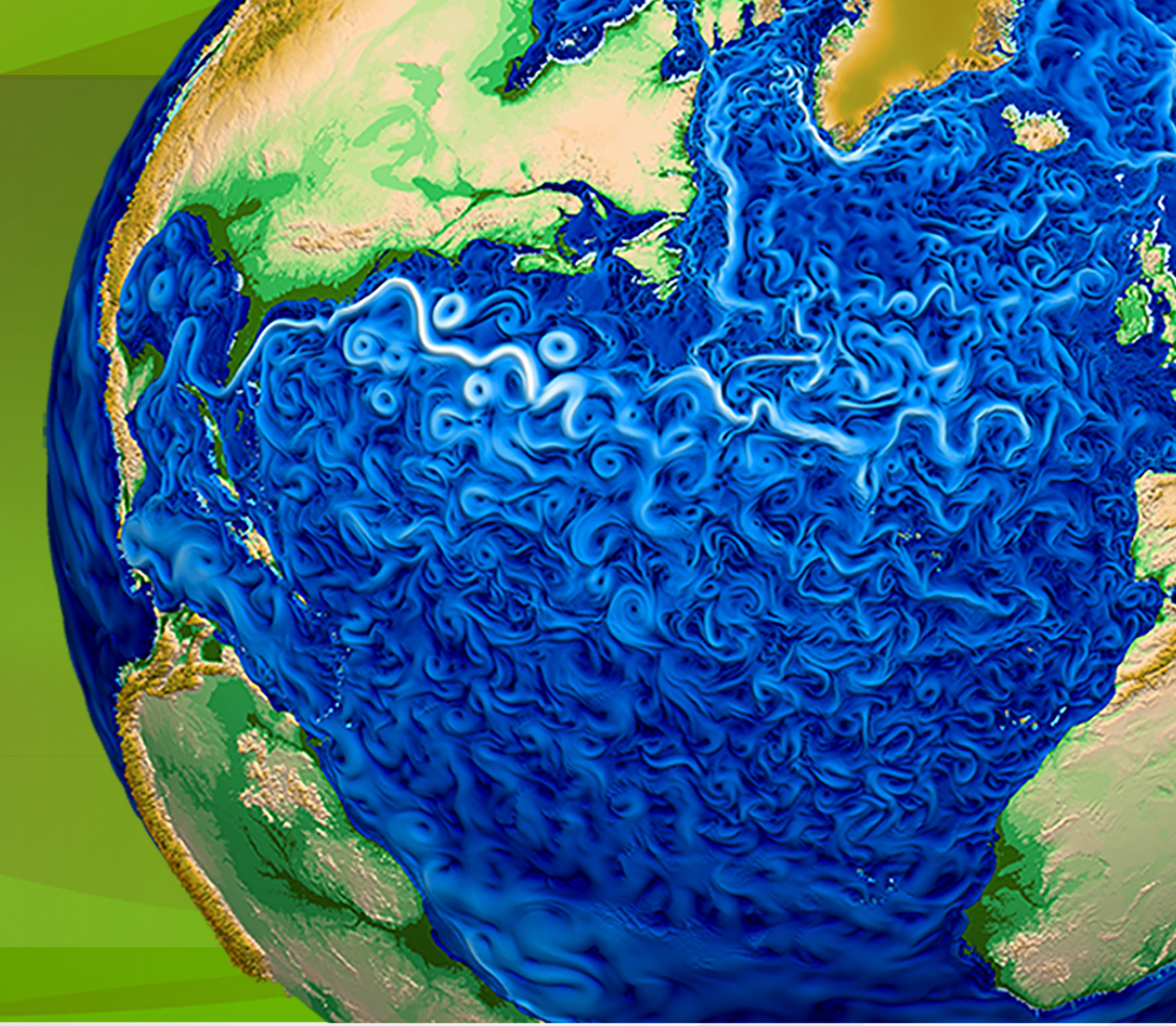# R: Vertical Resolution

## Po-Lun Ma and Philip J. Rasch

Objective

- Design vertical grids suitable for ACME, improving the model simulation with a computationally efficient grid
- Characterize and understand the vertical resolution sensitivity
- Understand the validity of the vertical overlap assumption in the higher vertical resolution model, and Improve the vertical overlap treatment in the model accordingly

Top row: Configurations for the **standard 30-level and two new 64-level** models, for the atmosphere (left), lower troposphere (middle), and near the surface (right).

Middle row: Reduction of **stratocumulus** clouds with increasing vertical resolution

Bottom row: Vertical resolution sensitivity of **tropical and monsoonal precipitation**

Approach

L60: Based on L30, double resolution uniformly

L64: Based on L60, add 4 more layers in PBL

L64b: Based on L64, lower the bottom 2 layers so that the model lowest layer thickness is 20m.

L47: Based on L30, double resolution above 5km

L50: Based on L30, double resolution below 5km

L72: Based on L64b, add 8 more layers above current model top (raise model top to 0.1 hPa)

L120: Based on L60, double resolution uniformly

L240: Based on L240, double resolution uniformly
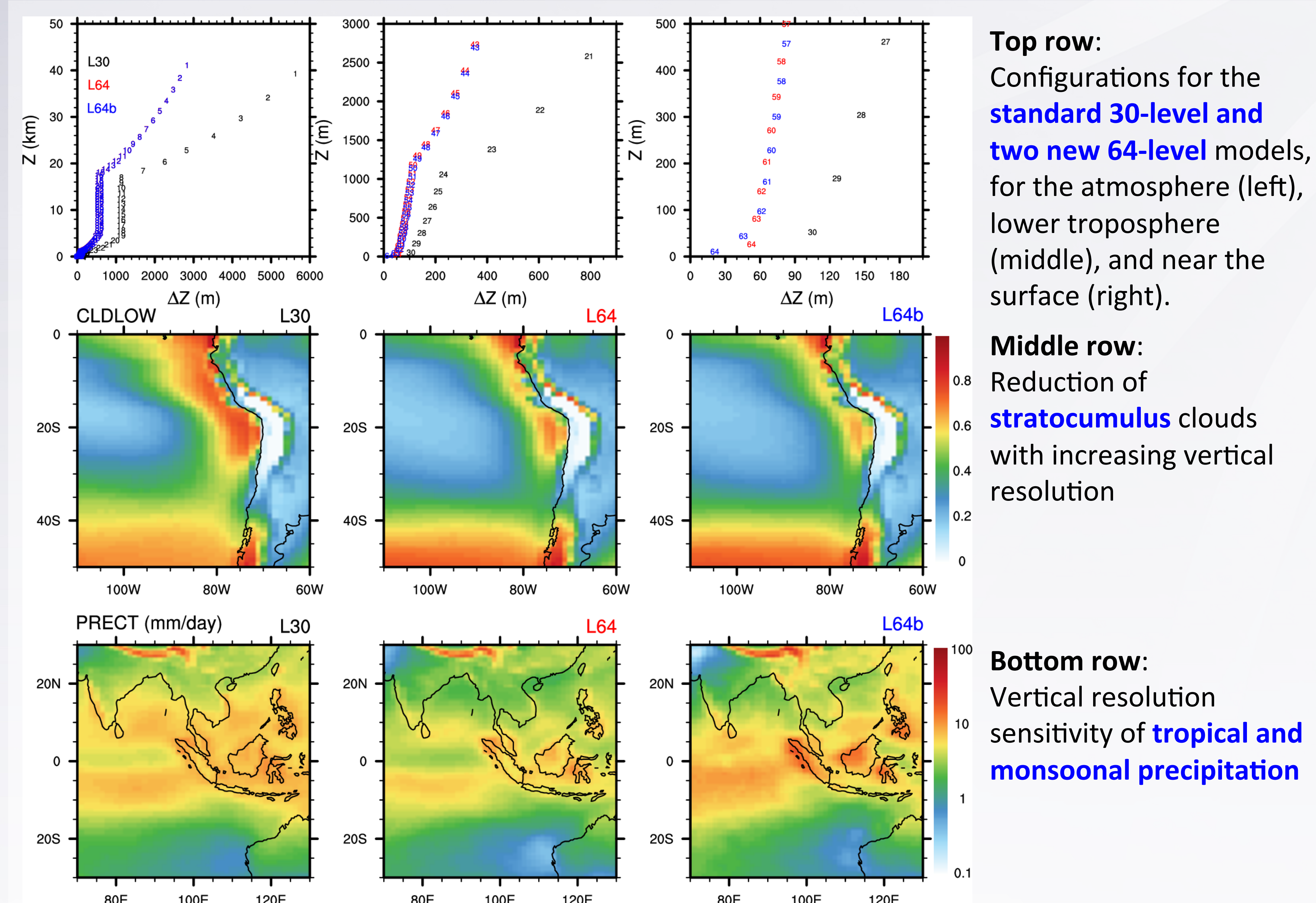
Next Steps

- Systematically test the vertical resolution sensitivity (L47, L50, L72)
- Test the resolution sensitivity with new model physics (e.g., aerosol, cloud, convection) as they become available
- Identify the correlation length scale of clouds, and improve the treatment of cloud vertical overlap assumption in the model
- Use satellite observations to constrain the vertical correlation length scale of clouds

ACME Accelerated Climate Modeling for Energy

Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

U.S. DEPARTMENT OF ENERGY