3DVAR System

- Background (6 hour forecast)
  - KIM: KIAPS Integrated Model
  - Cubed-sphere grid based on the spectral element method for horizontal spatial discretization
  - Horizontal resolution: ne120np4 (~ 25 km), Vertical resolution: 50 levels (top = 0.3 hPa)
  - Data assimilation
  - 3DVAR (Horizontal resolution: ne60np4 (~50 km))
  - Background Error covariance: Nonlinear balance equation approach (ECMWF, KIAPS)\
    \[ \n    \n    \begin{align*}
    \frac{\partial^2 M_{\text{B}}}{\partial t} &= \nabla \left( \mu \chi \frac{\partial V_{p}}{\partial p} \right) \\
    M_{\text{B}} &= \Phi_{\text{B}} + \gamma T \ln p_{\text{B}} \\
    \end{align*} \]

- Relatively free from sampling error, consideration of advection terms

Results: Case study “Typhoon: NANGKA”

Conventional observation produces the increasing the background error in the data assimilation. Wind corrections leads the temperature change with respect to circulation direction (Ex: cyclonic circulation: cold core). Mass information corrects the wrong temperature increment.

Summary

The KIAPS 3DVAR system reduces the background error during assimilation process. These experiments show the background error covariance describes the relationship between the wind and mass in typhoon case. Based on the conventional assimilation, adding the wind observation experiment produces the wind and temperature corrections in near the typhoon area. When the mass observation gets together, the wrong temperature correction induced by wind is corrected. Finally, the change of the wind and temperature fields makes typhoon track is more realistic.