

# ECOMIP Update Toward Revealing Vertical Velocity Structures in Deep Convection through EarthCARE-Kilometer-Scale Model Synergy

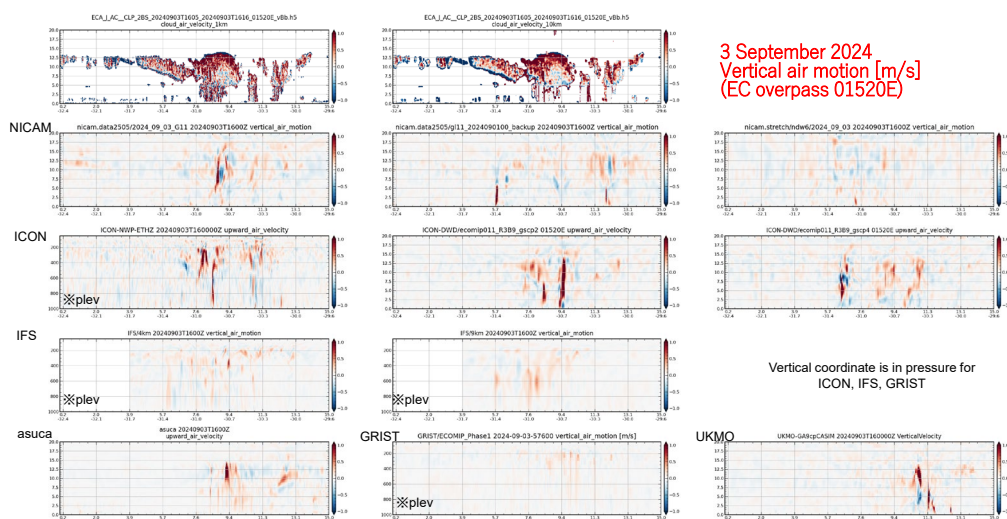
Masaki Satoh<sup>1,2</sup>, Woosub Roh<sup>1</sup>, Shunsuke Aoki<sup>3</sup>, Takuji Kubota<sup>3</sup>

(1: Atmosphere and Ocean Research Institute, The University of Tokyo,  
2: Typhoon Science and Technology Research Center, Yokohama National University,  
3: Earth Observation Research Center, JAXA)

The vertical velocity structure in deep convection remains one of the most uncertain aspects of mesoscale convective systems (MCSs). In numerical models, vertical velocity spectra are not adequately resolved at kilometer-scale (km-scale) resolution, while observational estimates of vertical velocity have been sparse and lack global coverage. The EarthCARE satellite provides the first global observations of vertical velocity through its Cloud Profiling Radar (CPR), which measures radar reflectivity and Doppler velocity worldwide. These unprecedented observations offer a new opportunity to evaluate the dynamical structure of MCSs.

In this study, we analyze EarthCARE CPR observations by comparing them with global and regional kilometer-scale simulations participated in ECOMIP (EarthCARE and ORCESTR Model Intercomparison Project; <https://www.earthcarescience.net/projects/ecomip>). We compare the model outputs with EarthCARE data and other field campaign data. Specifically, we apply the Joint Simulator for Satellite Sensors (J-Sim) and directly compare the simulated signals with the EarthCARE observations.

The figure presents the first multi-model ECOMIP analysis of vertical velocity and compares it with CPR vertical-velocity retrievals. We will then apply J-Sim to all model datasets to enable direct comparison with the CPR signals, and statistically compare them using the CFAD. In my presentation, we introduce the current status and milestones of the ECOMIP project, along with key findings from these analyses.



**Figure:** Cross sections of vertical velocity along the EarthCARE overpass in the tropical Atlantic on 3 Sep. 2024. The top two panels show the EarthCARE retrievals in the 1-km and 10-km averaging modes.