-15C cloud population peak (hobby) and parameterizing organized convection

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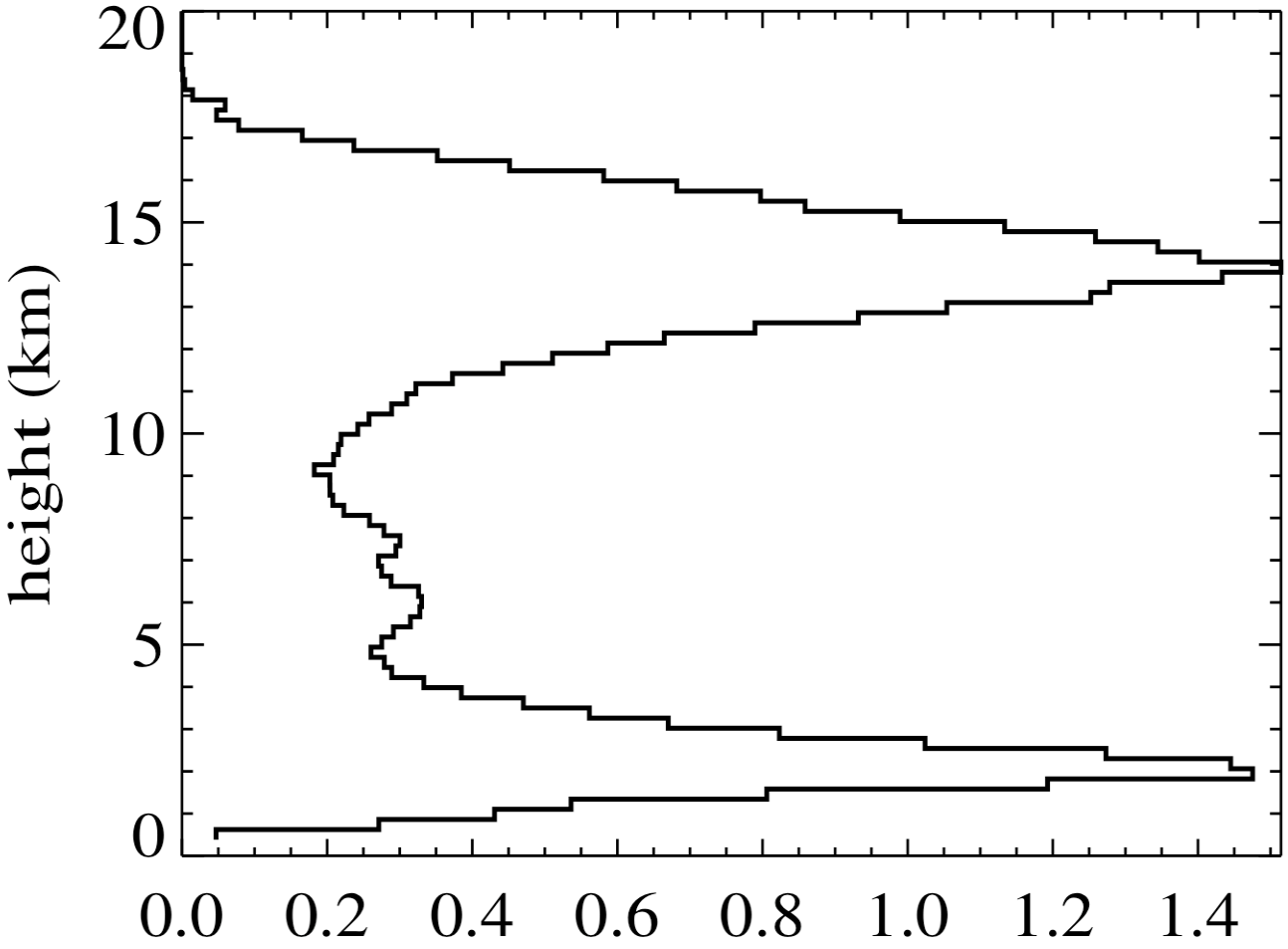
Cloudsat: Tropical echo top altitude distribution



Manus MMCR

ELSEVIER

Atmospheric Research 72 (2004) 169–186

ATMOSPHERIC RESEARCH

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Comparison of cloud-top height retrievals from ground-based 35 GHz MMCR and GMS-5 satellite observations at ARM TWP Manus site

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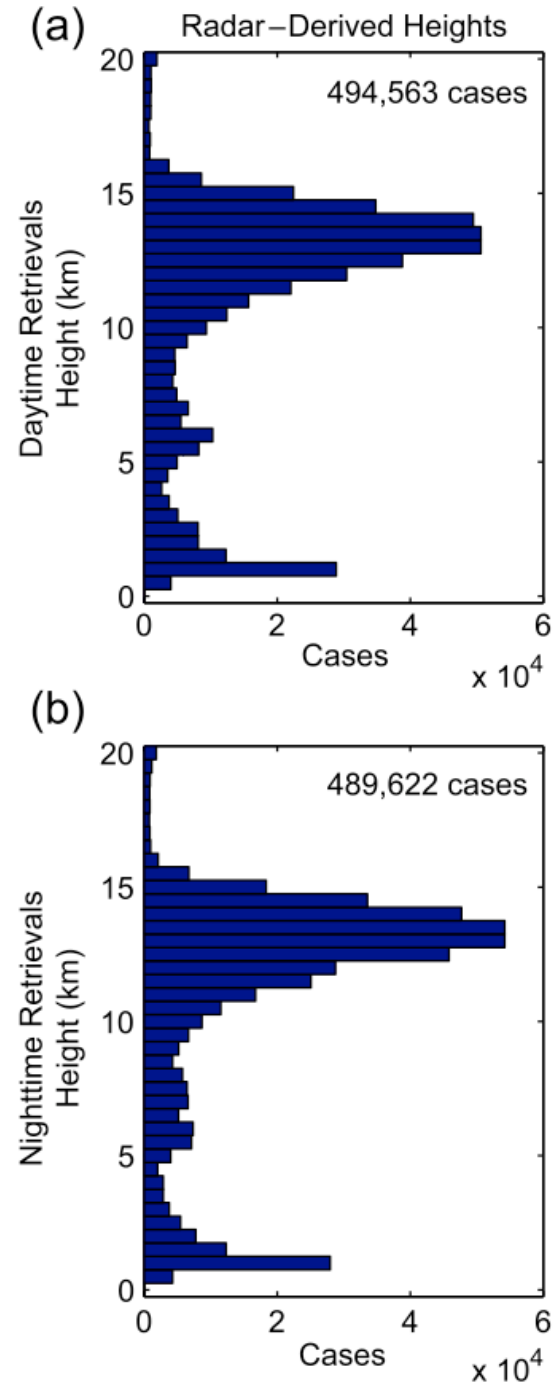

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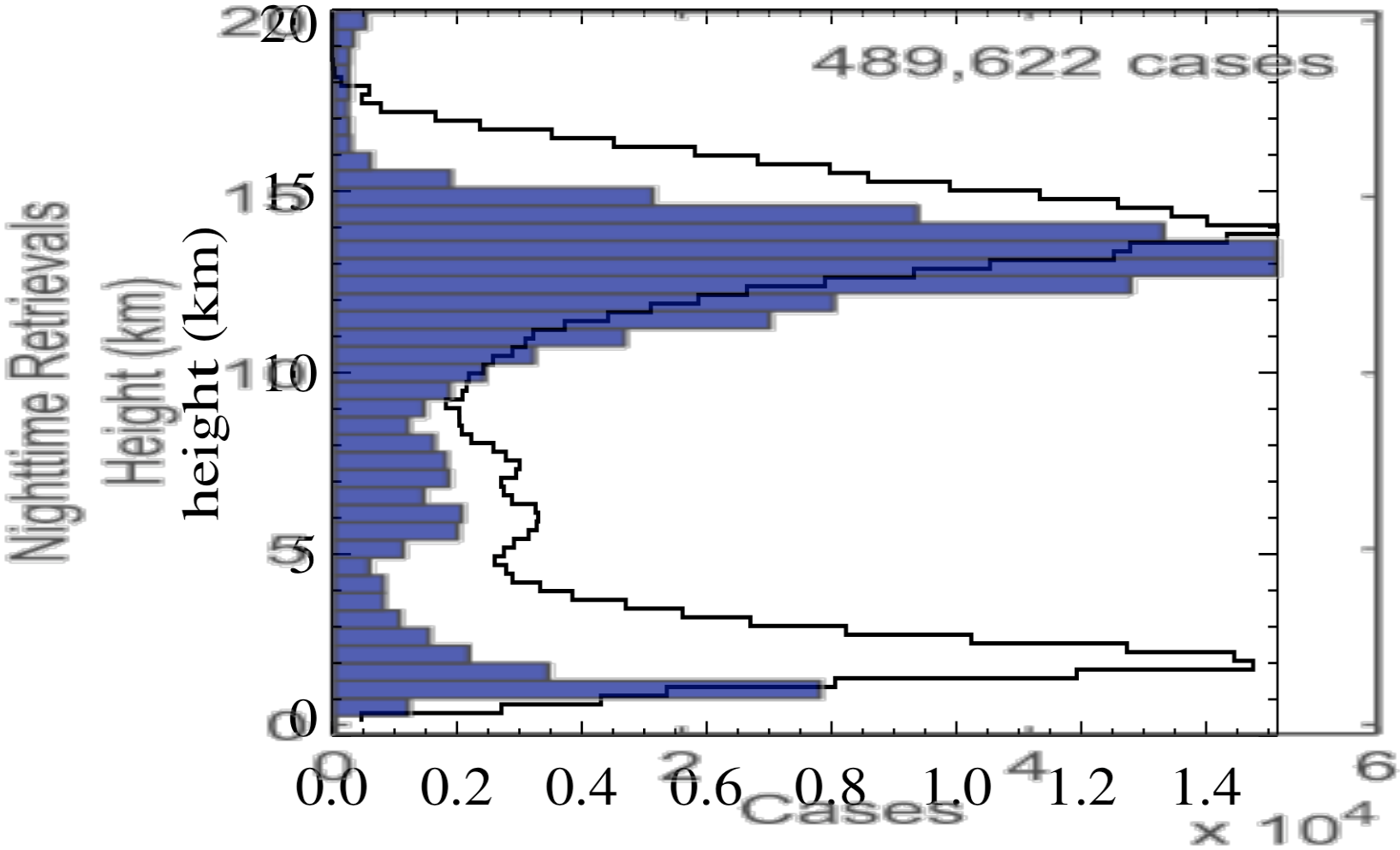
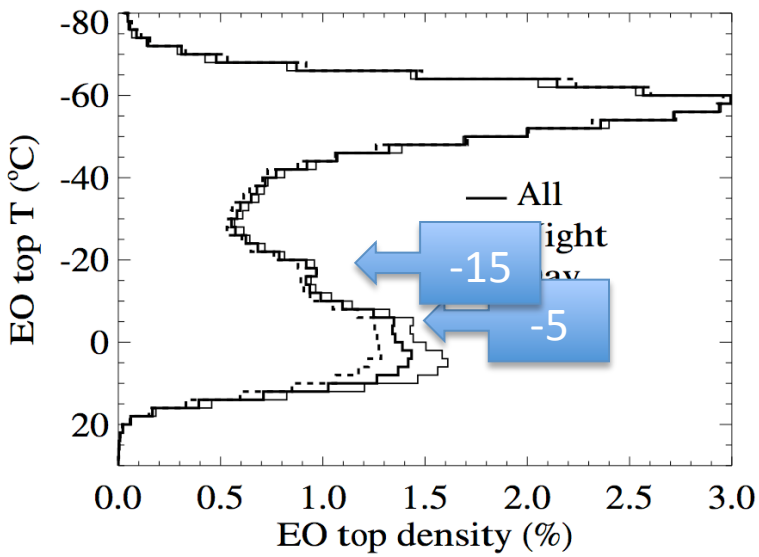
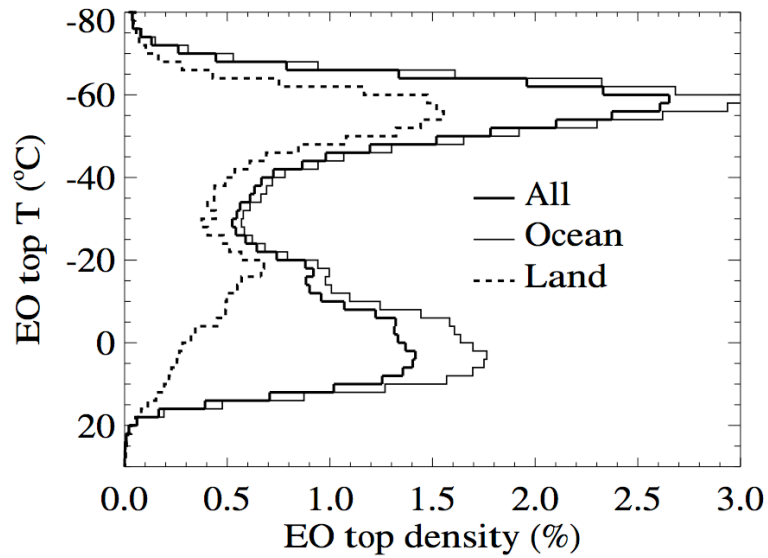
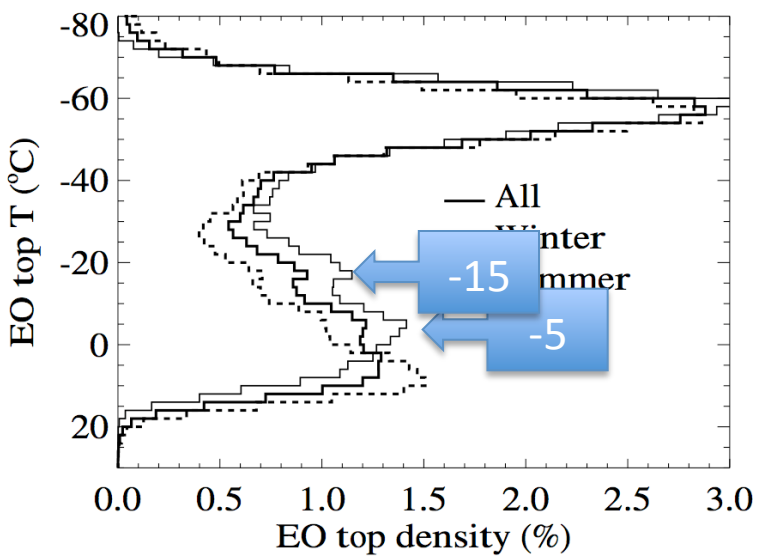


Extra-tropics (20°-60°N/S) show these peaks are tied to Temperature, not height

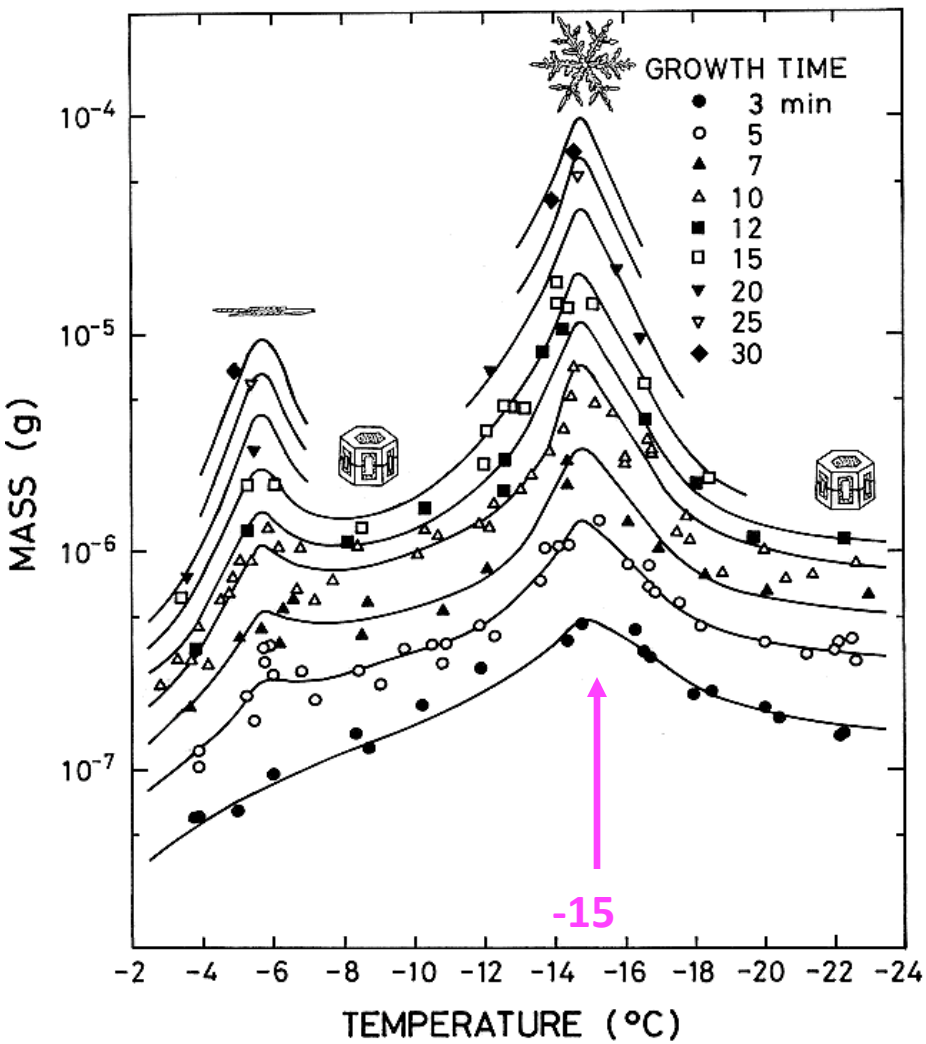






- Temperature is vertical coordinate

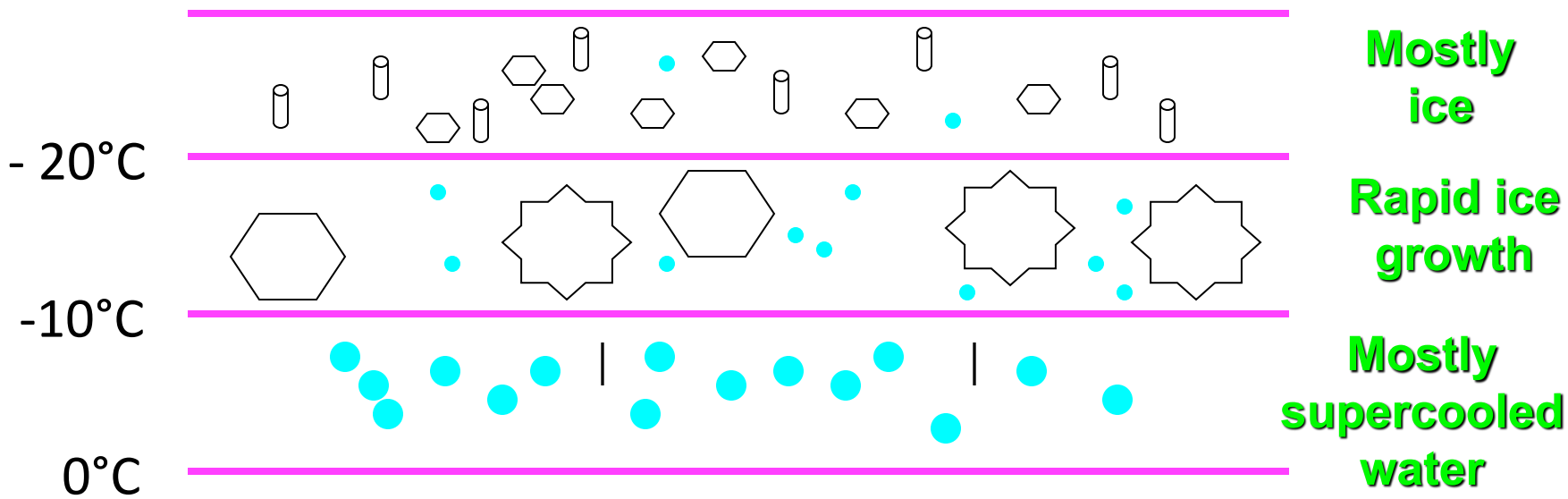
Ice Microphysics



Fukuta and Takahashi (1999)

- Maximum dendritic ice growth at -15°C
- Secondary growth maximum near -5C (needles)

Is peak just because ice Particles are fewer, larger, more reflective than droplets?



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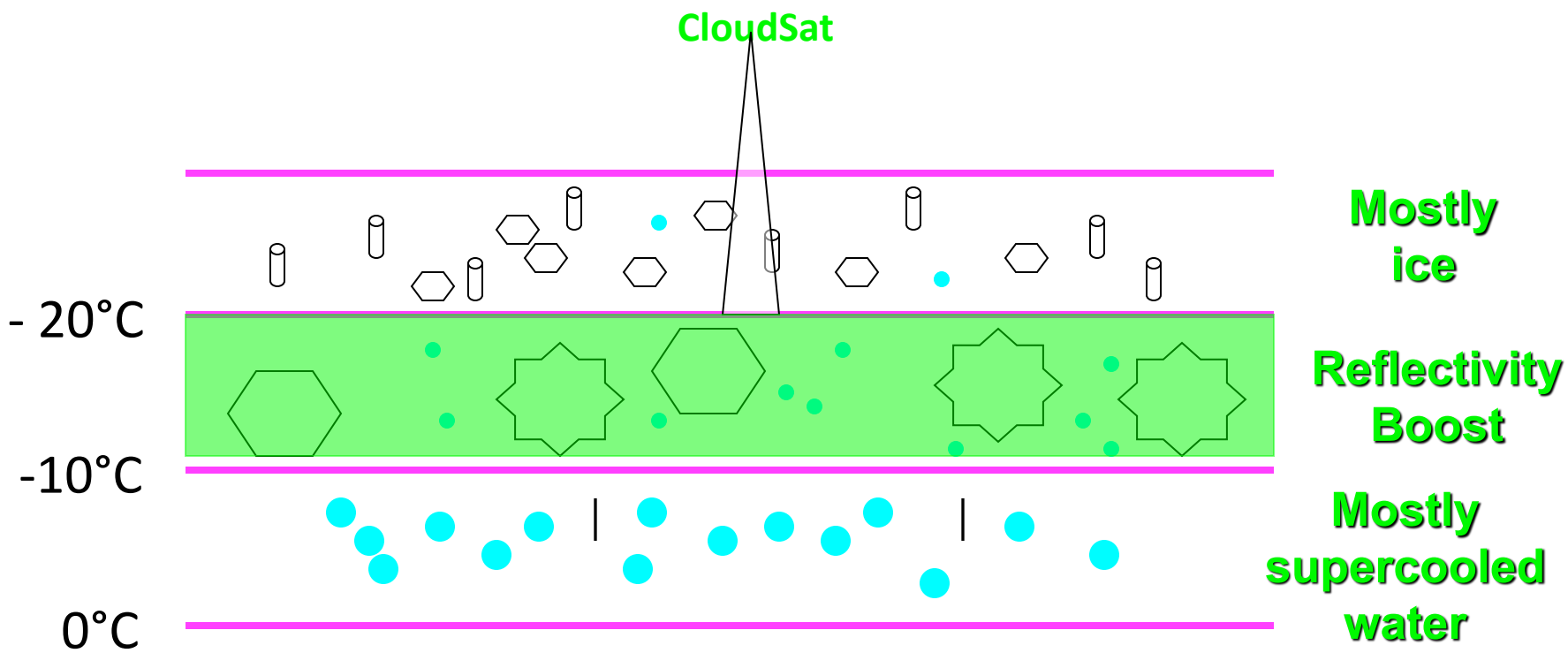
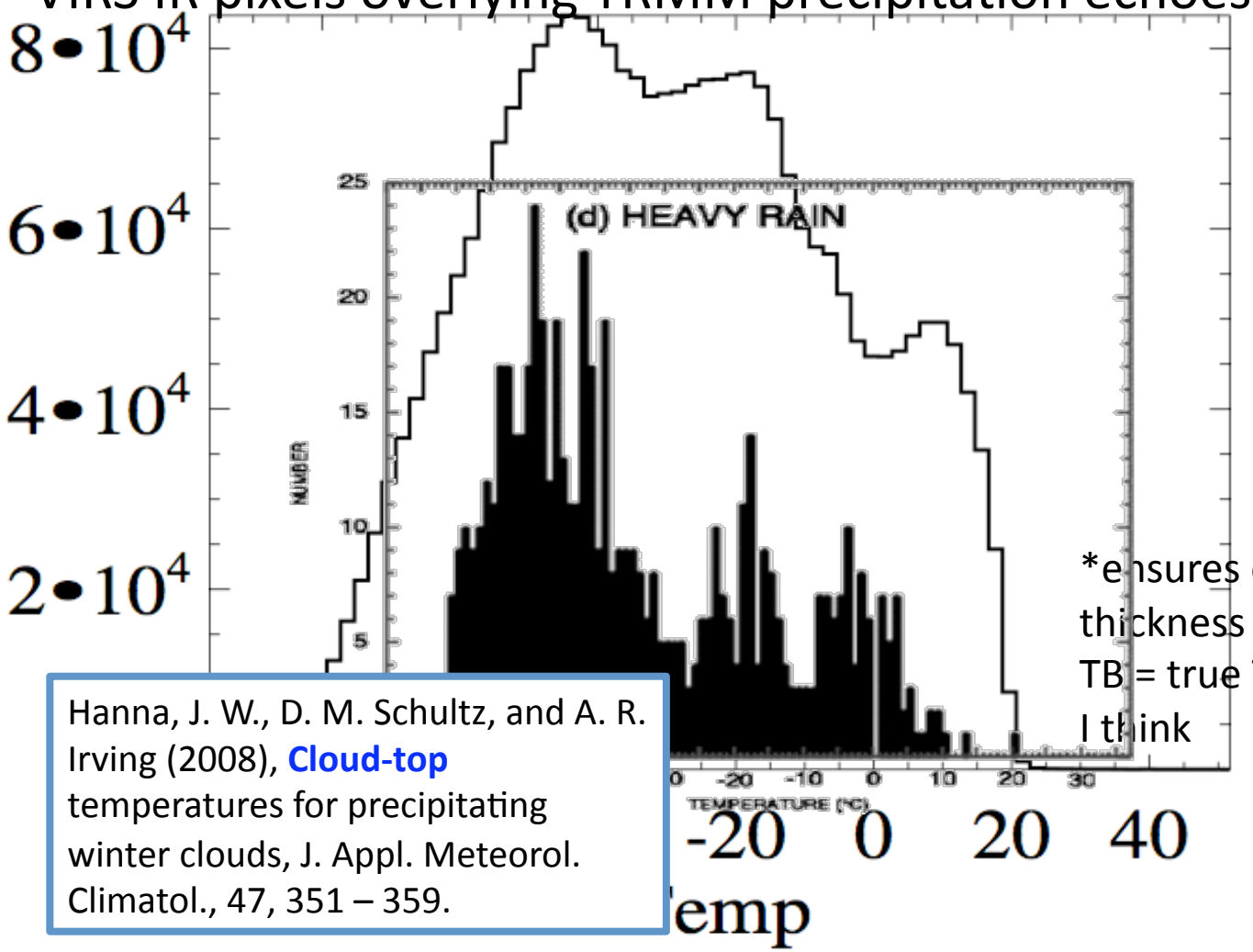


Not just –
there's a peak in IR cloud tops at -15C too!

VIRS IR pixels overlying TRMM precipitation echoes*

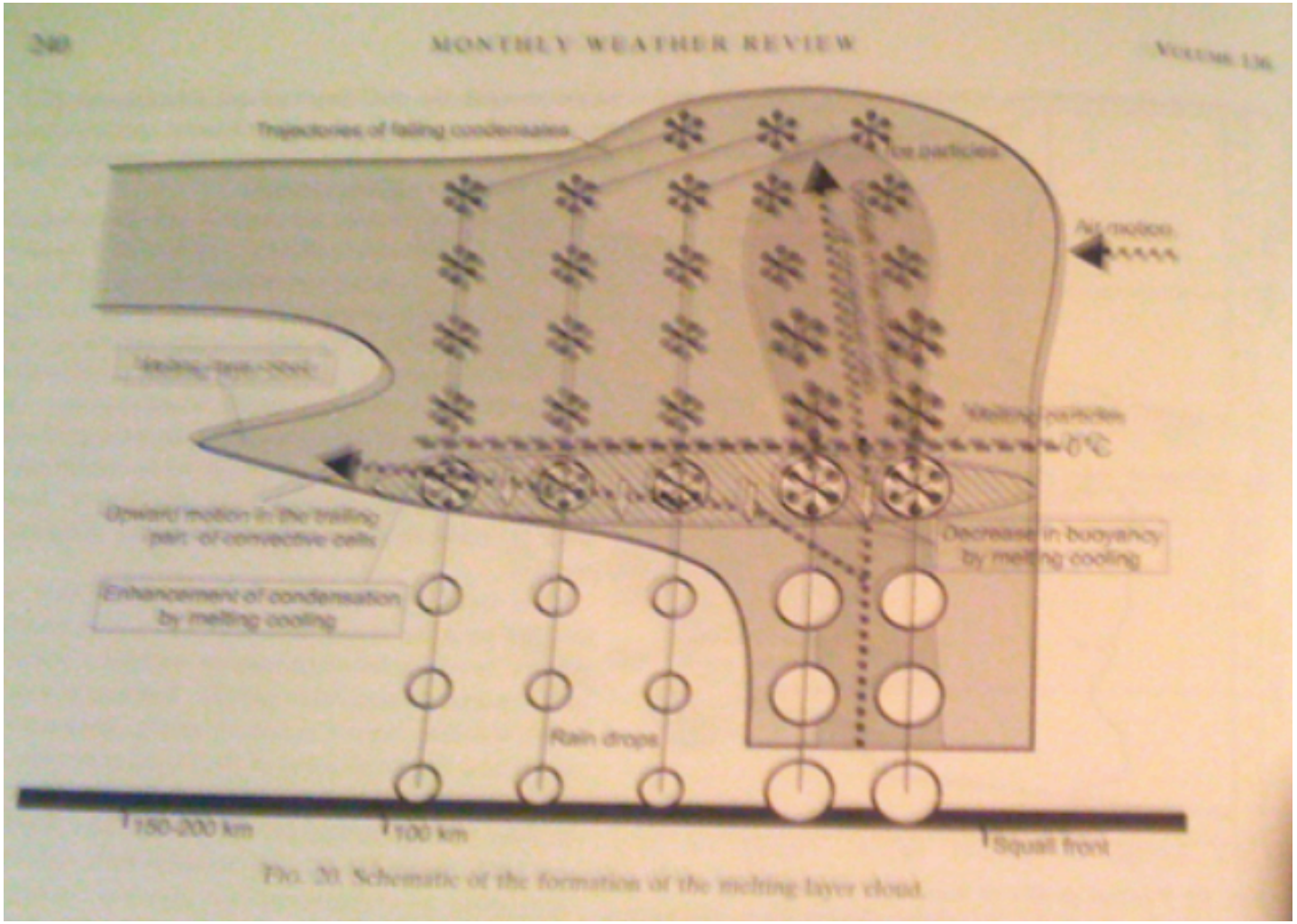


*ensures optical thickness so TB = true Ttop, I think

Hanna, J. W., D. M. Schultz, and A. R. Irving (2008), **Cloud-top** temperatures for precipitating winter clouds, J. Appl. Meteorol. Climatol., 47, 351 – 359.

plot Emily Riley, data H. Masunaga

How do we get from a microphysical process to a cloud population (cloudiness coverage peak)? Example: melting level cloud



Kazuaki Yasunaga et al. 2008

Toward a unified shallow + deep convection scheme (for CAM5?)

Brian Mapes

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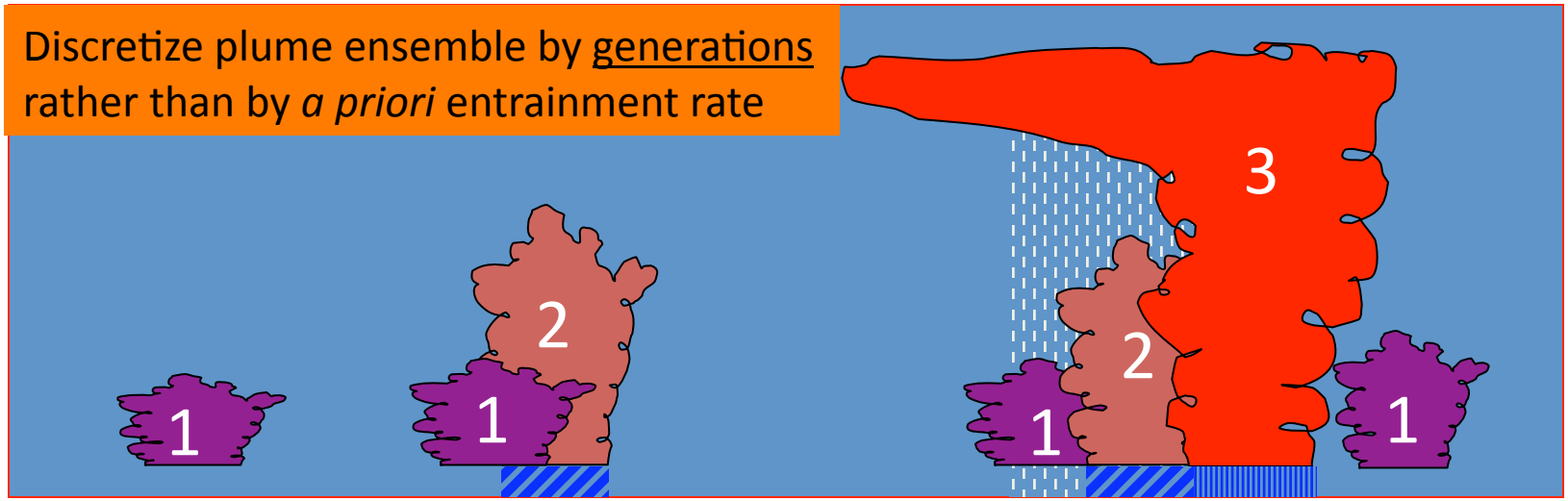
NCAR CGD, Tues. Sep 22, 2009

An assertion:

These taller clouds aren't subject to less mixing, they have a positional advantage (wet *local* env.)

Lots of entrainment, but sometimes of non-average air



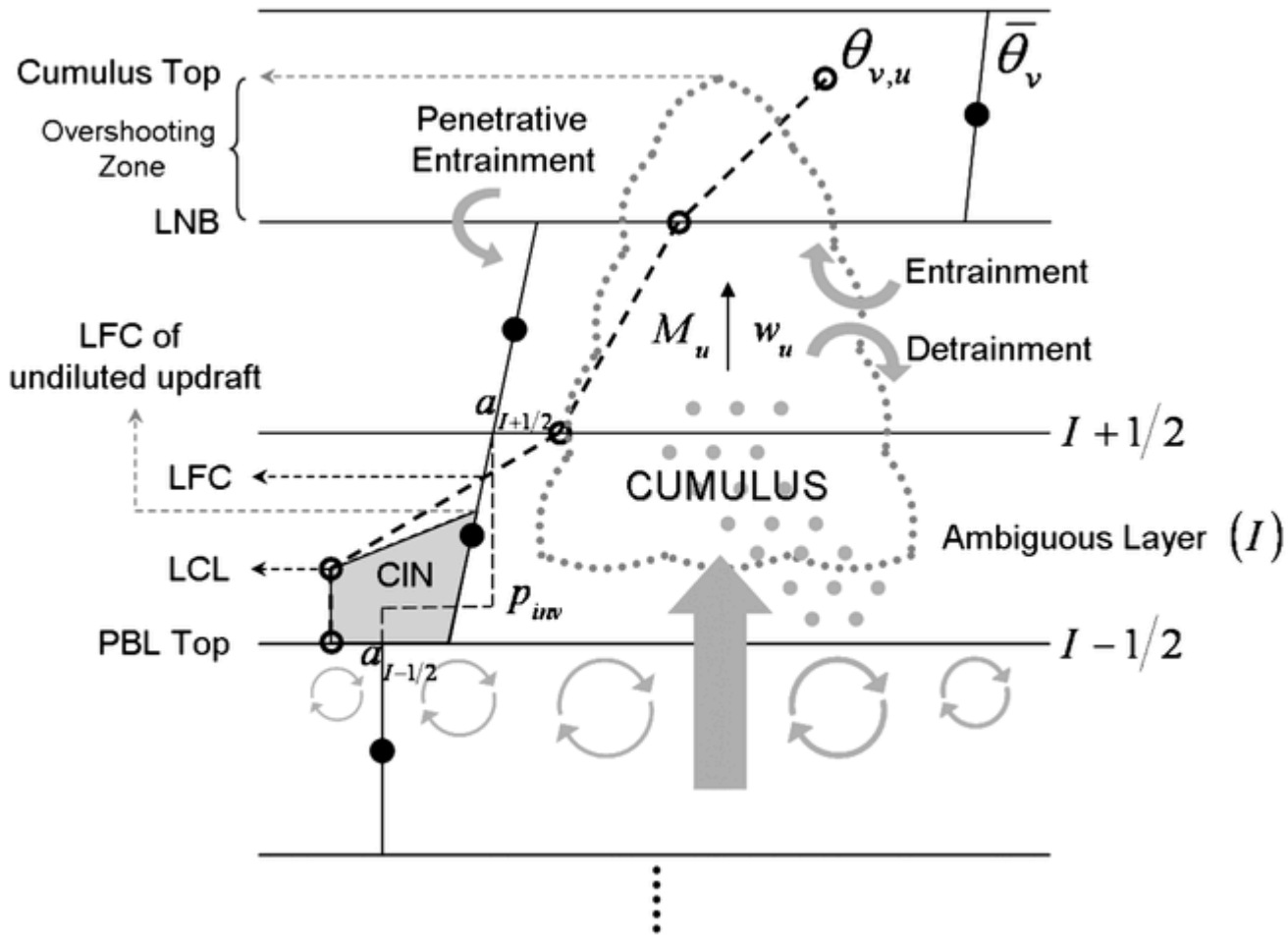
Probabilities of higher-generation plumes depend on (indeed, **define**) organization.

This slide is almost 10 years old! (Y2k)
(shown at ARM meeting in Broomfield)

'Organization'
Org = 1
Org = 0

$0 < org < 1$

Park, S., and C.S. Bretherton, 2009: The University of Washington Shallow Convection and Moist Turbulence Schemes and Their Impact on Climate Simulations with the Community Atmosphere Model. *J. Climate*, ***22, 3449–3469.***



ic structure of UW shallow cumulus scheme describing vertical evolution of a bulk cumulus updraft and

Gory details are all worked out...

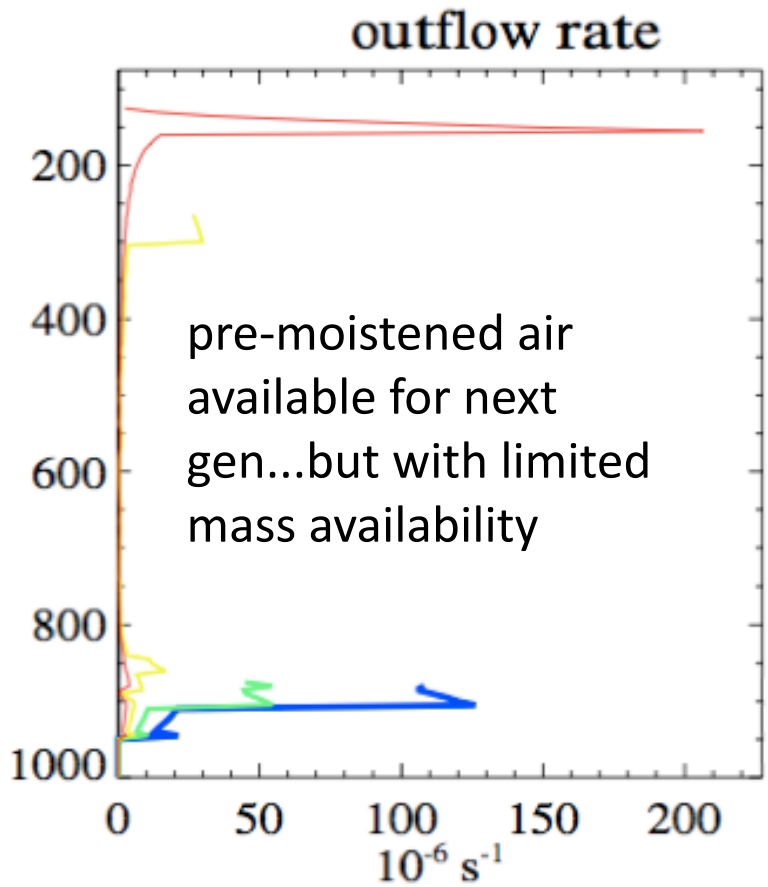
Code tuned globally and optimized for performance.

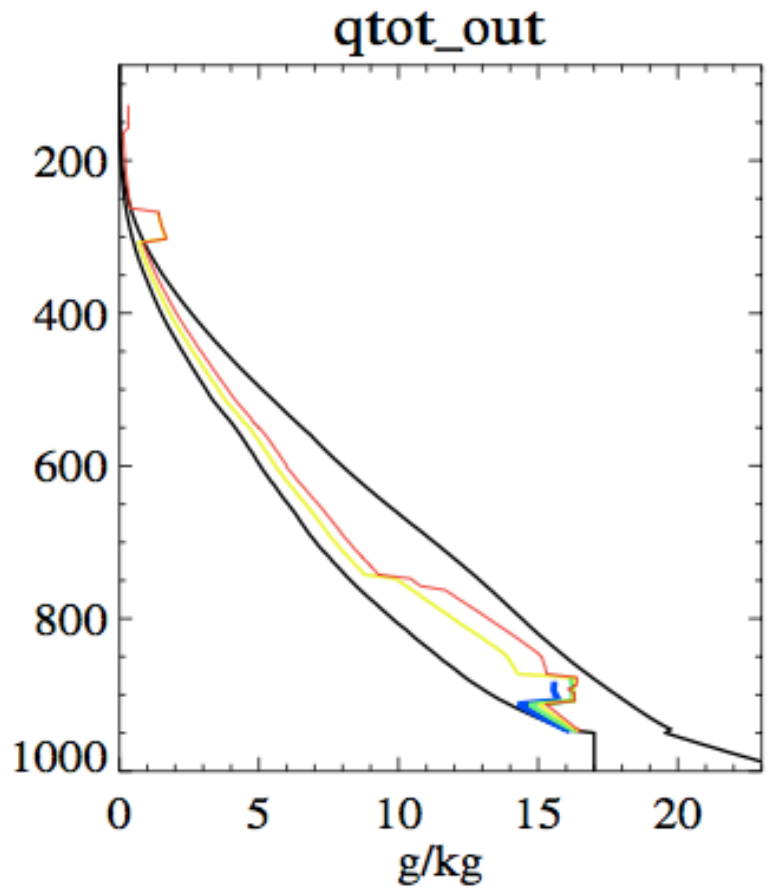
Leverage it!

Steady state assumption ends my 10-year stuckness!

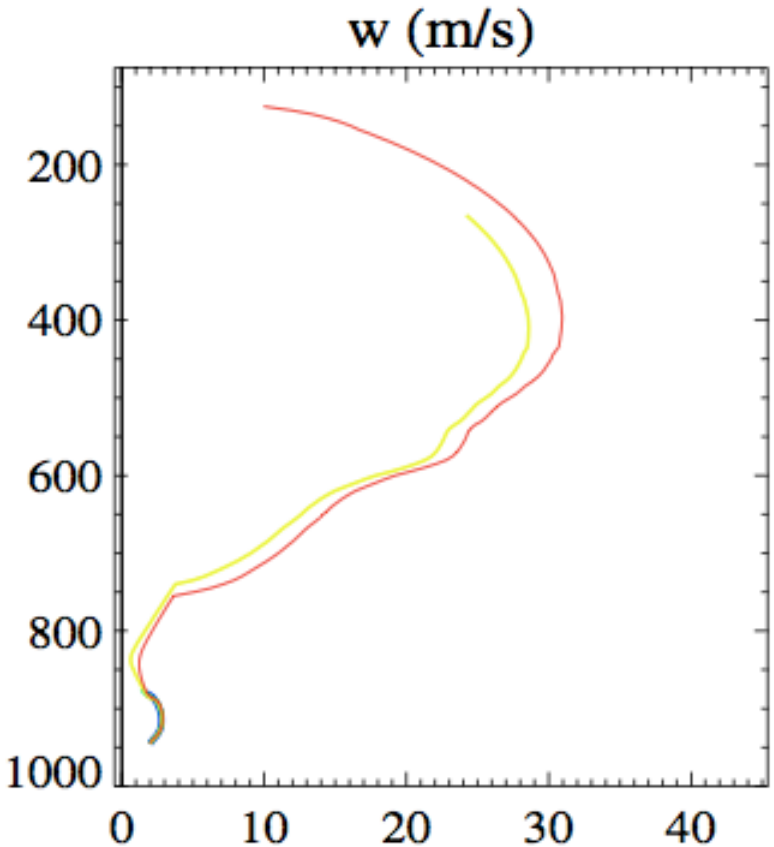
- "Unbiased", if not locally accurate...
- Game-changer for tractability (for me)
  - no time-dep. multiple cloud masses to keep track of!
    - accounting nightmare
      - what to store in memory, conserve, update, expire...
  - Everything (updraft, in/outflow, mixing) is a Mass Flux (kg/m2/s): now it's just plumbing
  - whole plume set rebuilt every time step

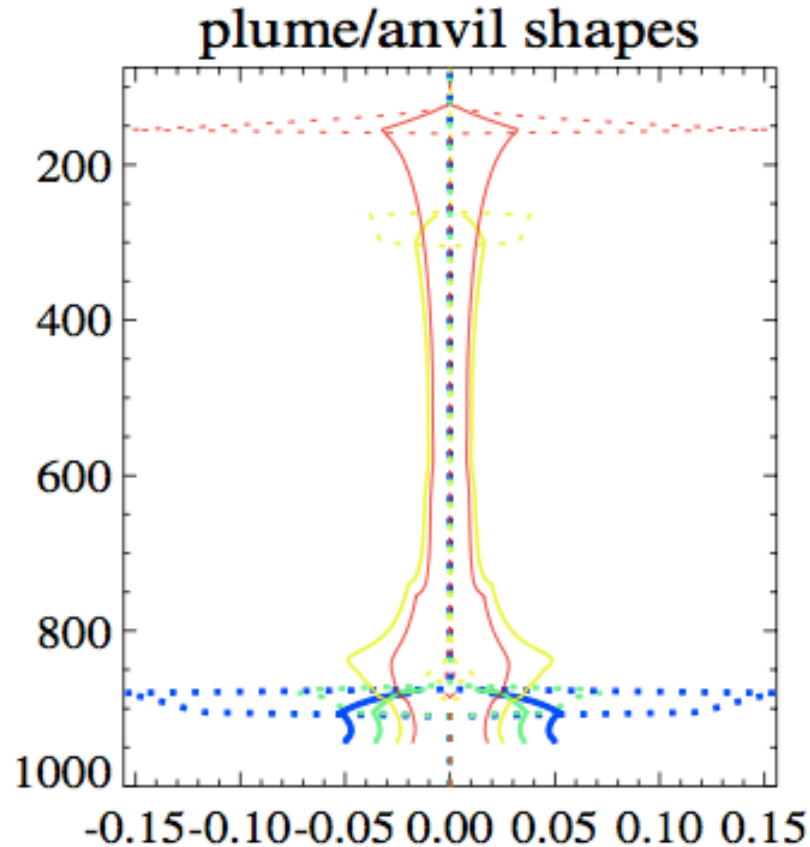
Example: 4 plumes case





Needs adjustments...





help wanted (avail. now)

Convection scheming in a GCM and evaluations thereof...