Progress in the Implementation of IPHOC in VVCM

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Introduction

- Can boundary-layer clouds be simulated in MMF?
- If not, two approaches can be adopted:
1. Coupled LES-CRM-GCM: expensive, but more reliable
2. Parameterized boundary-layer clouds in CRM: cheaper, may be less reliable

but,

Will a coarse-resolution CRM with a sophisticated subgrid-scale pararmeterization perform as well as a fine-resolution CRM?

Intermediately Prognostic Higher-Order Closure Model

- Double-Gaussian distribution of liquid-water potential temperature, total water mixing ratio and vertical velocity

- Skewnesses of these three third-order moments predicted

- All first-, second-, third- and fourth-order moments, subgrid-scale condensation and buoyancy based on the same probability distribution function

- Subgrid-scale bulk microphysics in development: Rain In Cumulus over the Ocean (RICO) case
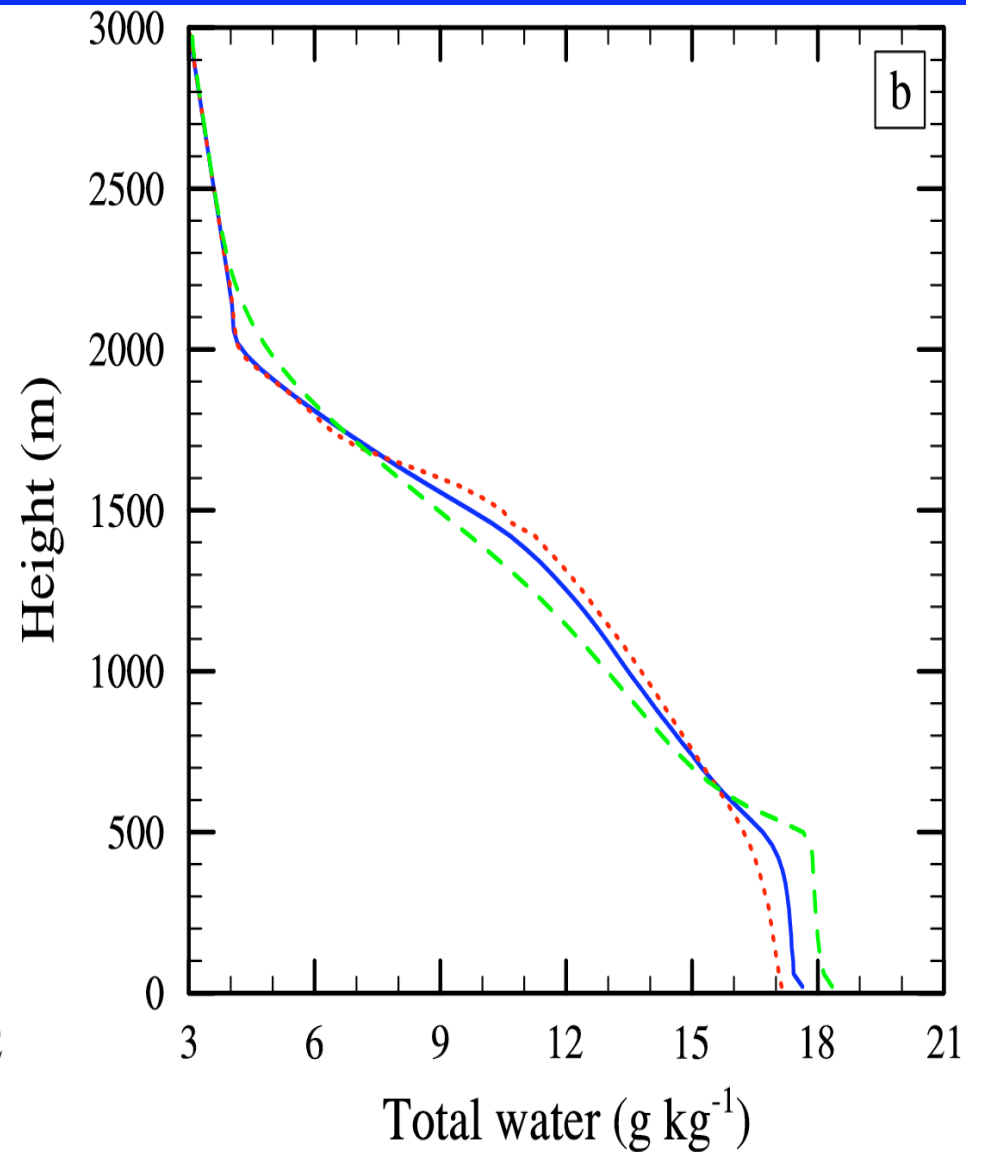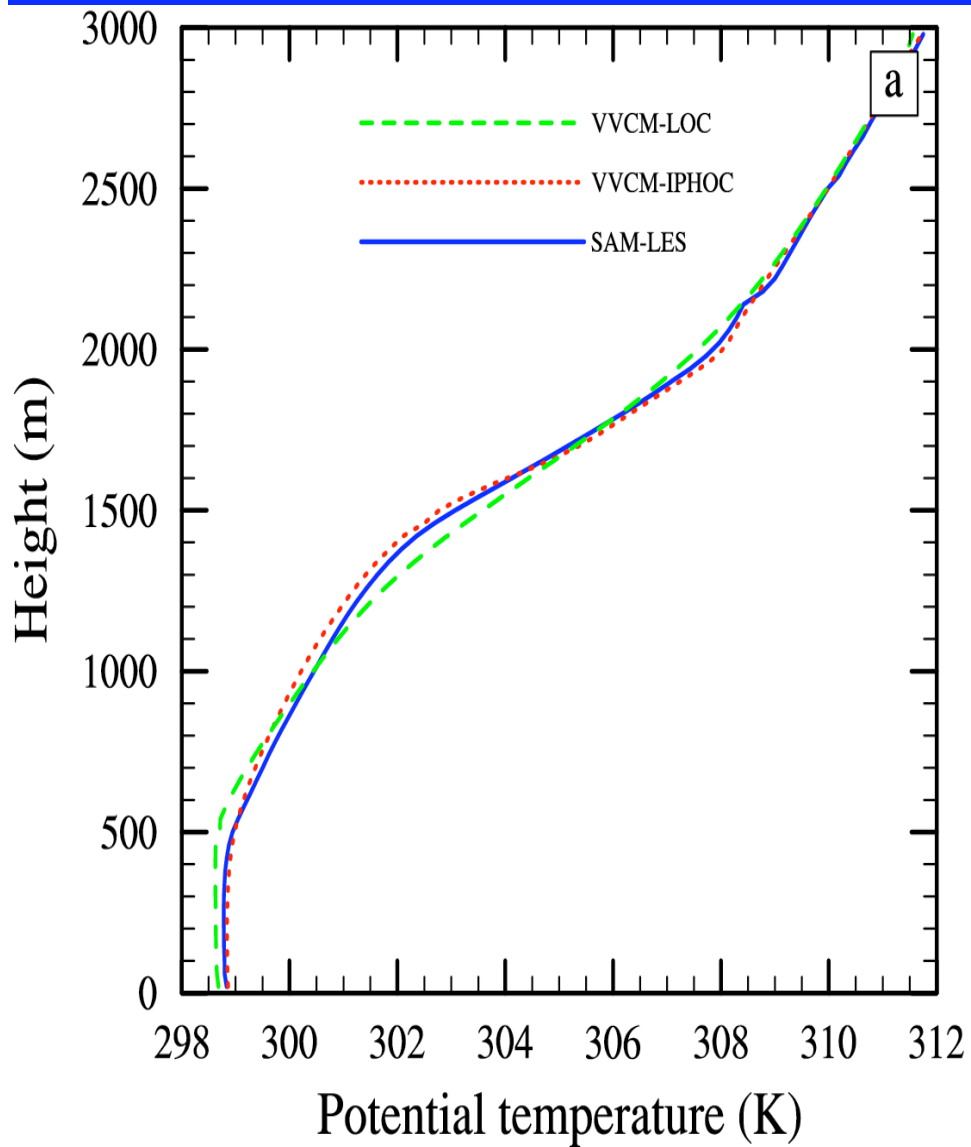
Experiment Design

- Standard initial condition and forcing for GCSS BOMEX case

- Domain: 256 km in horizontal and 3 km in vertical direction

- Resolution: 4km by 40 m

- An LOC and IPHOC made

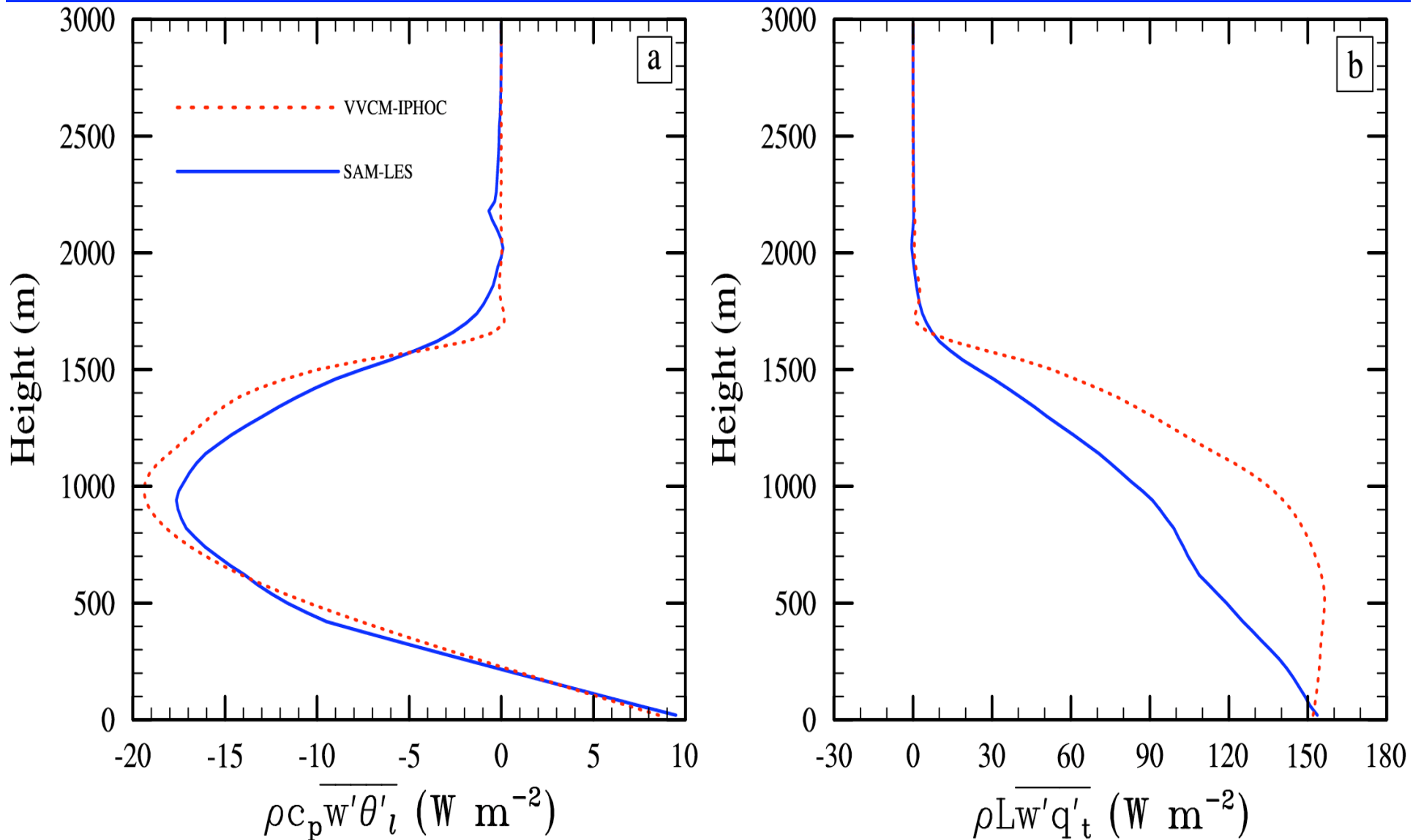- Momentum fluxes from IPHOC not used

Time evolution of cloud field for BOMEX (%)
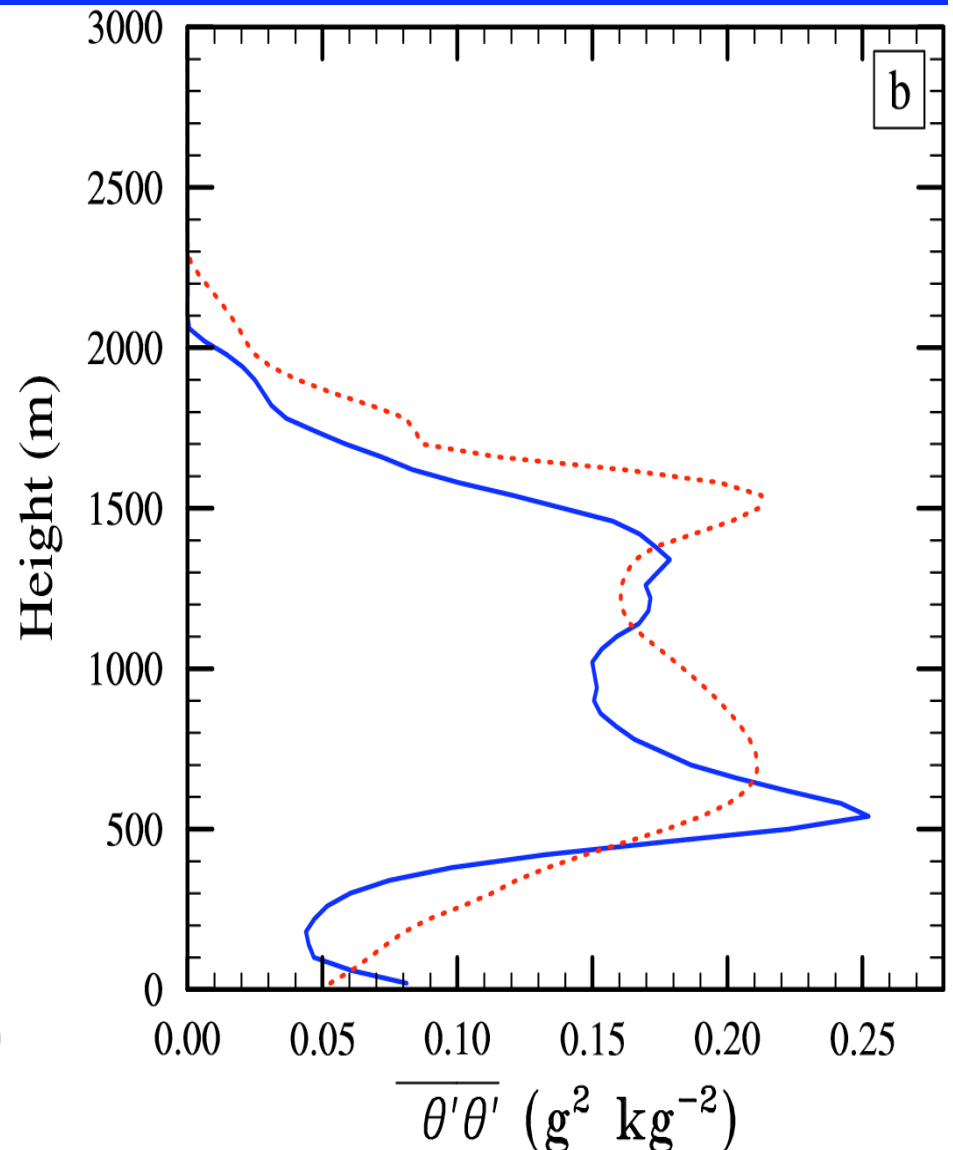
VVCM-IPHOC
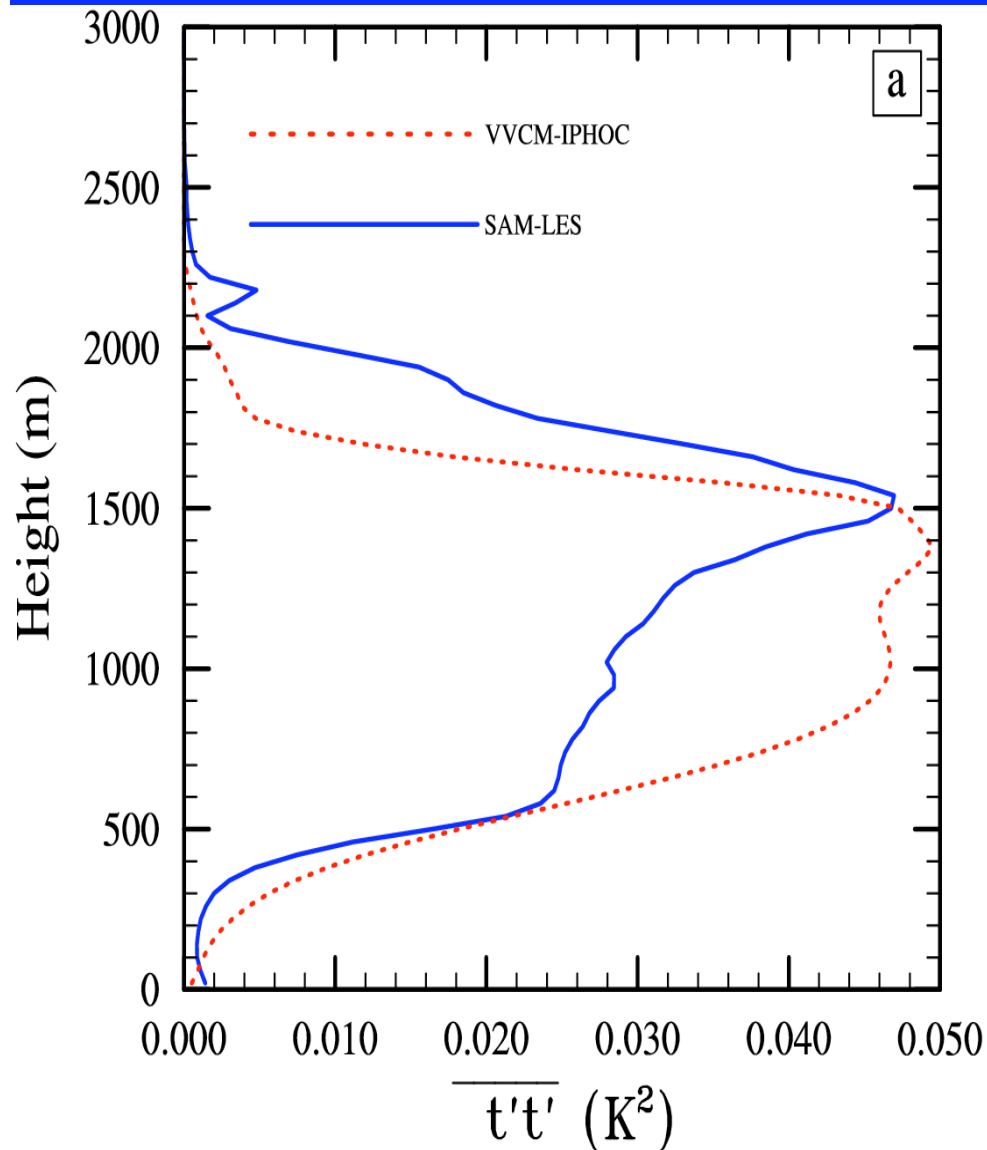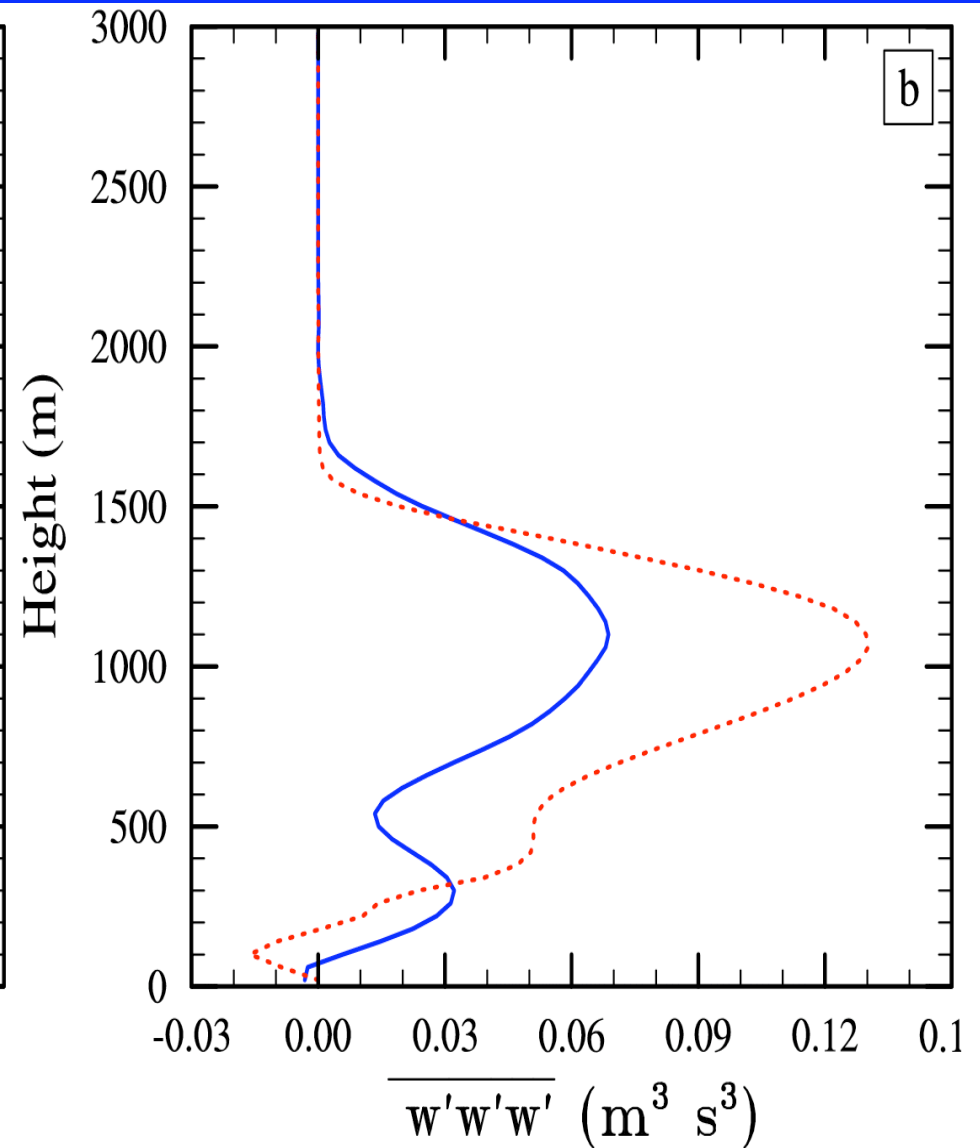

VVCM-LOC

SAM-LES
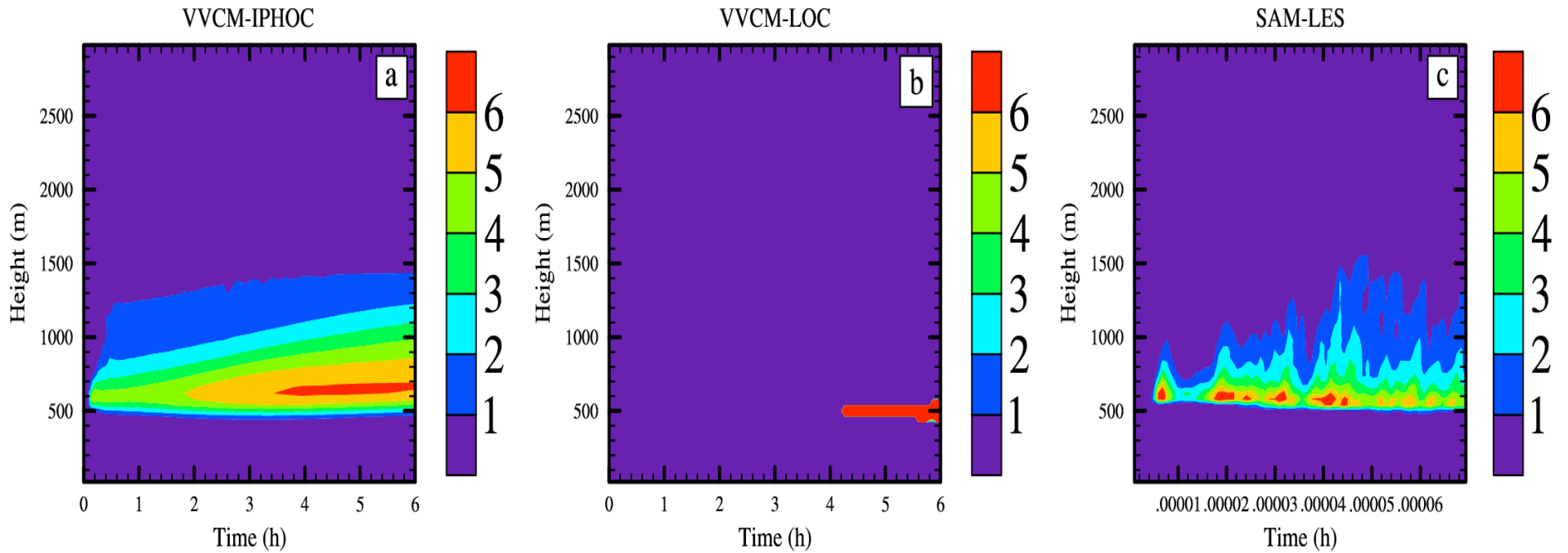
Mean Profiles at Last Hour

Fluxes at Last Hour
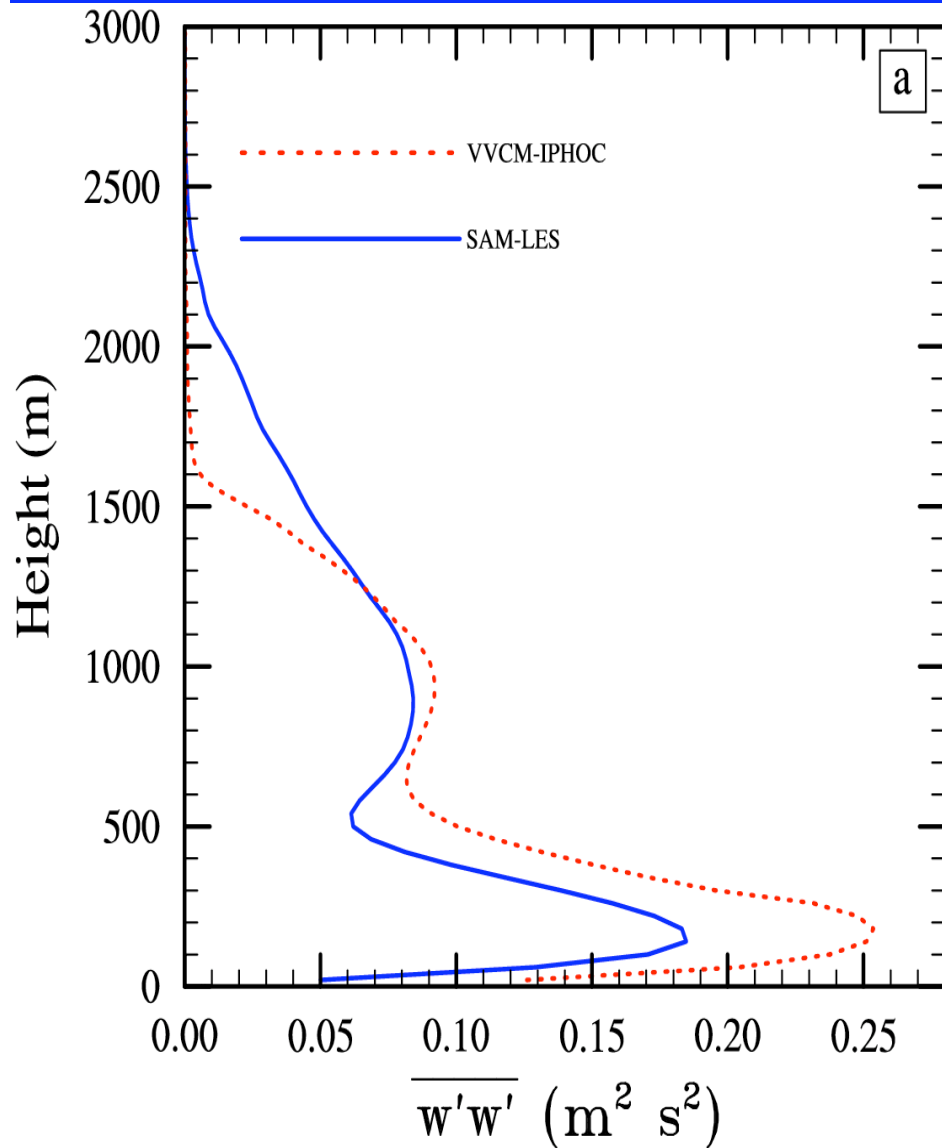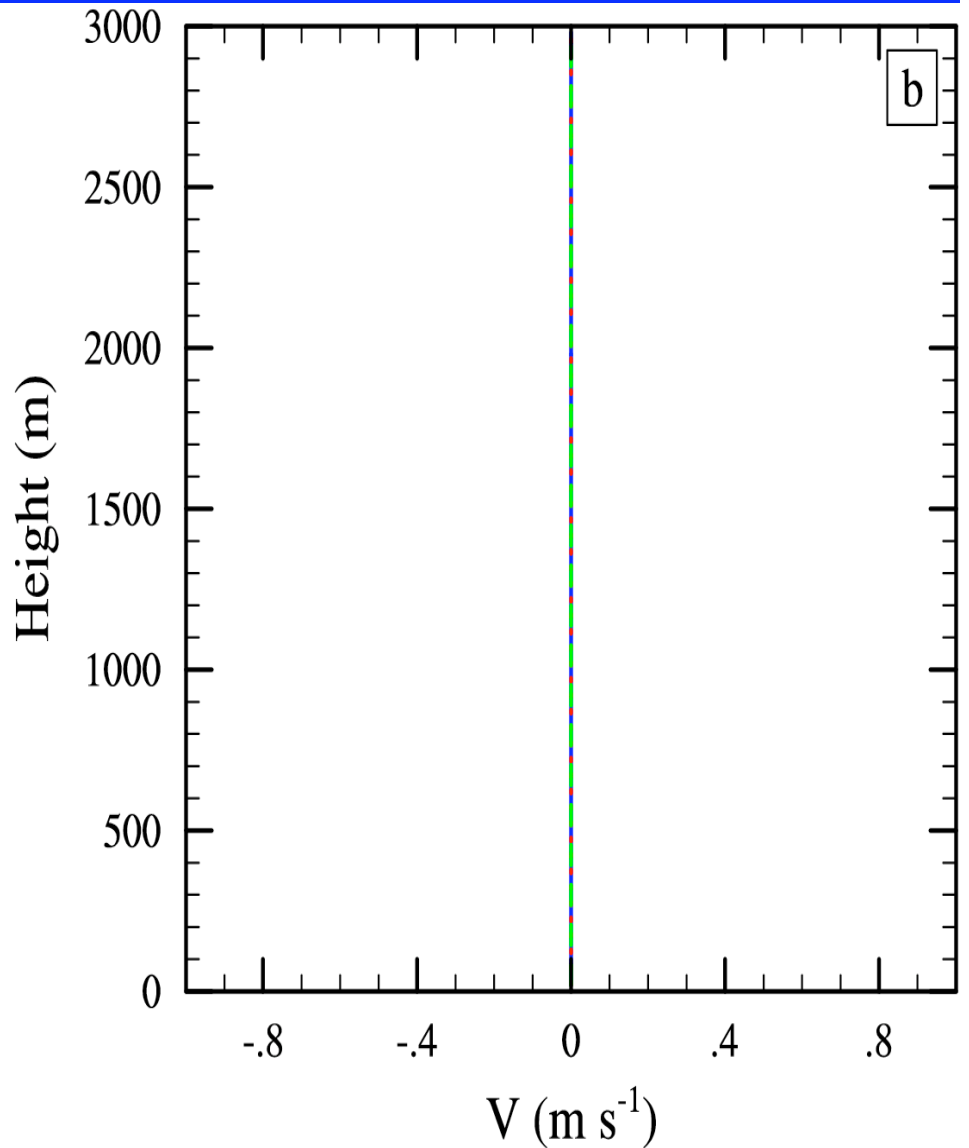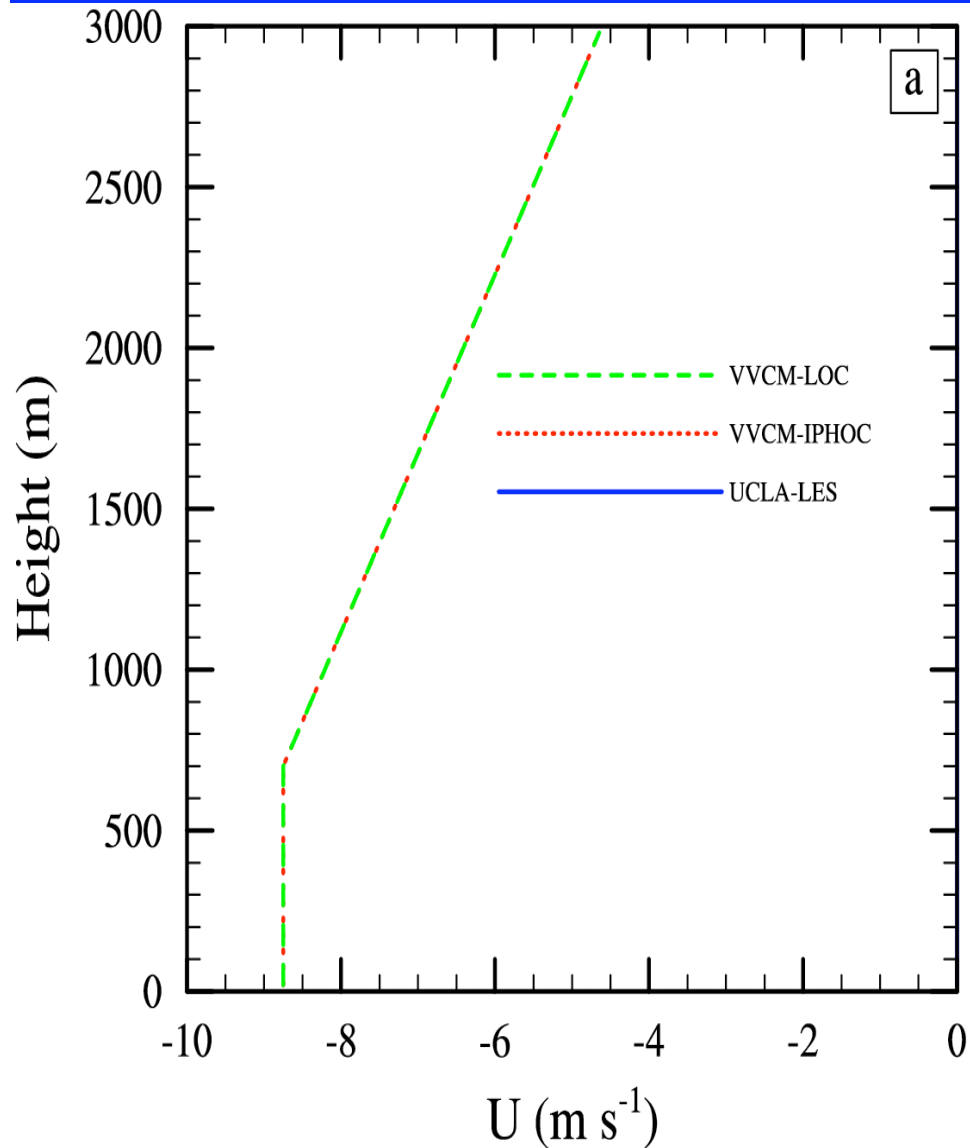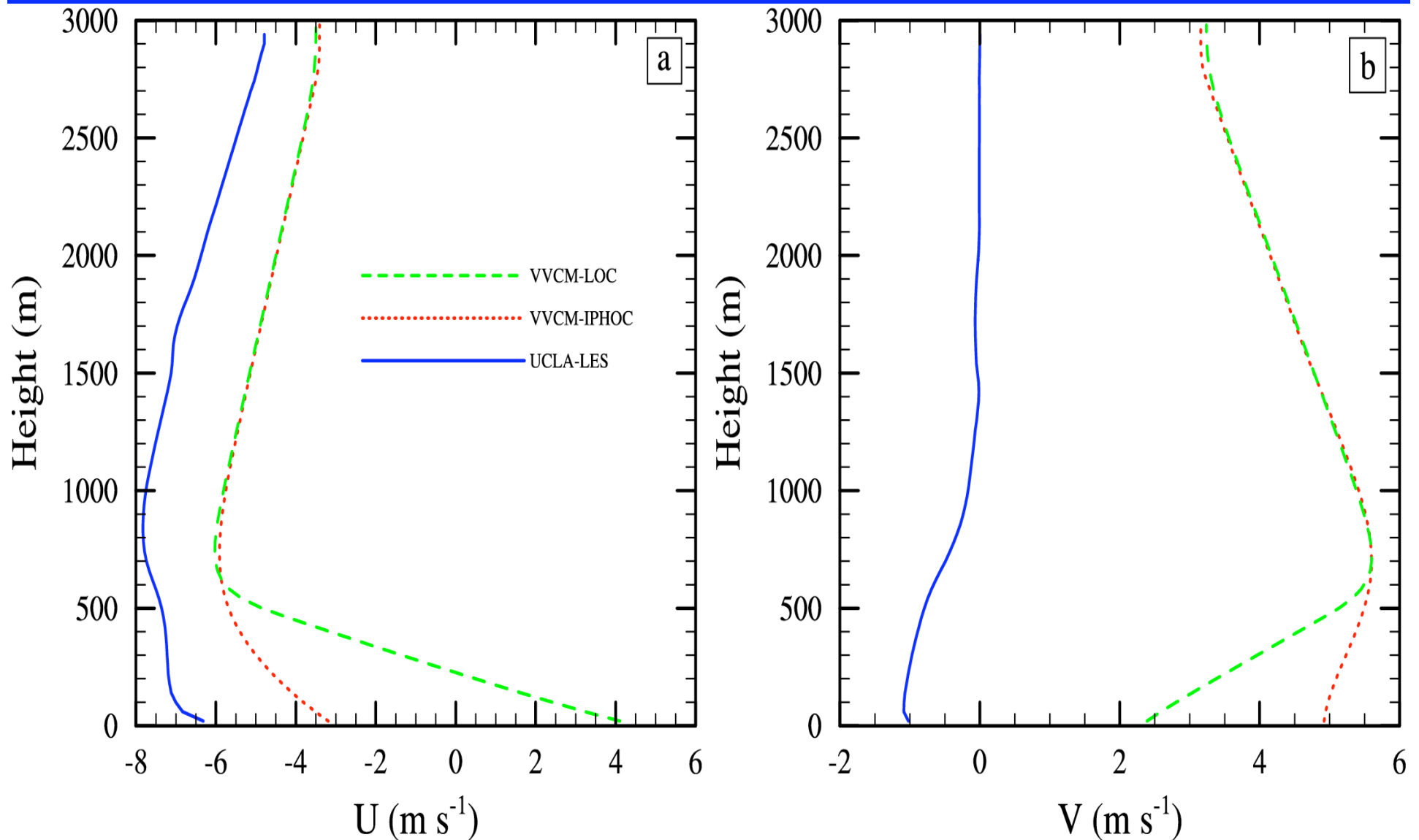
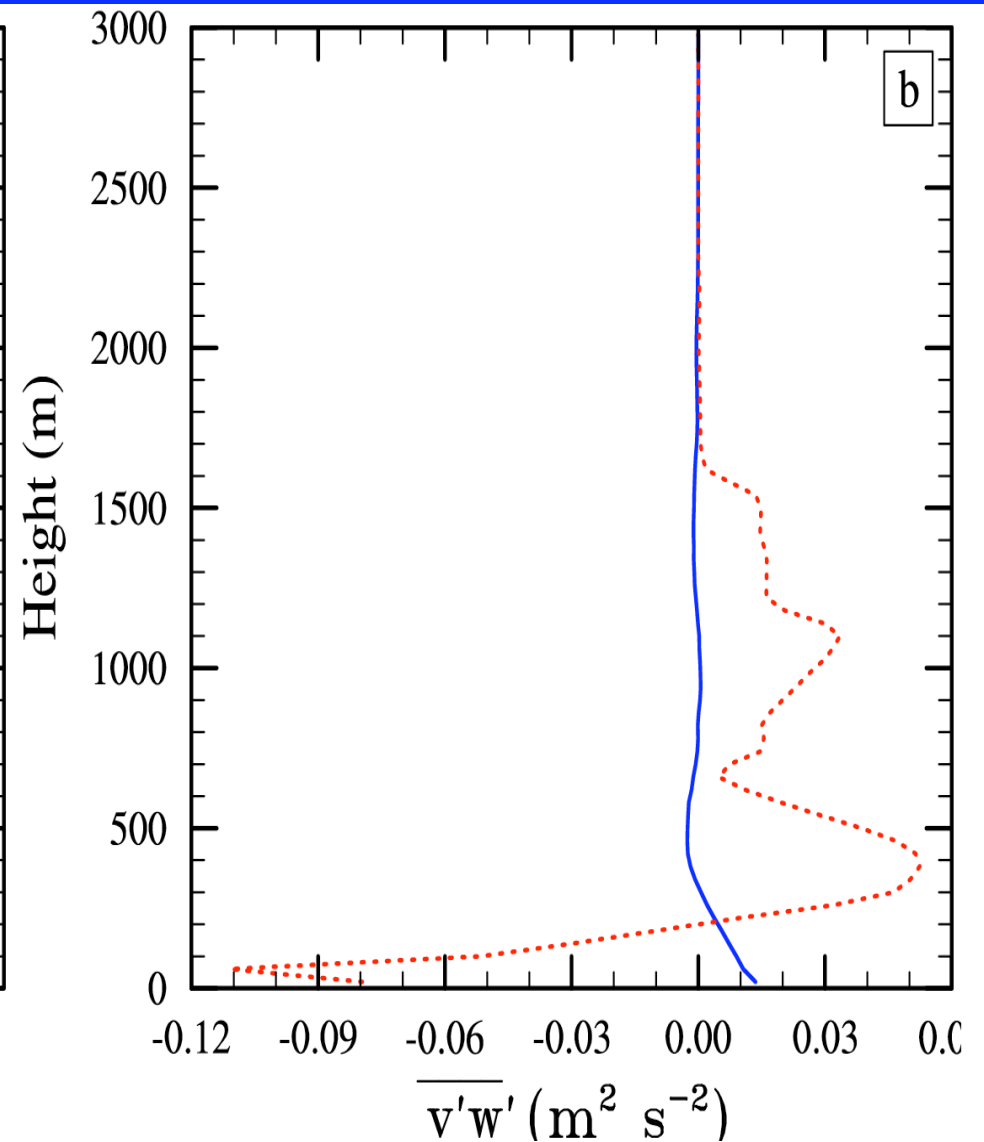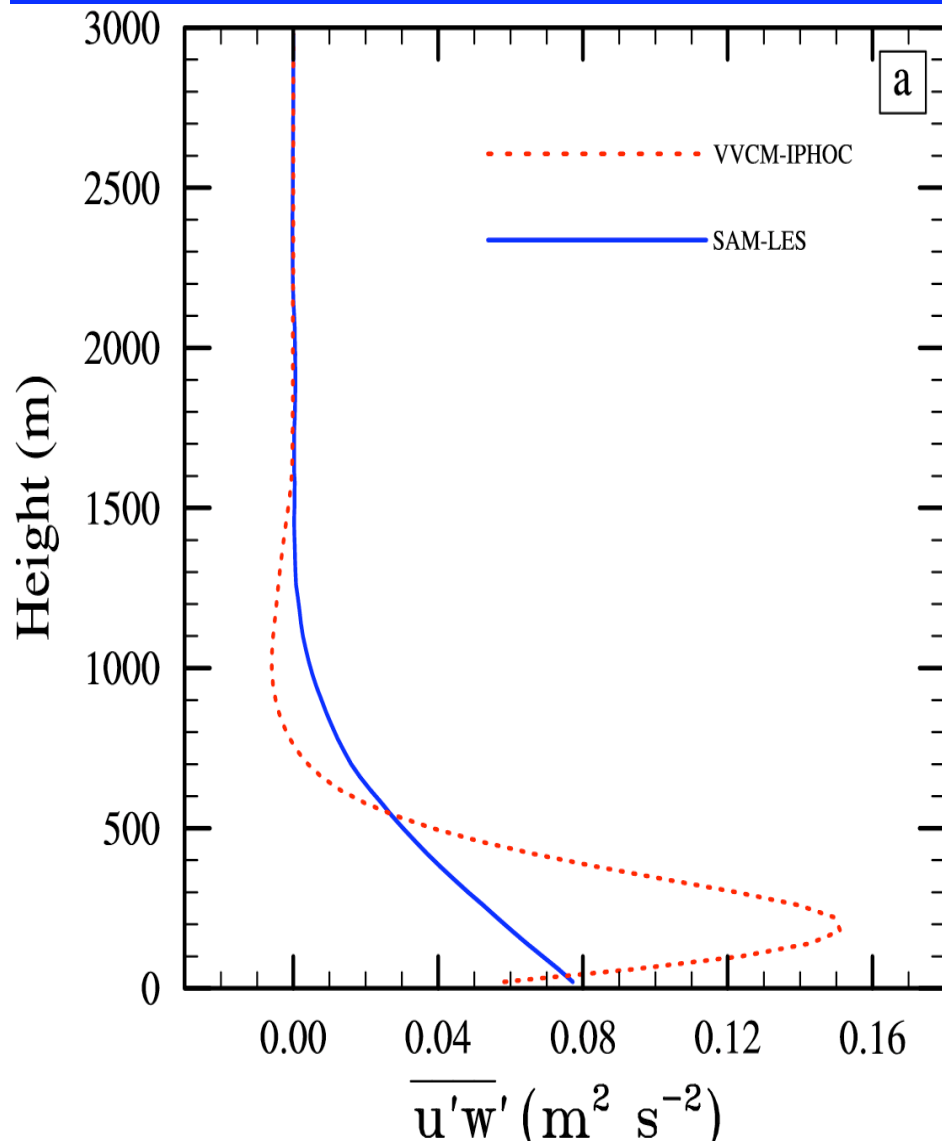# Second Moments at Last Hour

Moments of w at Last Hour

Initial Profiles of Momentum

Mean Momentum at Last Hour

Fluxes of Momentums

Summary and Discussion

- An IP-HOC has been implemented in VVCM

- Mechanism to produce shallow cumulus clouds in CRM resolution begins to work

- System bias on mean profiles of wind is still under invetigation

- Higher resolution runs for GCSS clouds need more work

- Extensive testing is underway

Thank You!