Gaps and Limitations in Atmospheric Modeling of the Water Cycle

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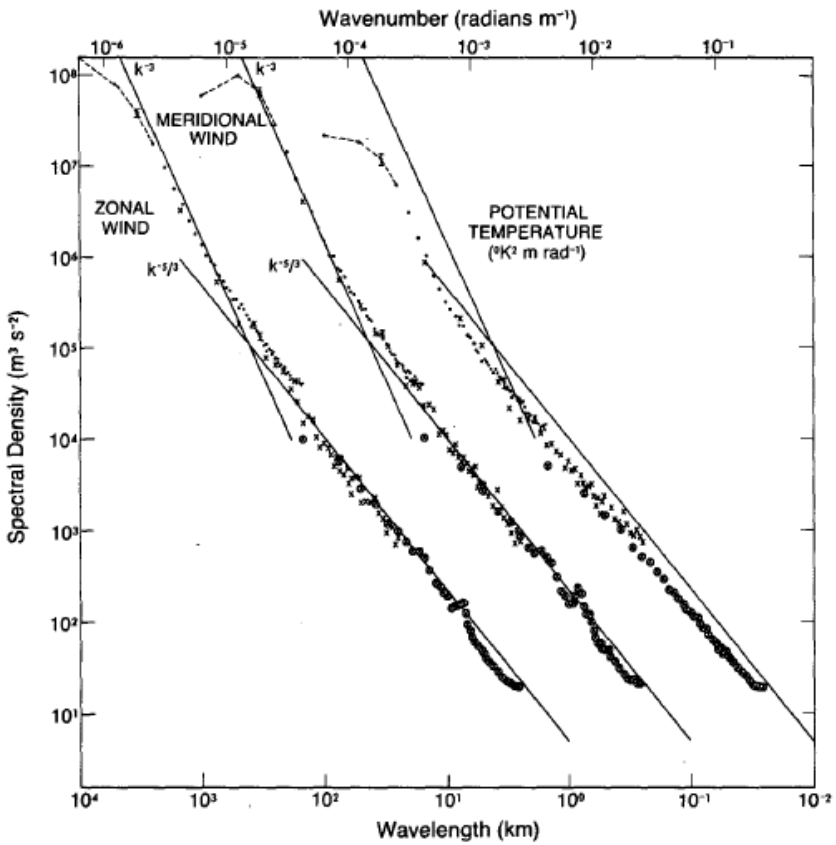
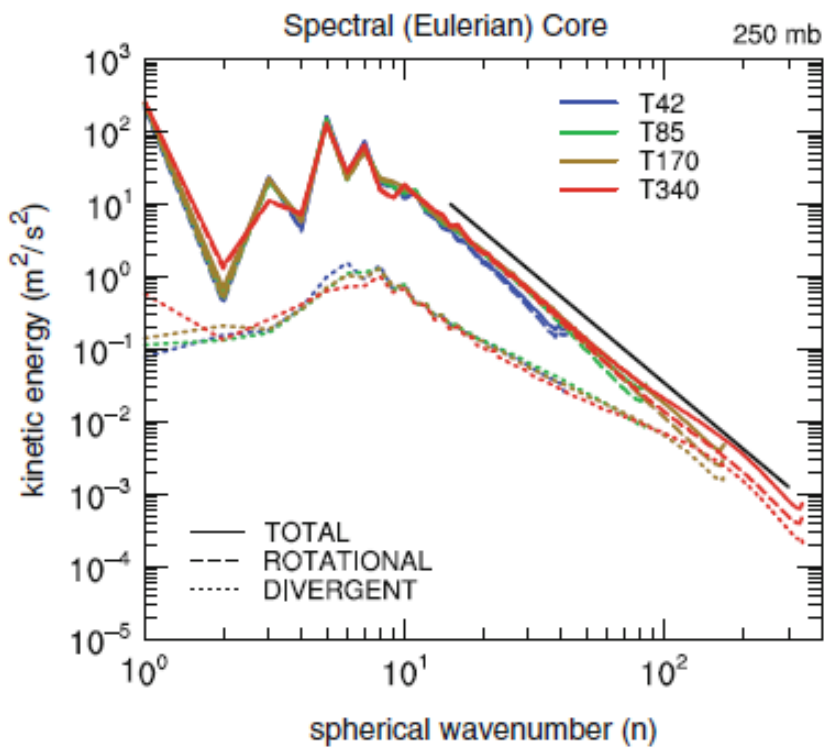
1. The Scales

The Dynamics

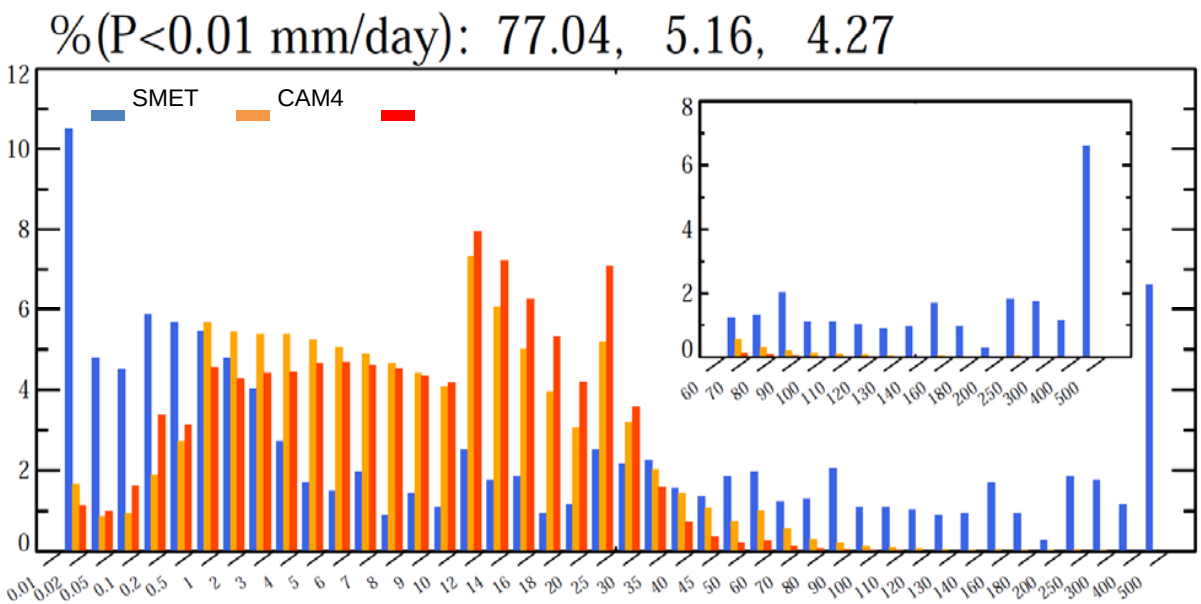


(Nastrom and Gage 1985)

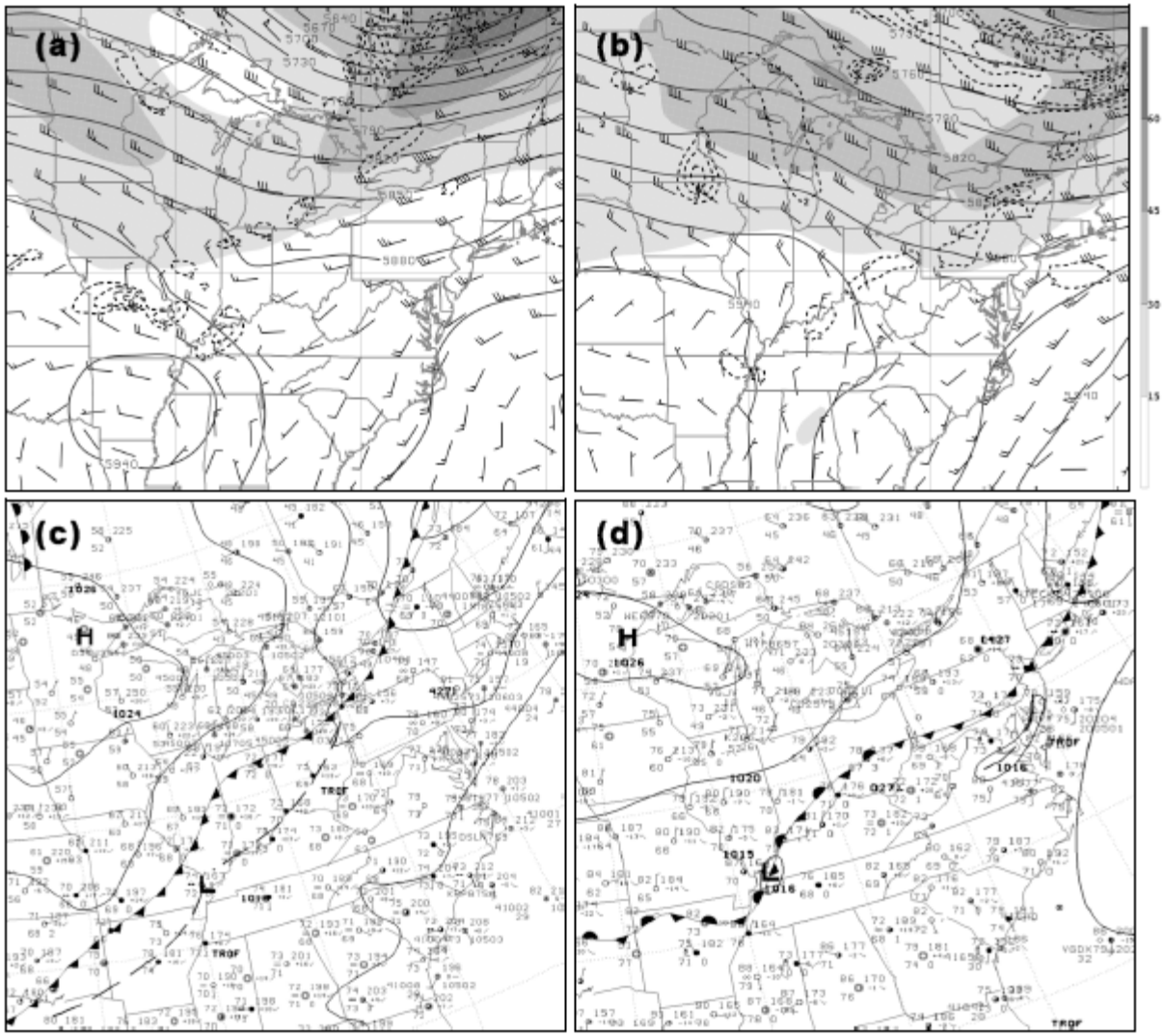


(Williamson 2006)

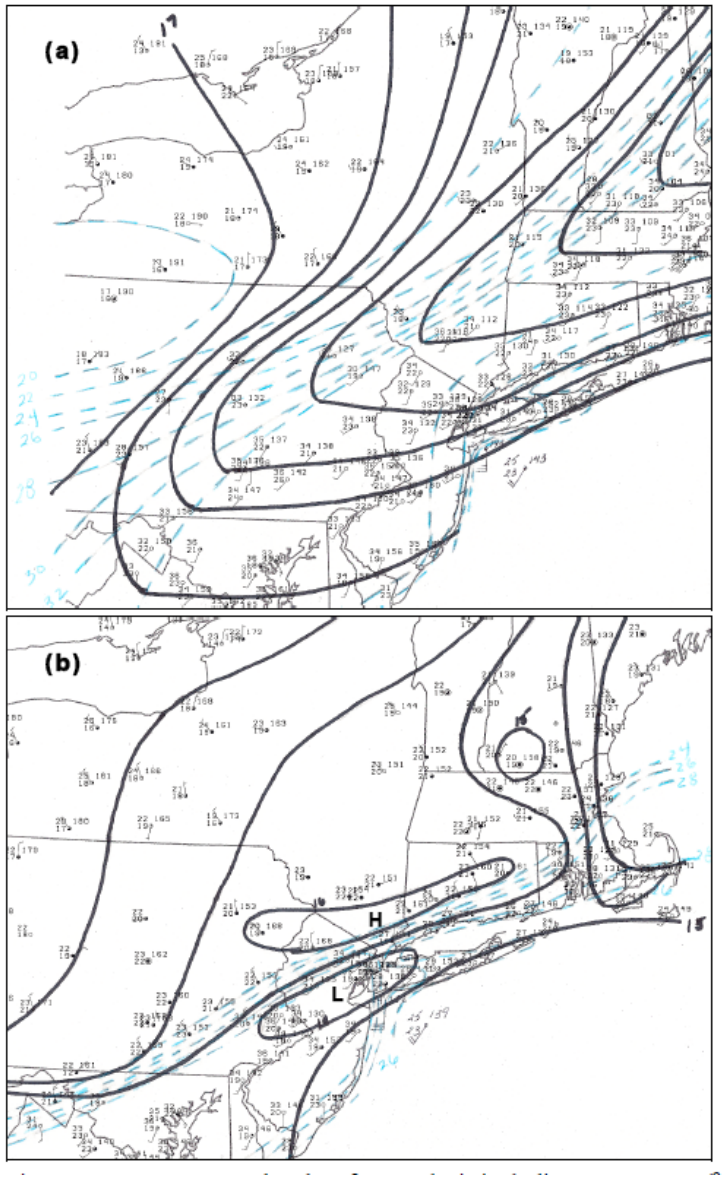
Rainfall
Frequency at ARM TWP



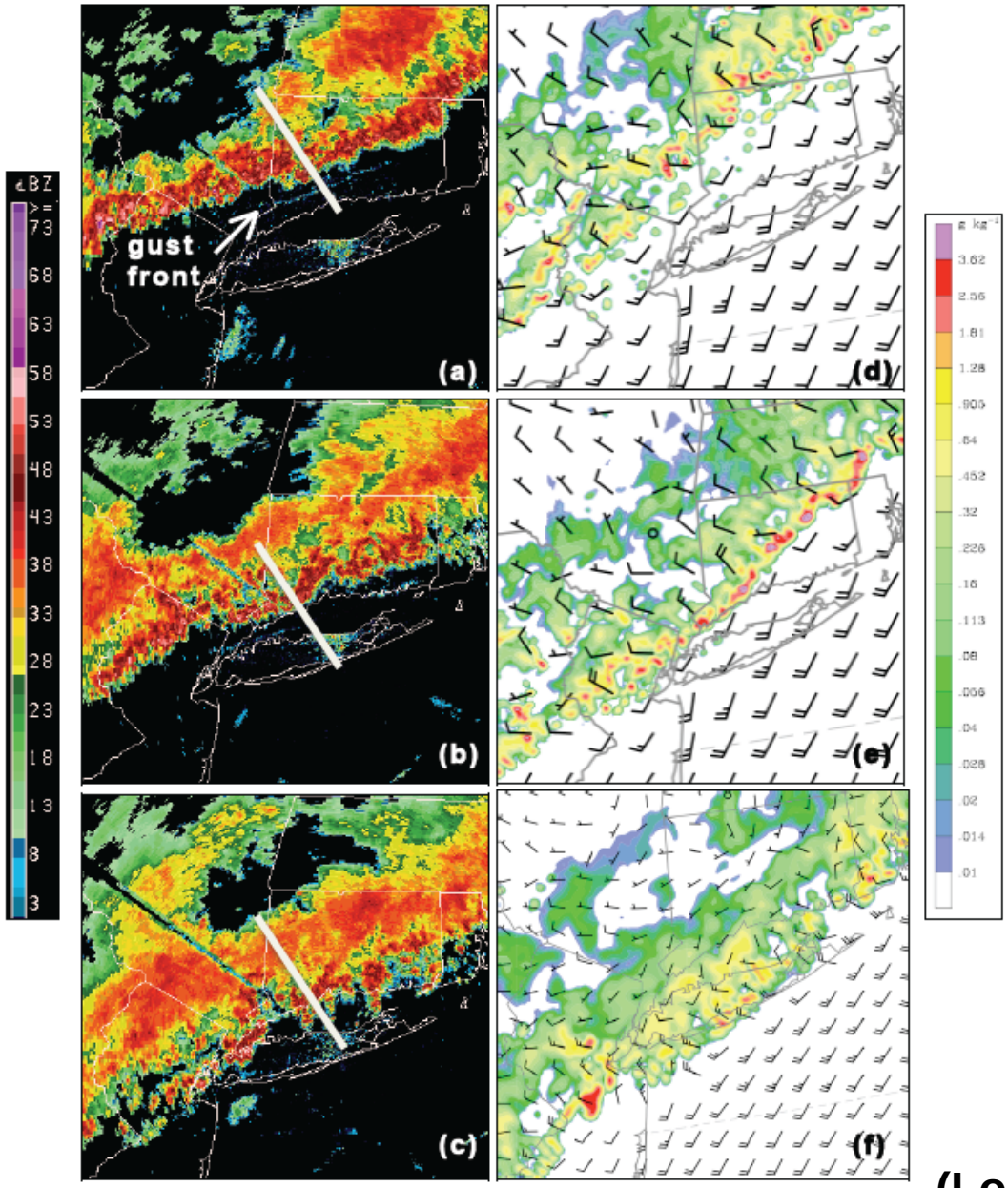
12 UTC July 23, 2002 **21 UTC July 23, 2002**



(Lombardo et al. 2012)


(a)
(b)
H
L

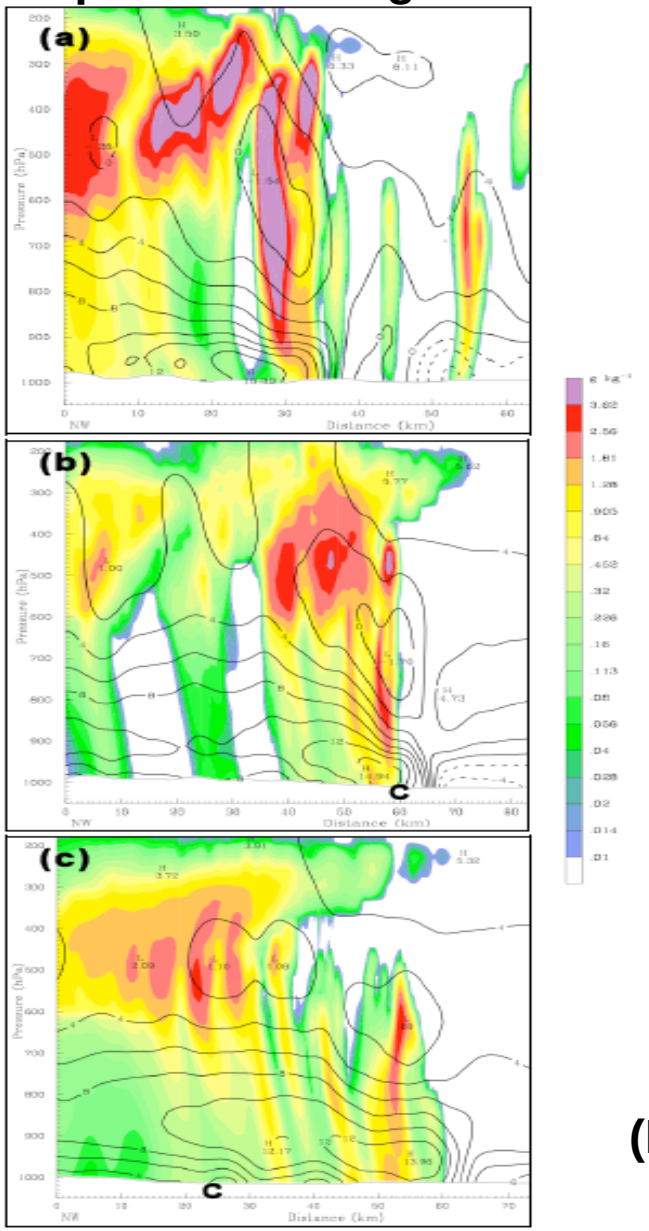
Radar



WRF (2km)

(Lombardo et al. 2012)

Precipitation mixing ratio



(Lombardo et al. 2012)

1. **The range of spatial and time scales of precipitation far exceeds what current models can describe.**

Yet, features at these scales are important to the water cycle.

Two possible approaches:

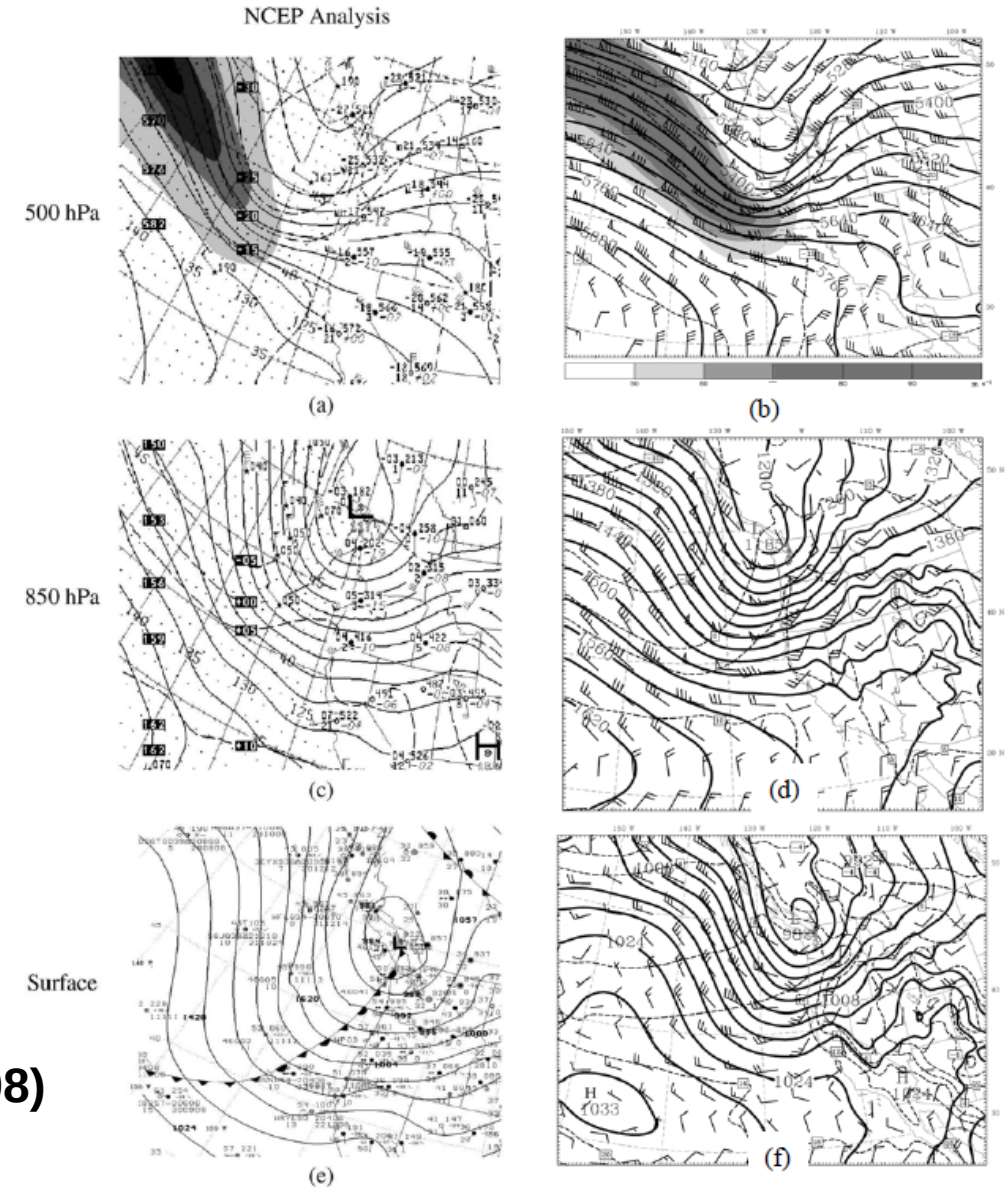
Parameterization: unproven, and unlikely succeed

High resolution: how high?

2. The Processes

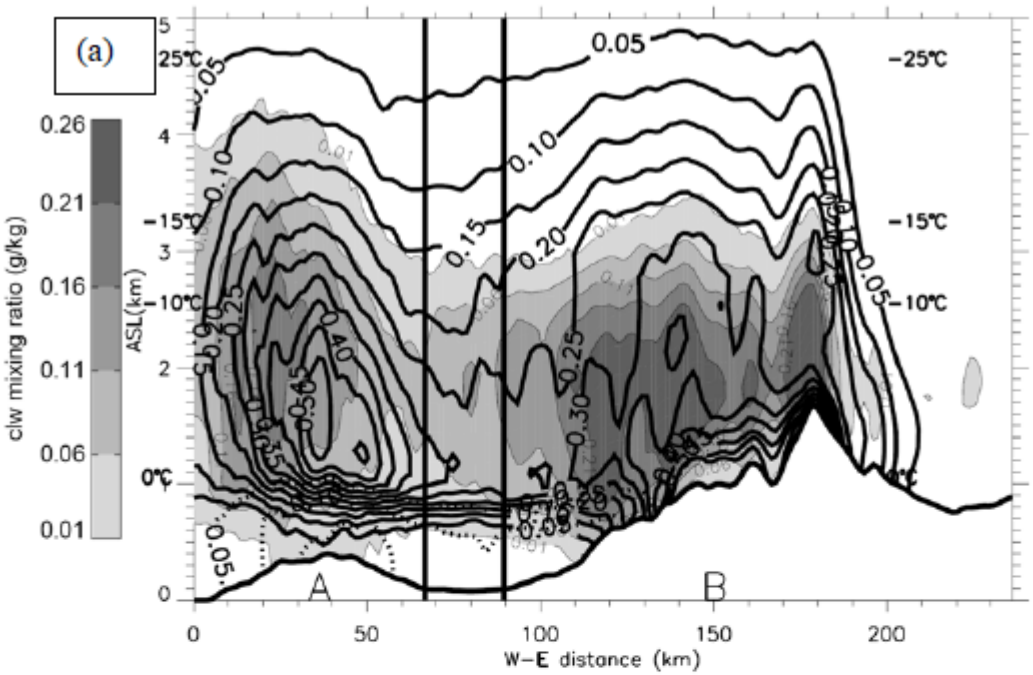
00 UTC December 14, 2001

NCEP **WRF (24 hr)**

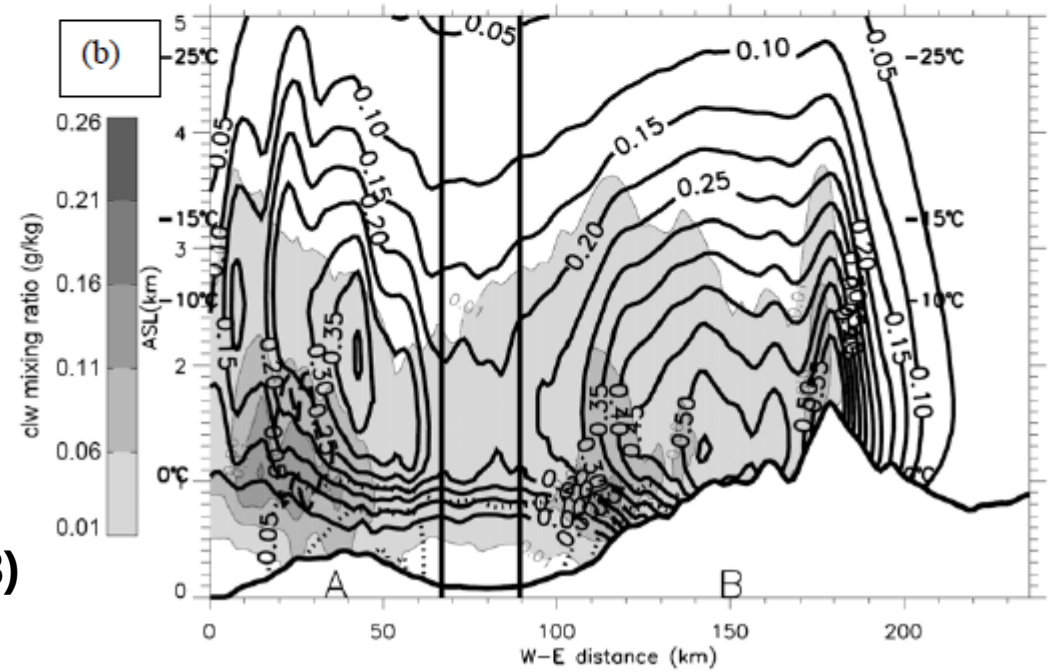


(Colle et al 2008)

Mixing Ratio
of
Cloud liquid
Cloud Ice
Precipitation



SUNYSB
Microphysics



Thompson
Microphysics

(Colle et al 2008)

2. Some of the key processes are still not characterized.

Yet, these processes are important to the water cycle.

The requirements:

More comprehensive observations

Knowledge on the asymptote of these processes