ALARO microphysics validation (without the convection part)

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LACE

Quick overview

- A quick reminder
- Consistency check
- Water species profiles
- Evaporation and melting
- Wegener Bergeron Findeisen process
- Autoconversion sensitivity
- Hydrometeors from microphysics vs. those from radiation

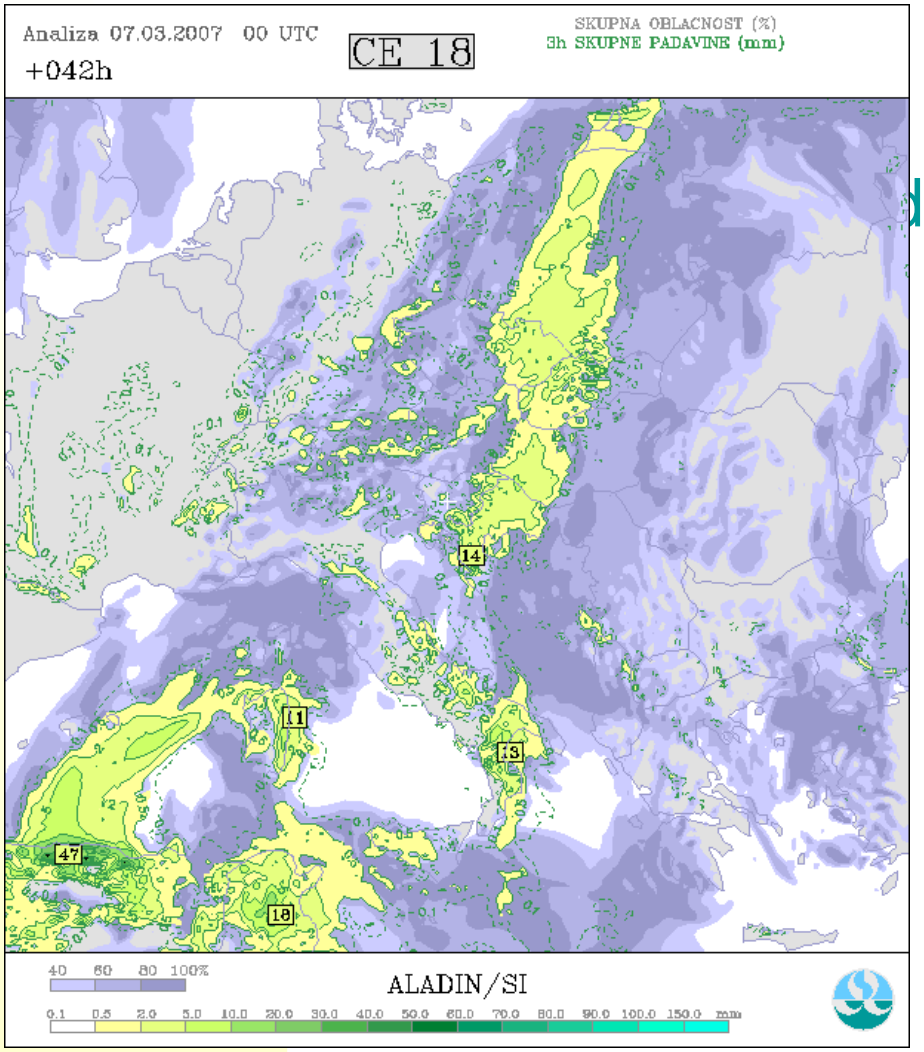
A quick reminder

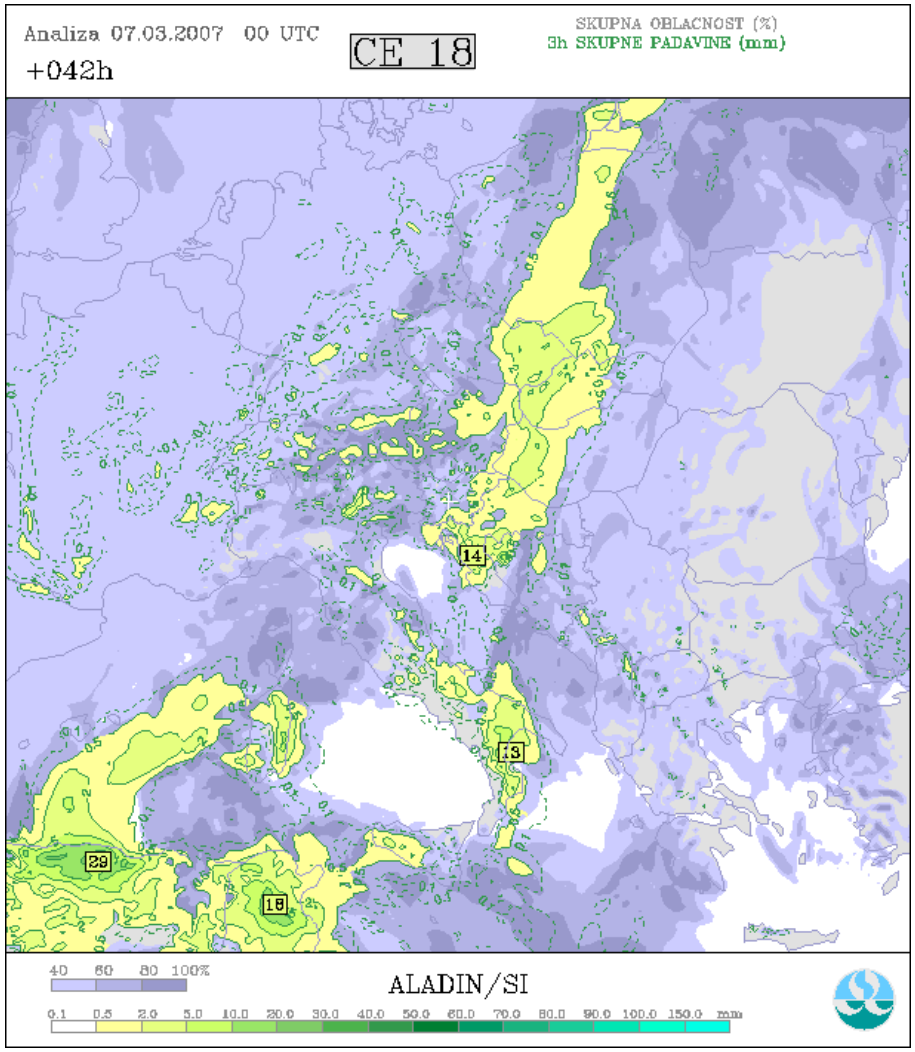
- Mass-weighted framework
- APLMPHYS:

  as close as possible

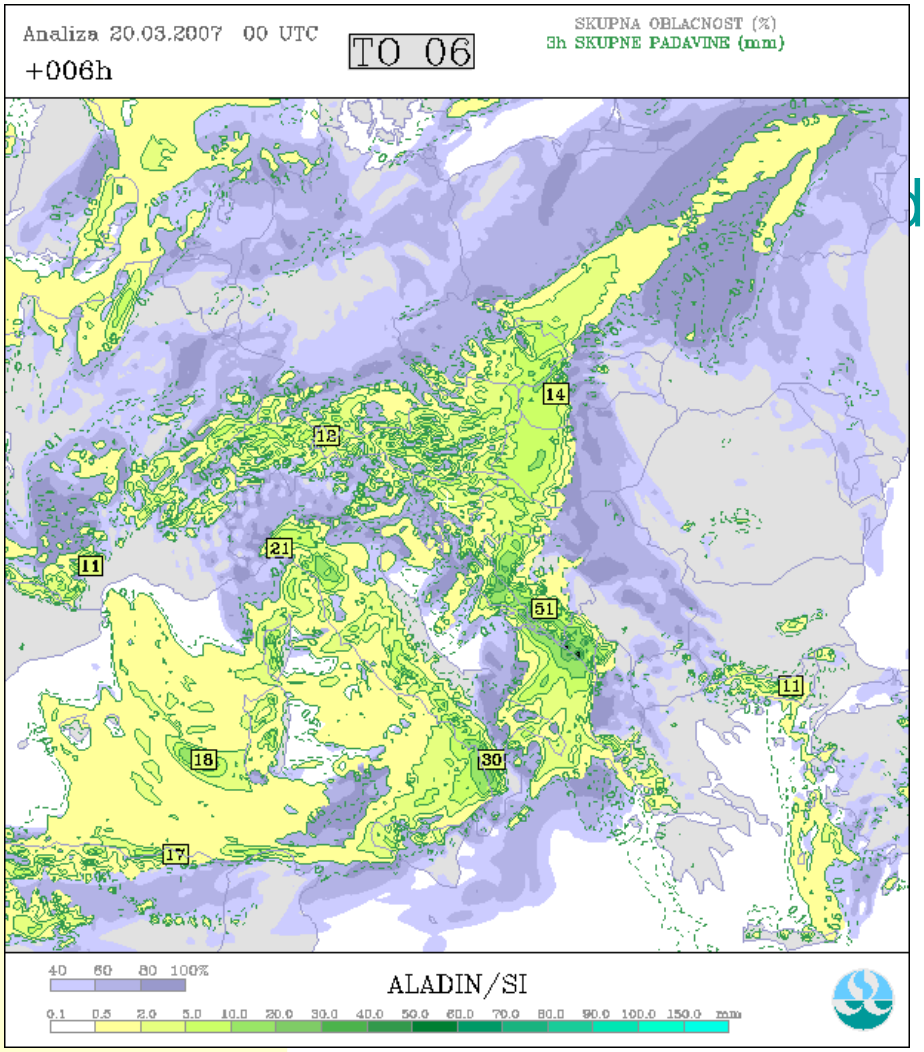
  to ACPLUIE
- But – we need additional processes:
  - statistical sedimentation
  - collection
  - autoconversion
  - Weger Bergeron Findeisen

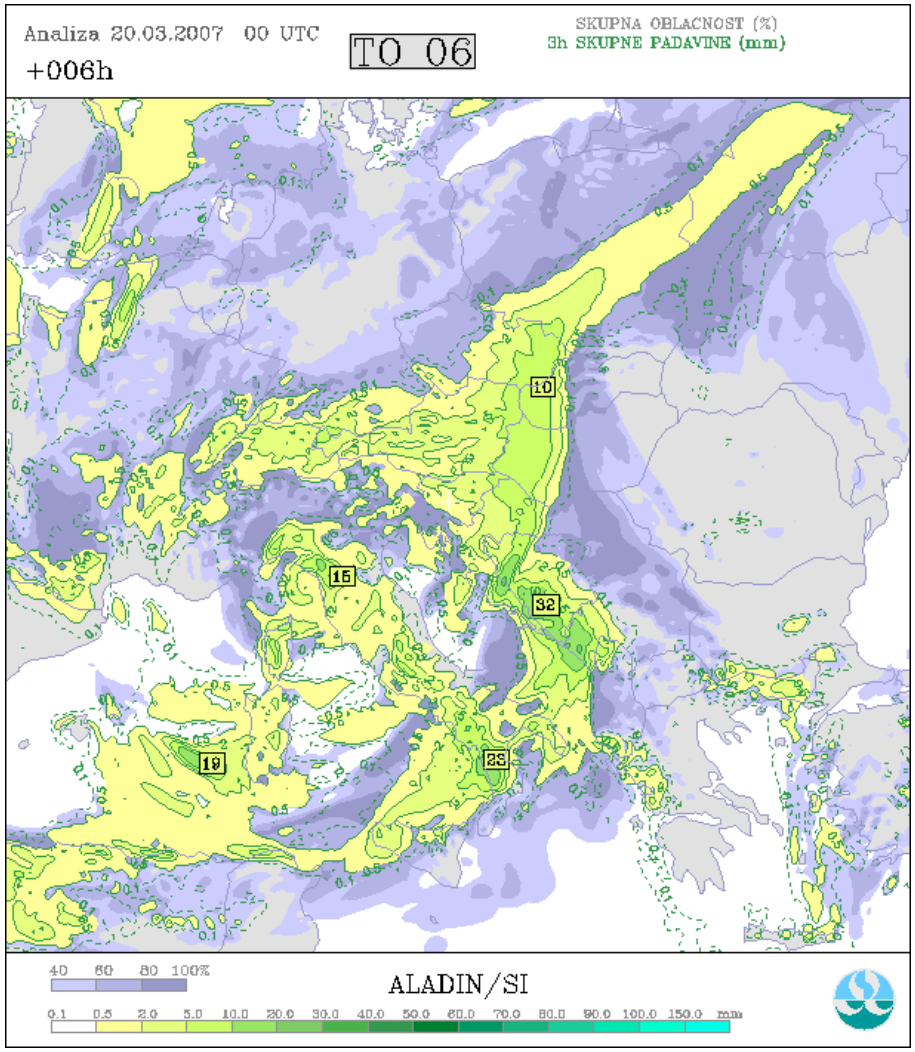
Consistency (1)



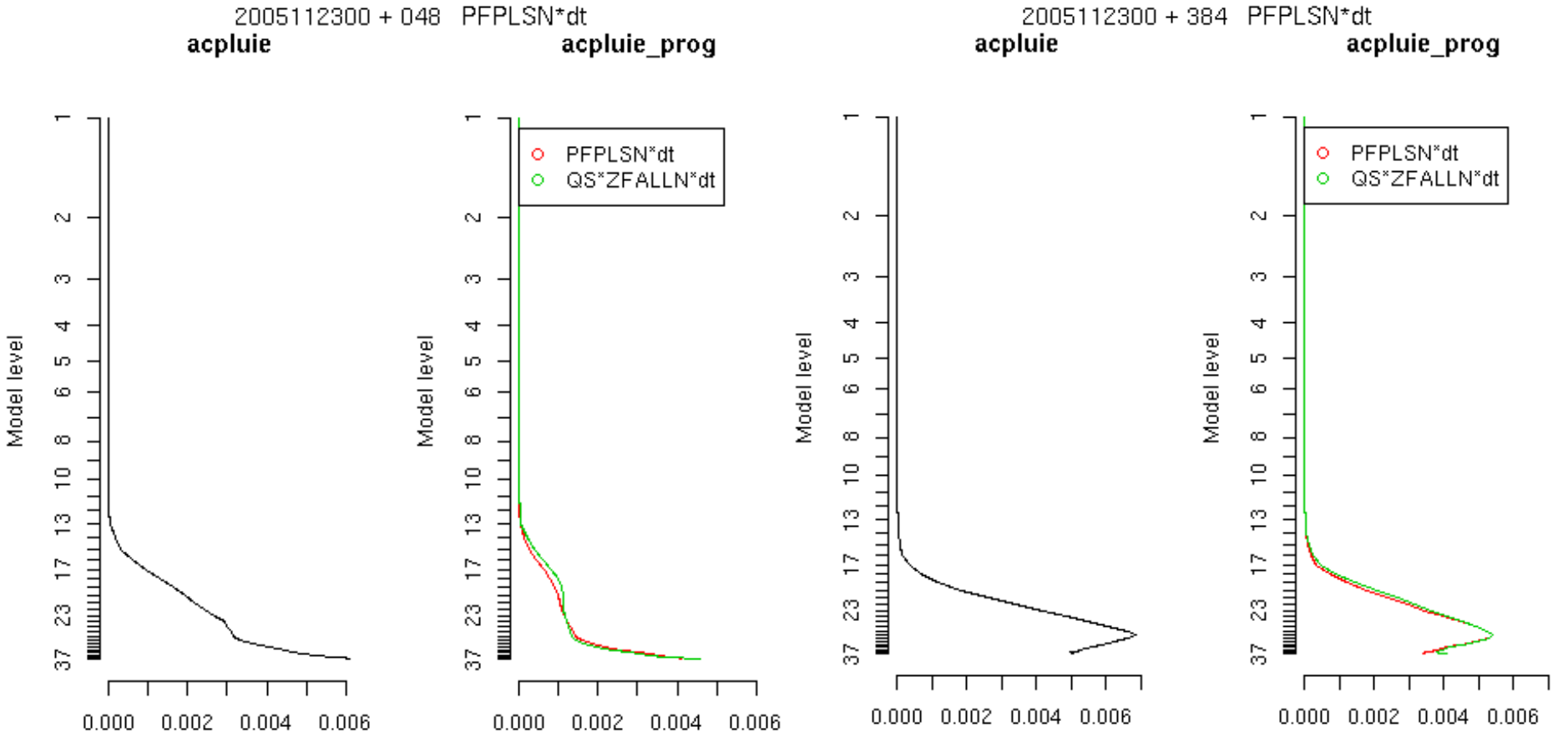


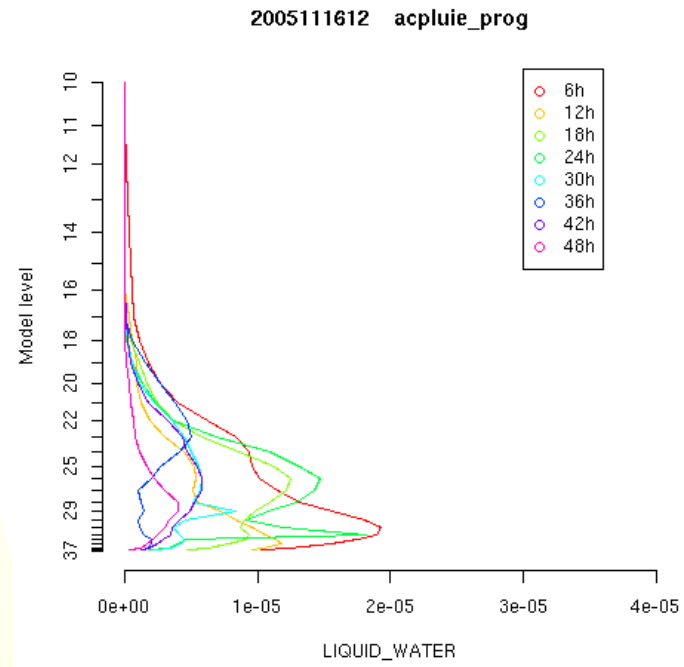
Consistency (2)

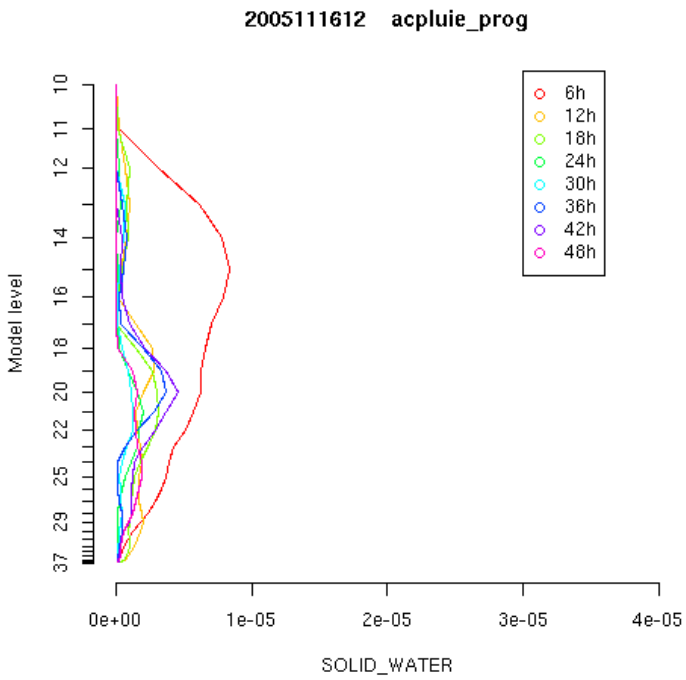




Consistency (3)




2005111612 acpluie_prog
Model level
LIQUID_WATER
6h
12h
18h
24h
30h
36h
42h
48h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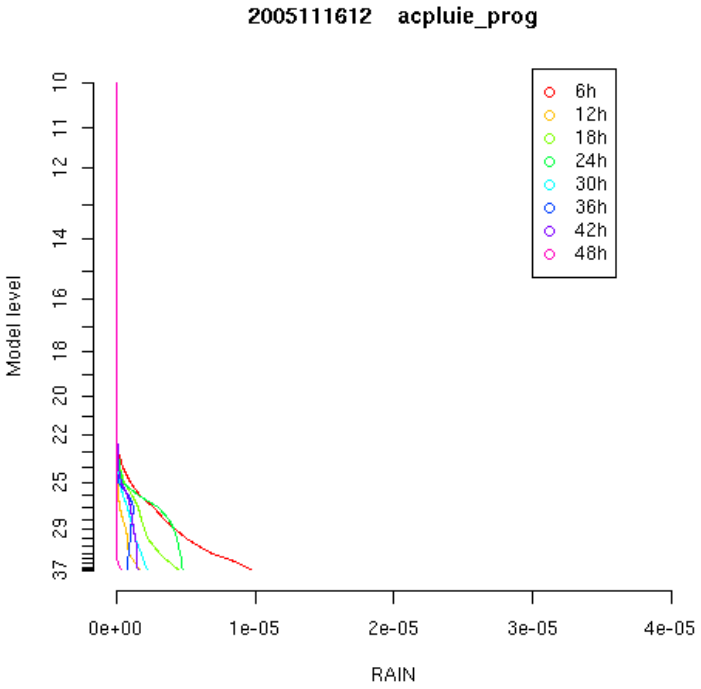
Model level
SOLID_WATER
6h
12h
18h
24h
30h
36h
42h
48h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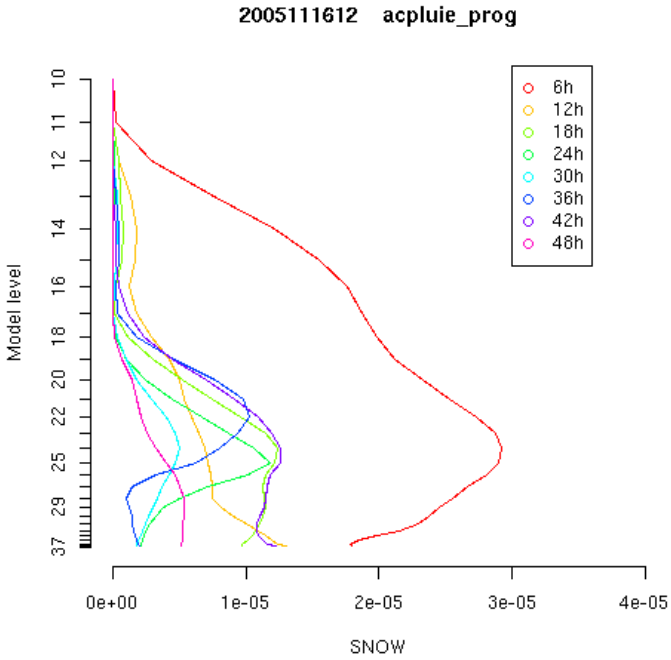
Model level
RAIN
6h
12h
18h
24h
30h
36h
42h
48h


2005111612 acpluie_prog
Model level
SNOW
6h
12h
18h
24h
30h
36h
42h
48h

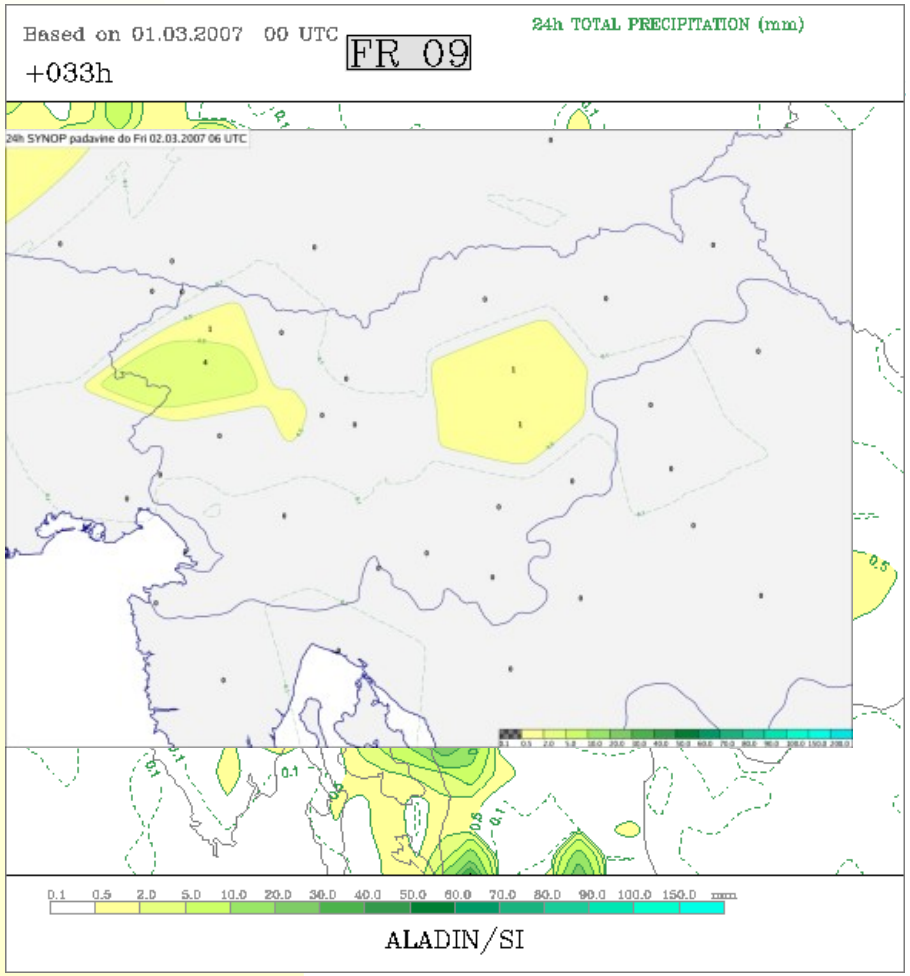
Evaporation and melting (1)

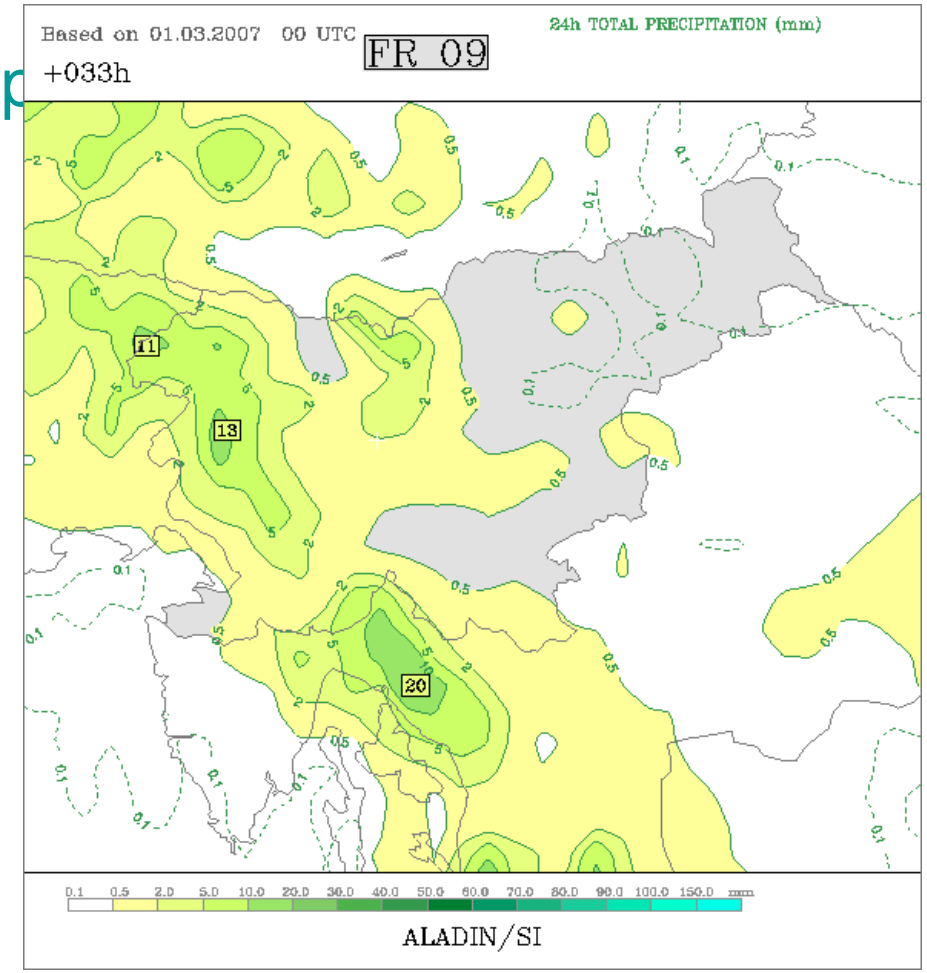
- ACEVMEL

$$\frac{\partial \sqrt{P}}{\partial (1/p)} = E_{vap} . (q_w - q)$$

- Same as in the old scheme, but now with a much more pronounced impact due to advection of water species
- No senstivity test / tuning

Evaporation and melting (2)





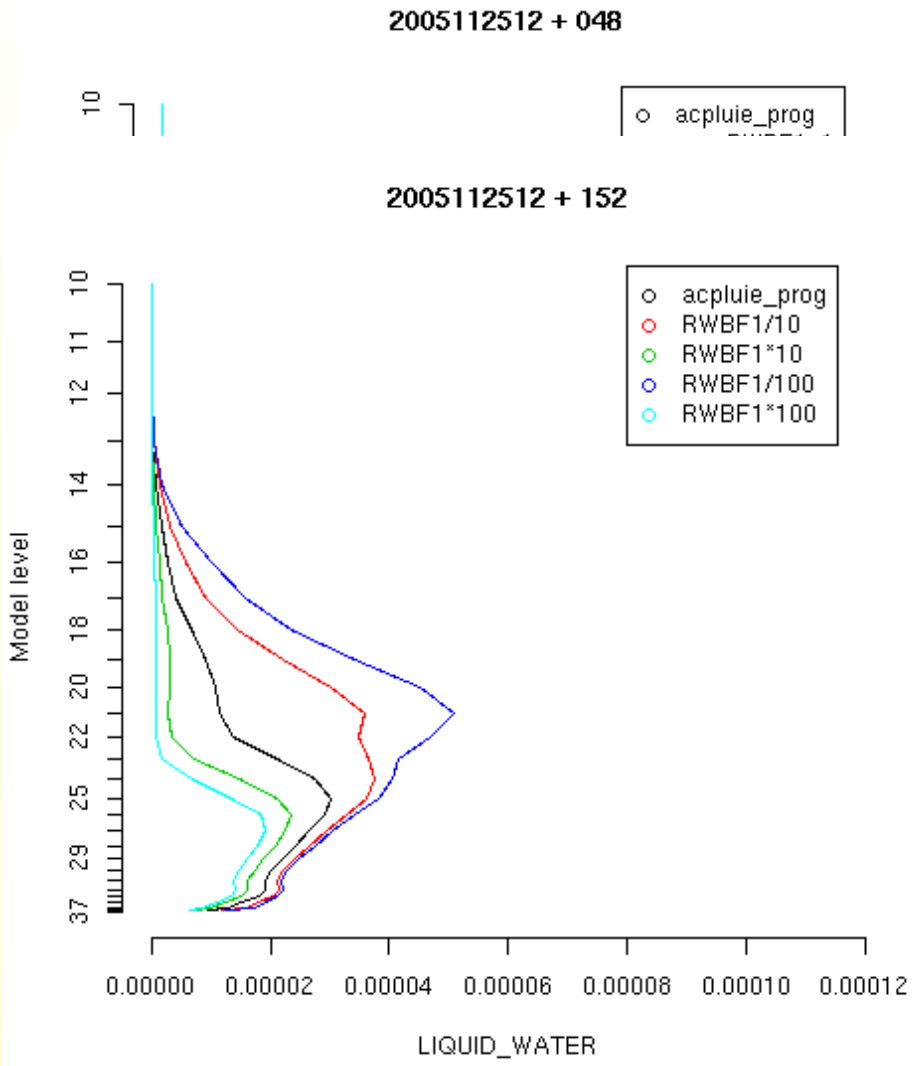
Wegener Bergeron Findeisen

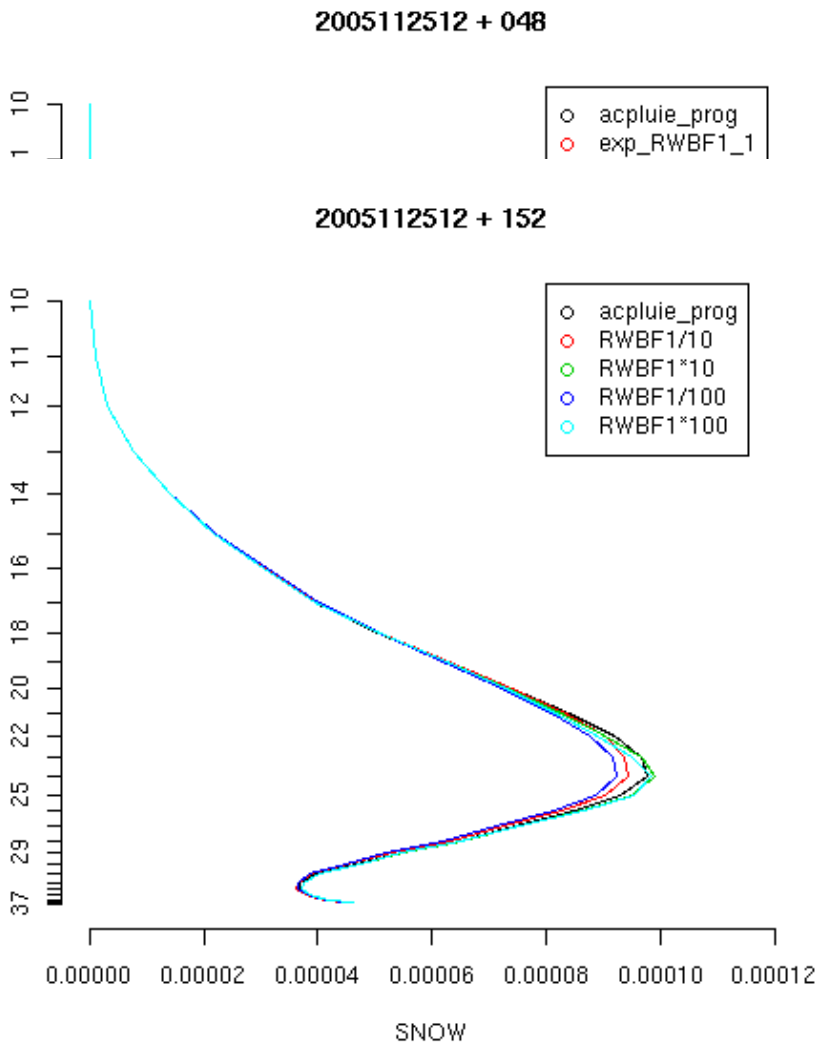
- Directly from cloud droplets to snow

$$\left(\frac{dq_l}{dt}\right)_{WBF} = -F^a_{WBF}\frac{q_l}{\tau_l}\frac{q_l \cdot q_i}{(q_l+q_i)^2}\left[1-e^{-\frac{\pi}{4}\left(\frac{q_l \cdot q_i}{q_l^{cr}.F^b_{WBF}.q_i^{cr}(T).F^b_{WBF}}\right)}\right]$$

- Sensitivity to F^a_{WBF} (RWBF1), initially set to 300.

Wegener Bergeron Findeisen (2)





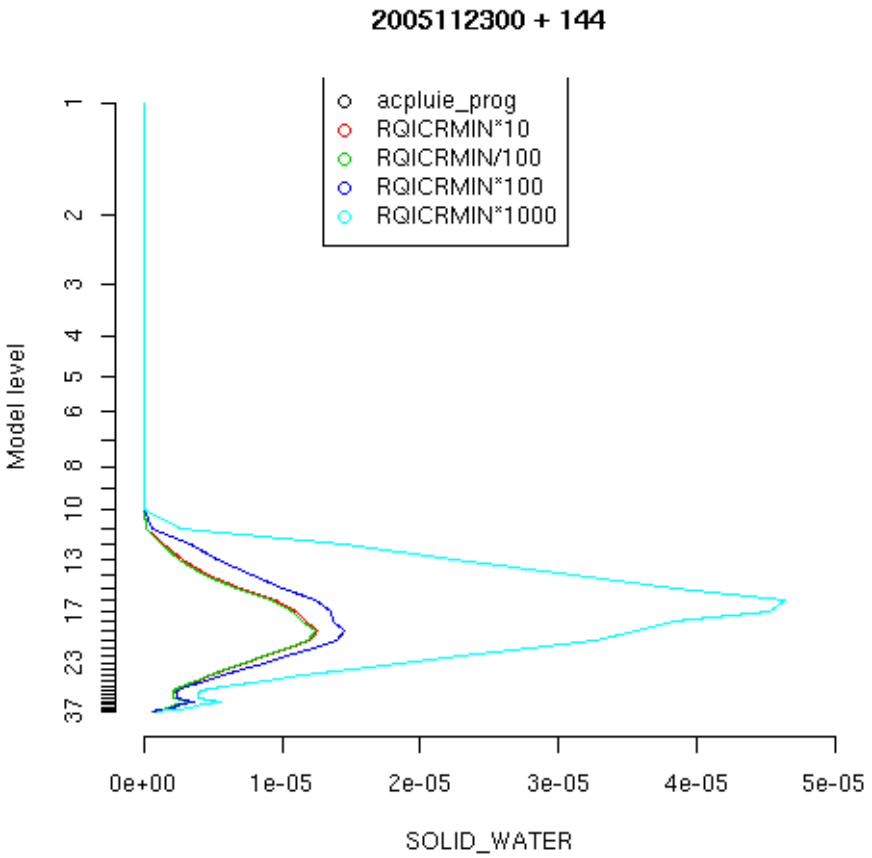
Autoconversion

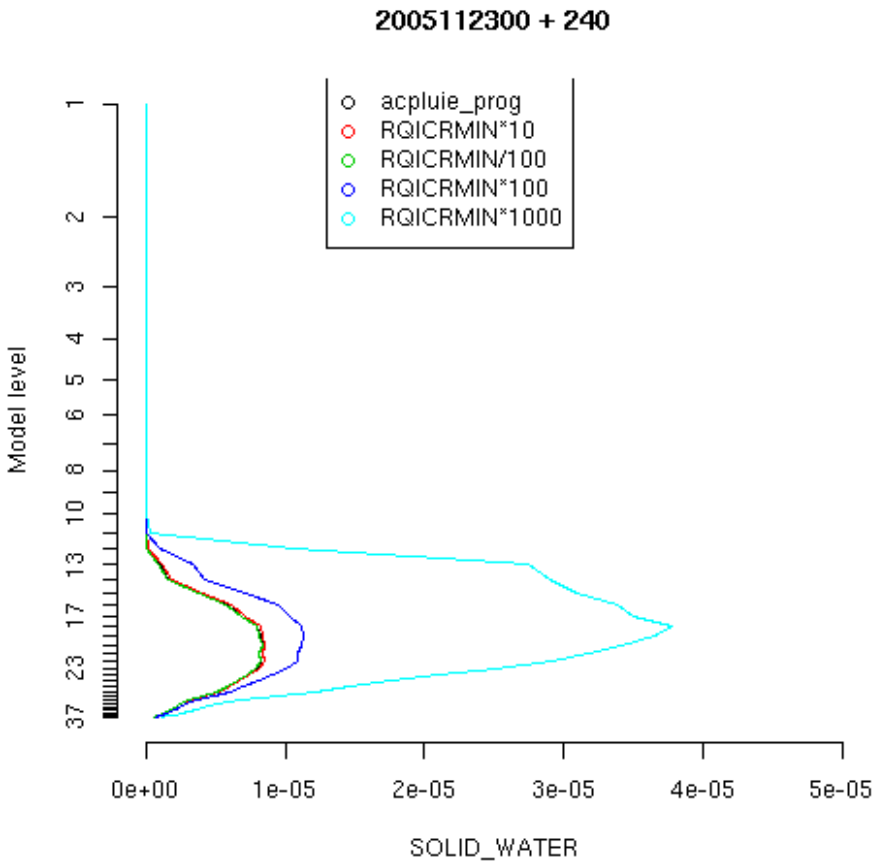
- Simply, with a Sundquist type expression

$$\left(\frac{dq_{l/i}}{dt}\right)_{ACO} = -\frac{q_{l/i}}{\tau_{l/i}(T)}\left[1 - e^{-\frac{\pi}{4}\left(\frac{q_{l/i}}{q_{l/i}^{cr}(T)}\right)^2}\right]$$

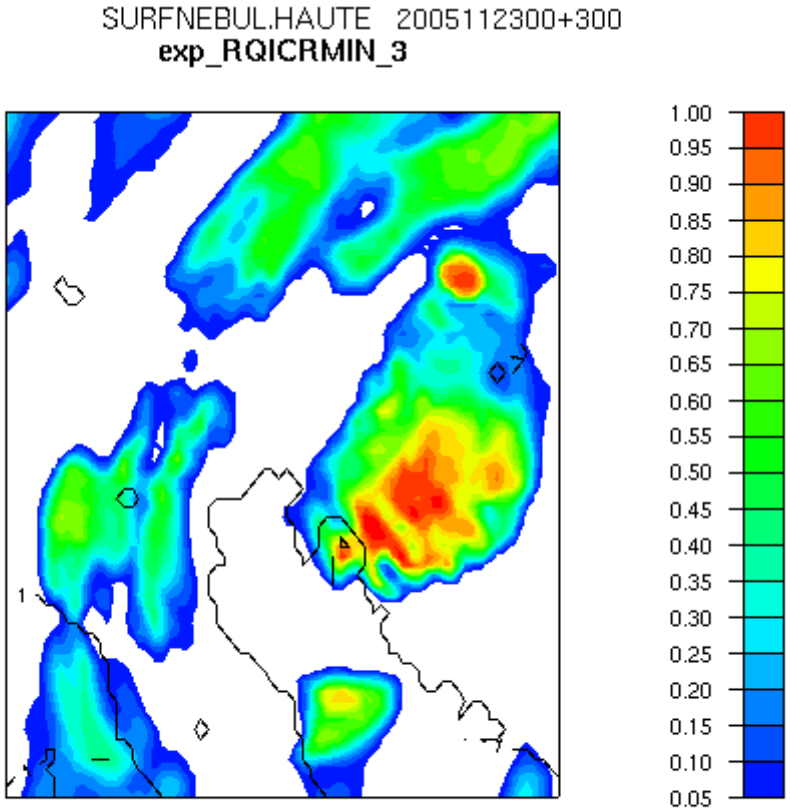
- Sensitivity to $q_{l/i}^{cr} \Leftarrow$ RQICRMIN
- RQICRMIN arbitrarily set to 8.E-7

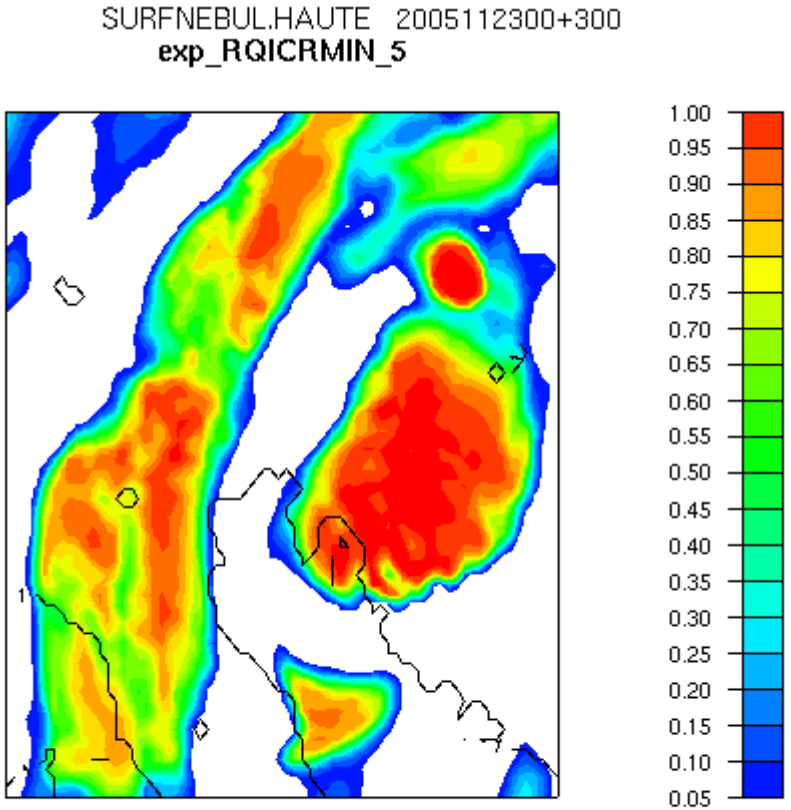
Autoconversion (2)



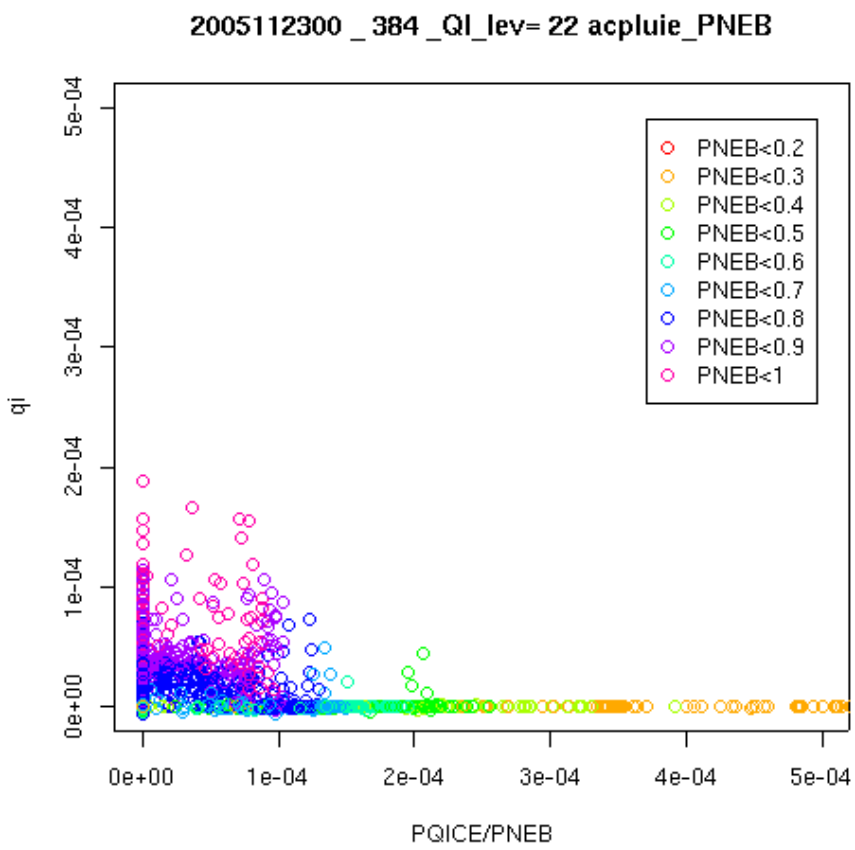


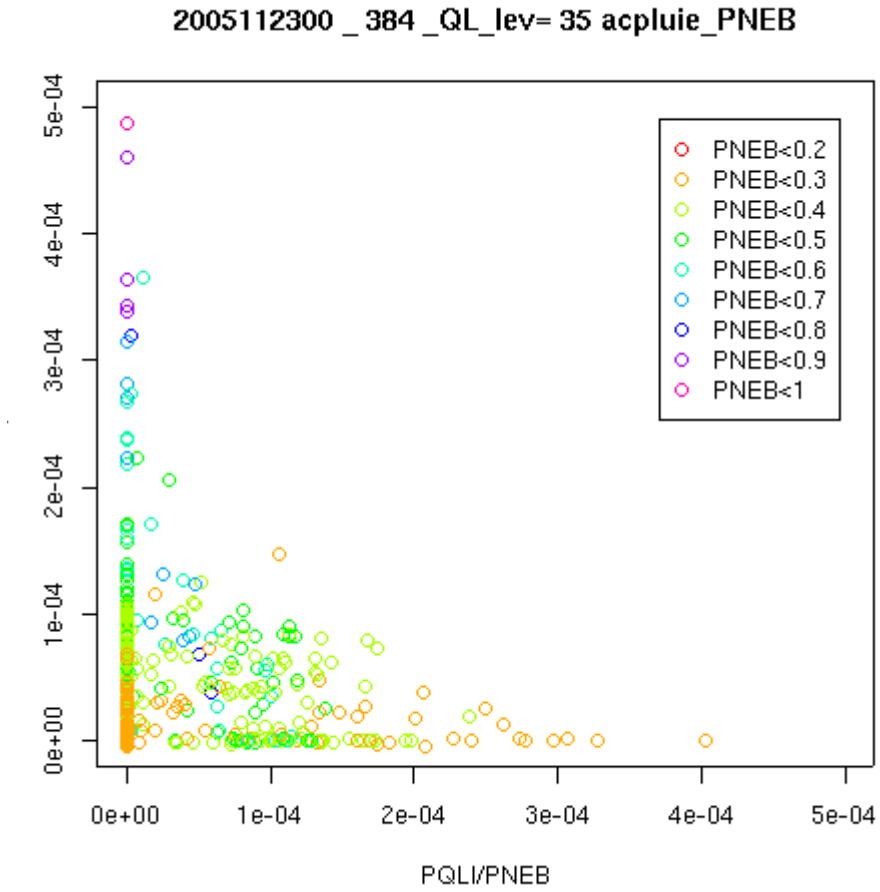
Autoconversion (3)





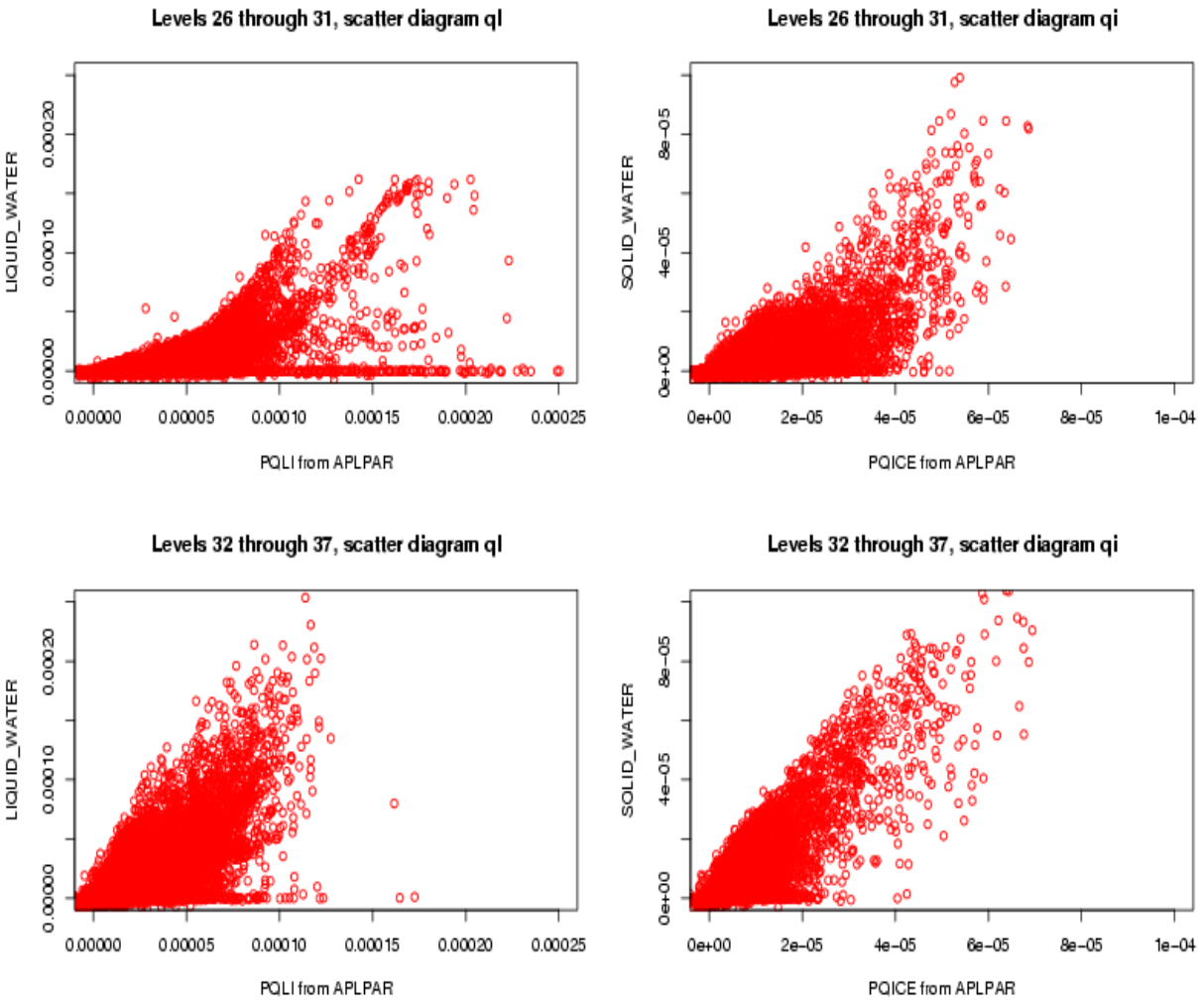
Microphysics and radiation





Microphysics and radiation

ql and qi from microphysics



ql and qi diagnosed in radiation