

# **Convergence of the 3MT deep convection parameterization with the explicit convection at high resolution**

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# Topics

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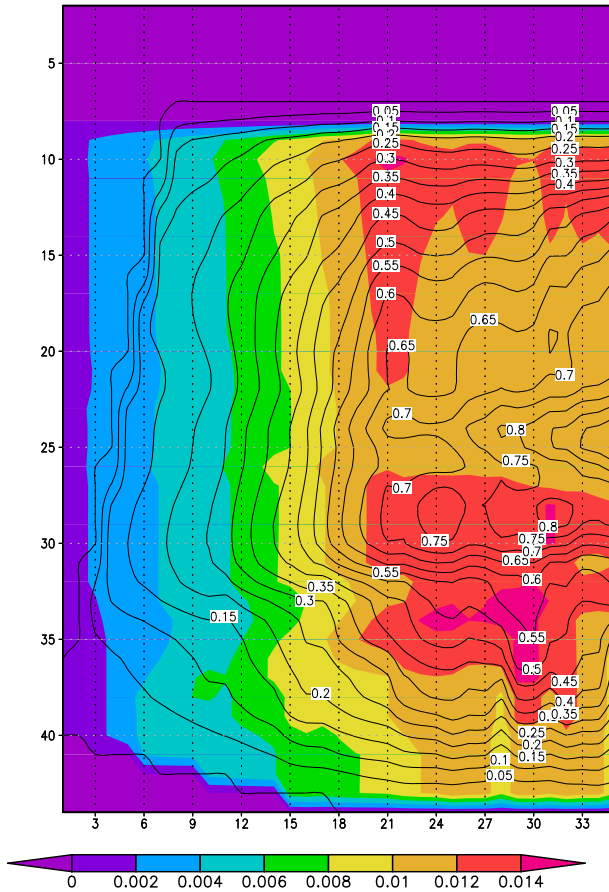
Part I : Cloud evolution.

Part II : Closure.

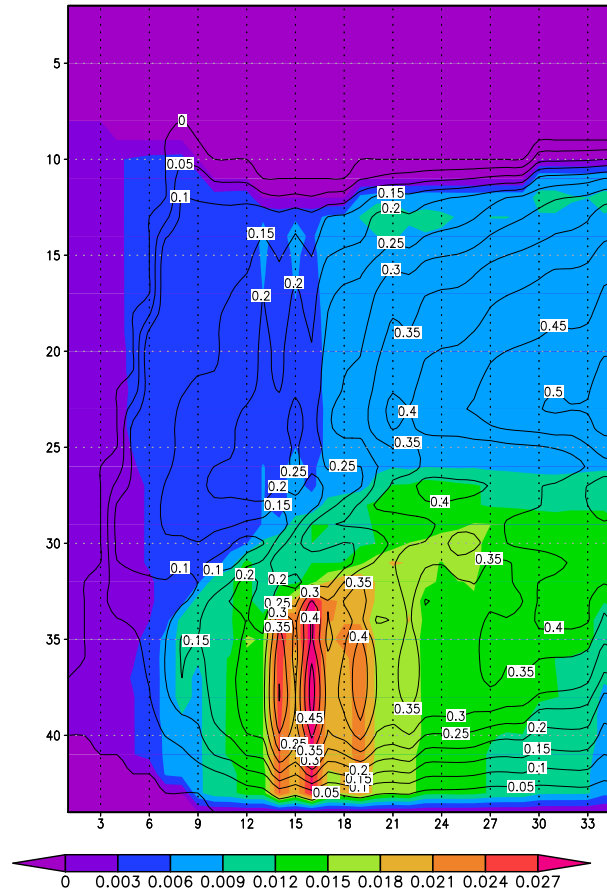
Part III : Preliminary Results.

# Single Column experiments

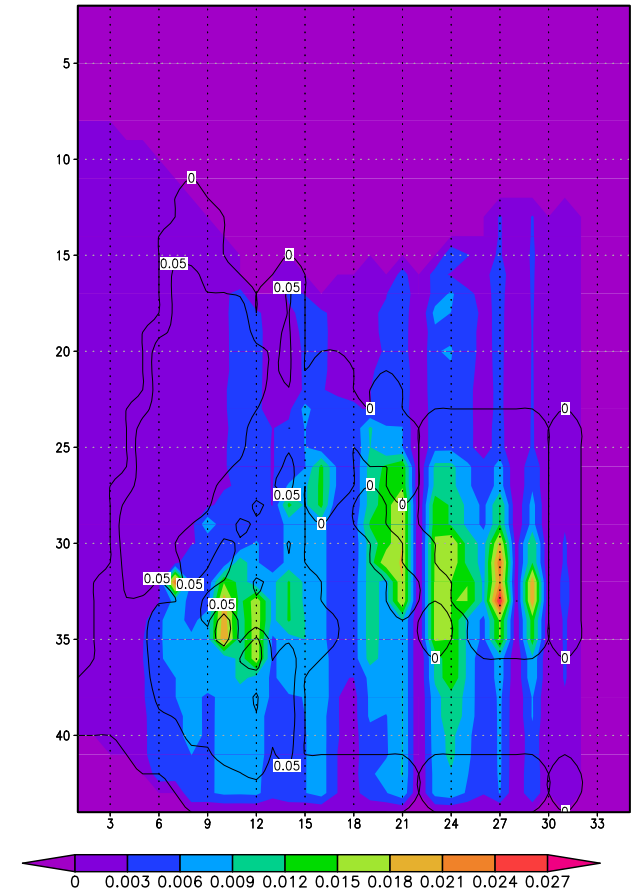
Mesh fraction, transport mass flux (Pa/s)  
(sampled every 12 min)



$\Delta x = 60$  km,  $\Delta t = 144$  s.



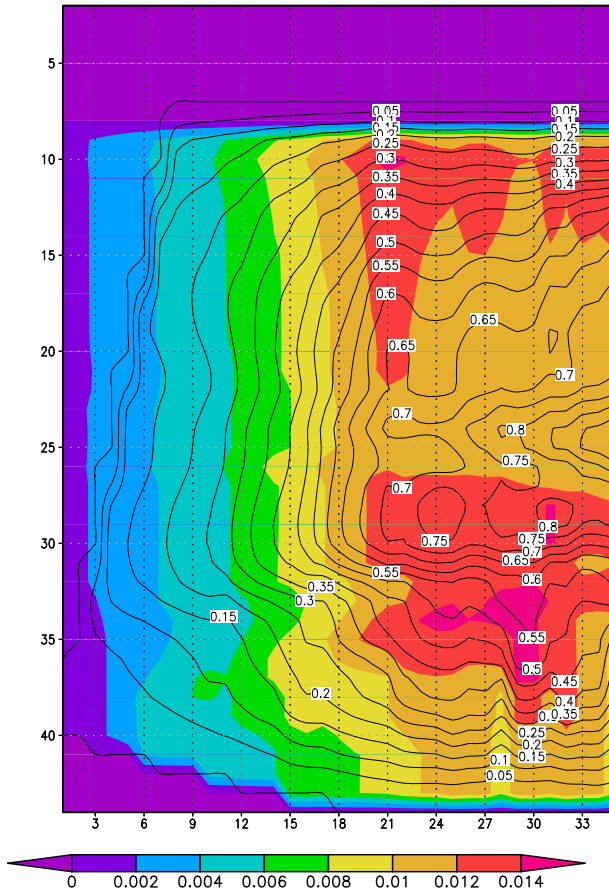
$\Delta x = 15$  km,  $\Delta t = 36$  s.



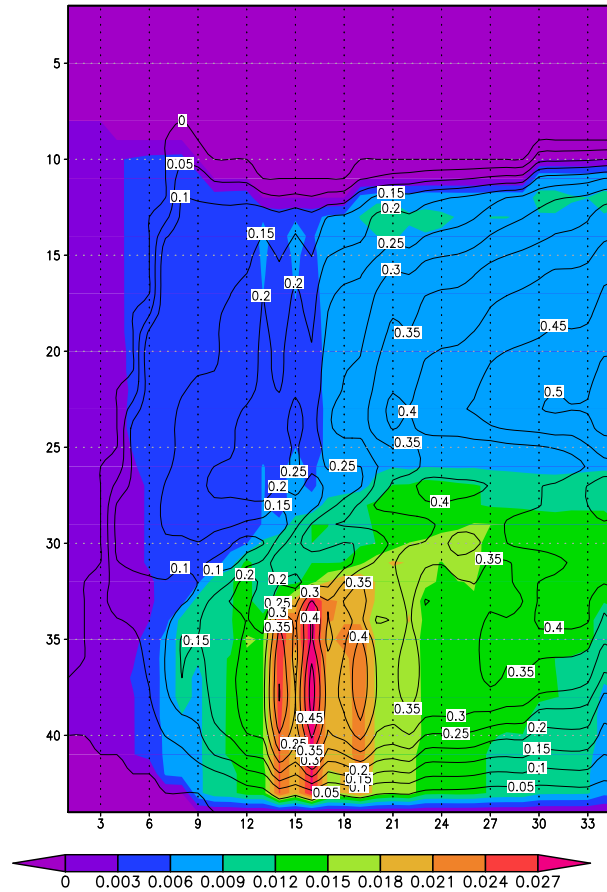
$\Delta x = 4$  km,  $\Delta t = 9$  s.

# Single Column experiments

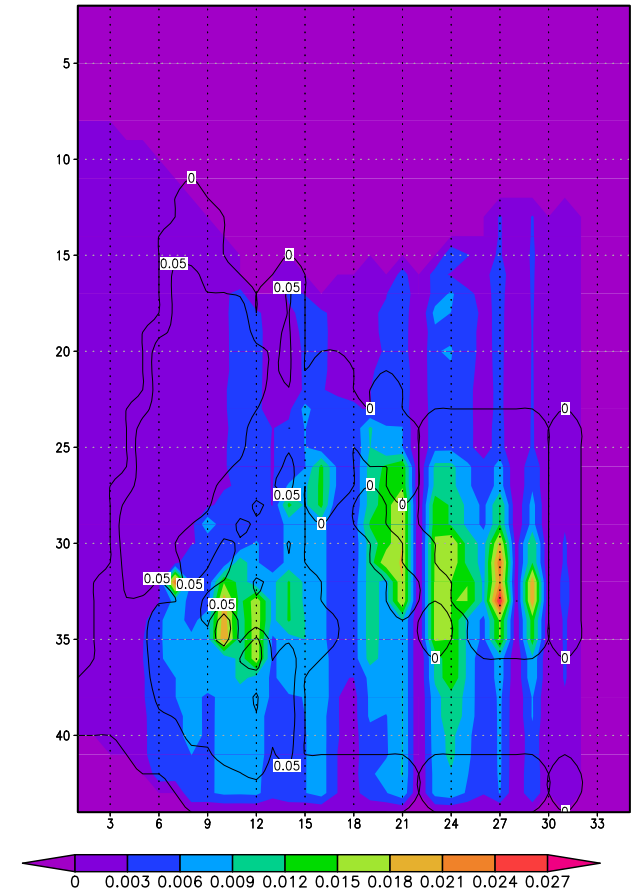
Mesh fraction, transport mass flux (Pa/s)  
(sampled every 12 min)



$\Delta x = 60$  km,  $\Delta t = 144$  s.

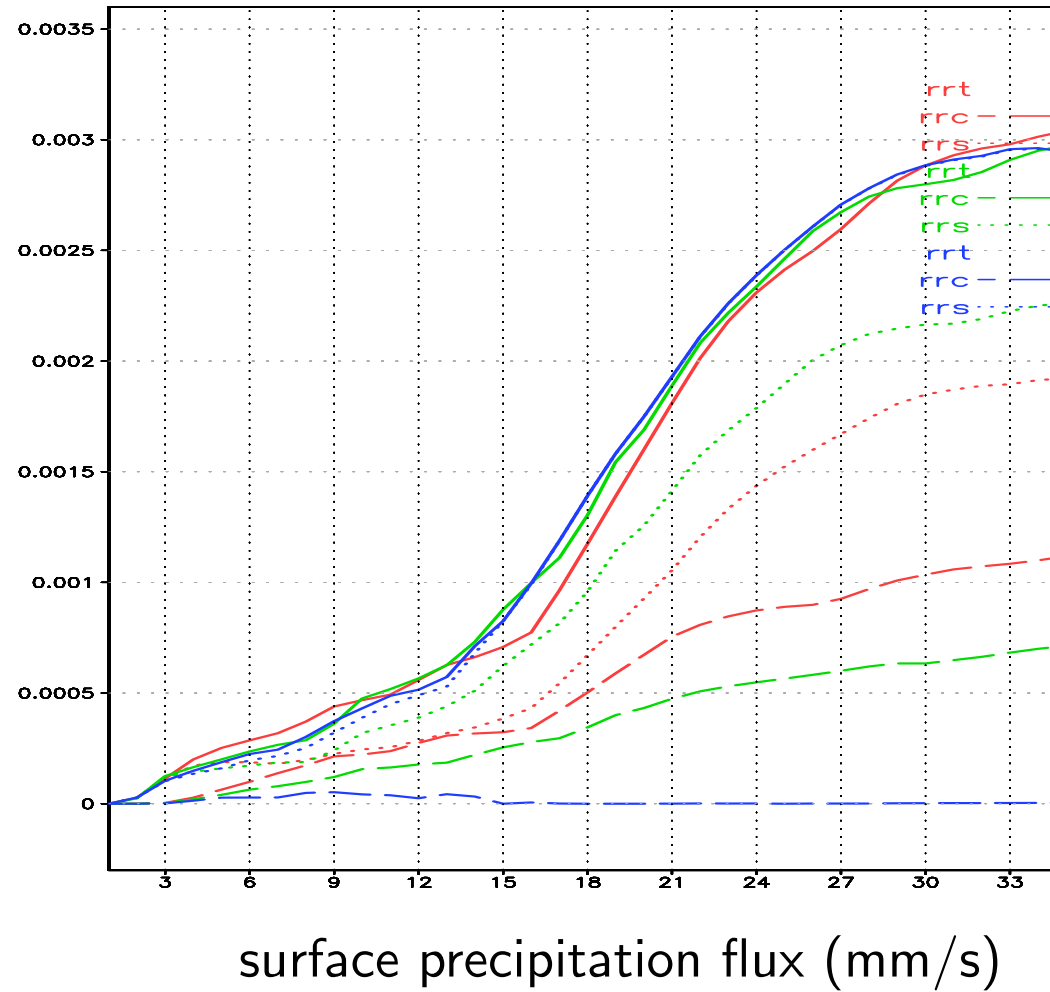


$\Delta x = 15$  km,  $\Delta t = 36$  s.



$\Delta x = 4$  km,  $\Delta t = 9$  s.

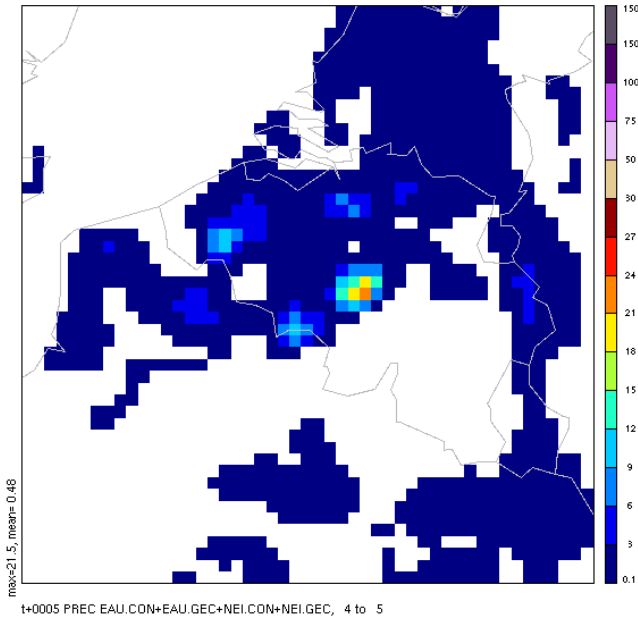
# Single Column experiments(2)



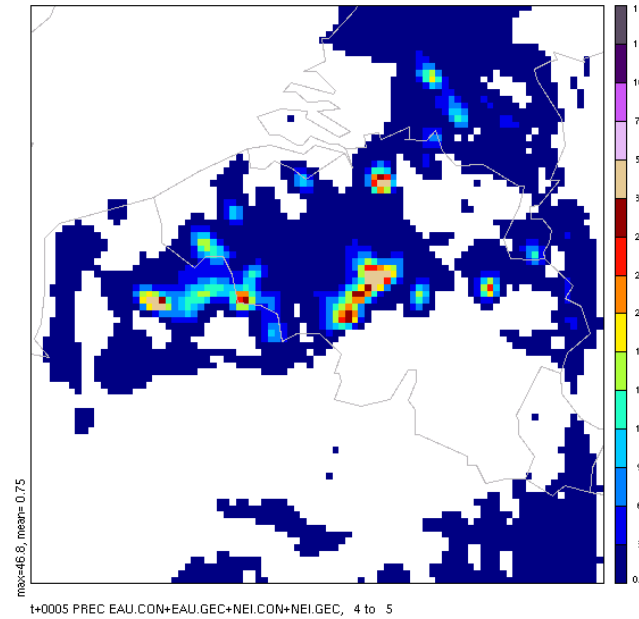
# 3D multi-scale study

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t8F : 2005/9/10 z12:0 +5h

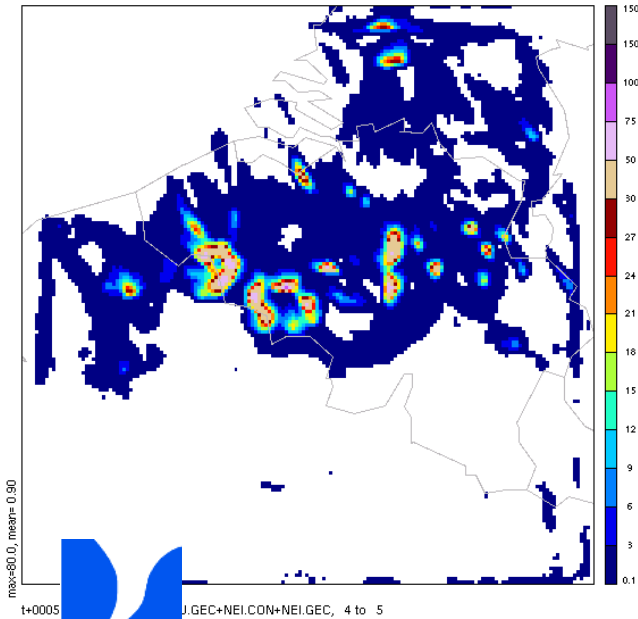


t4F : 2005/9/10 z12:0 +5h

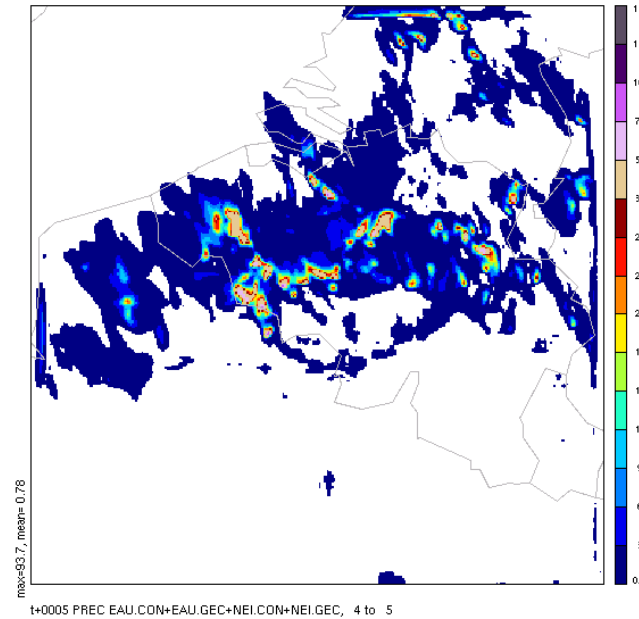


1h-accumulated  
total precipitation (mm)

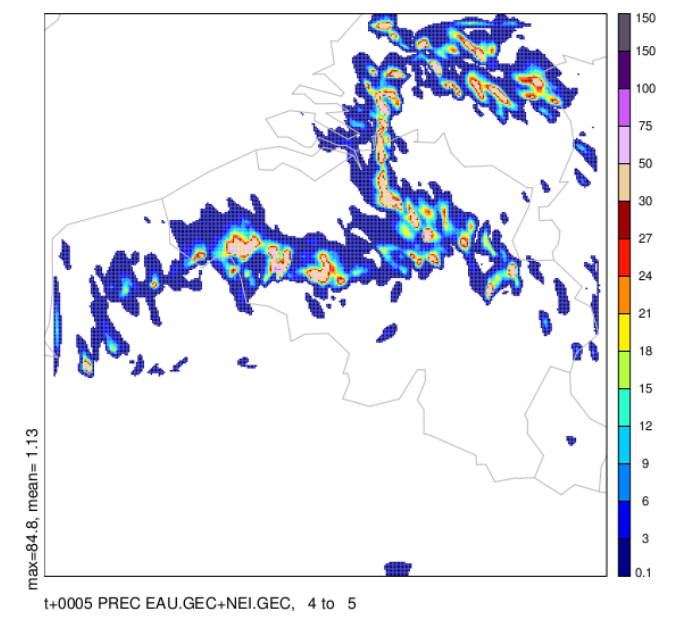
t2F : 2005/9/10 z12:0 +5h



t1F : 2005/9/10 z12:0 +5h



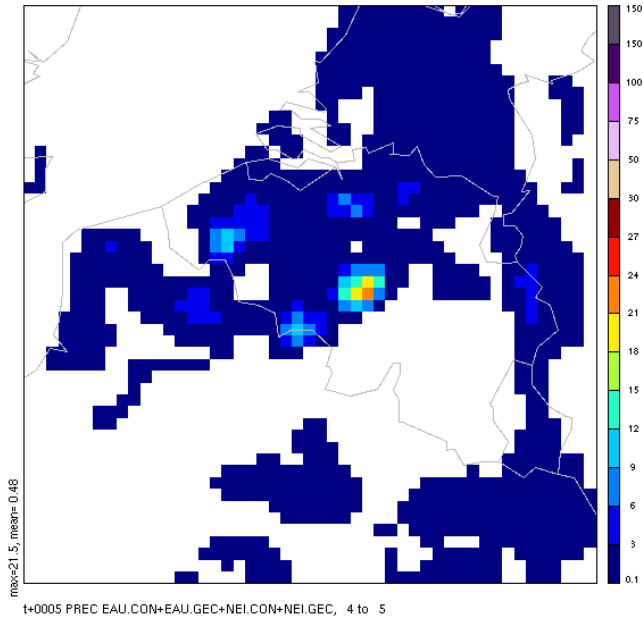
t1nocxr : 2005/9/10 z12:0 +5h



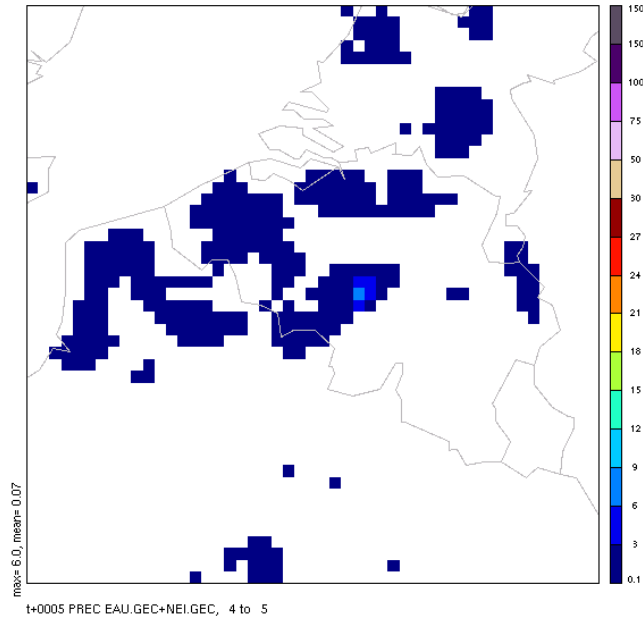


# 3D multi-scale study

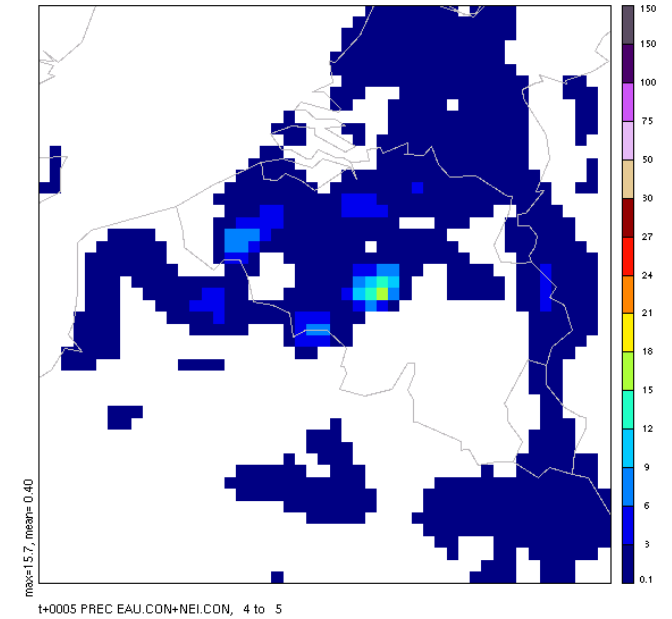
t8F : 2005/9/10 z12:0 +5h



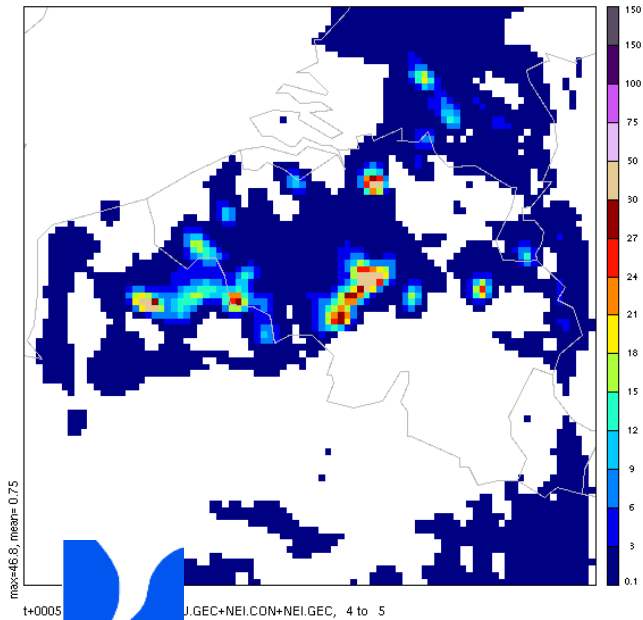
t8F : 2005/9/10 z12:0 +5h



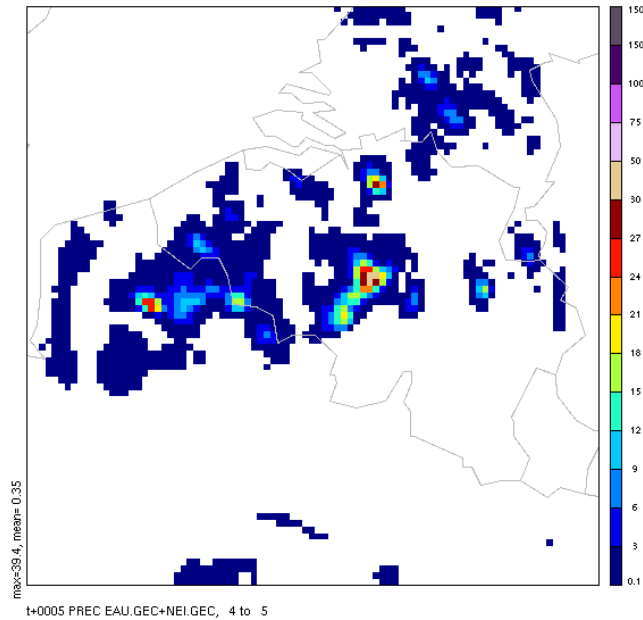
t8F : 2005/9/10 z12:0 +5h



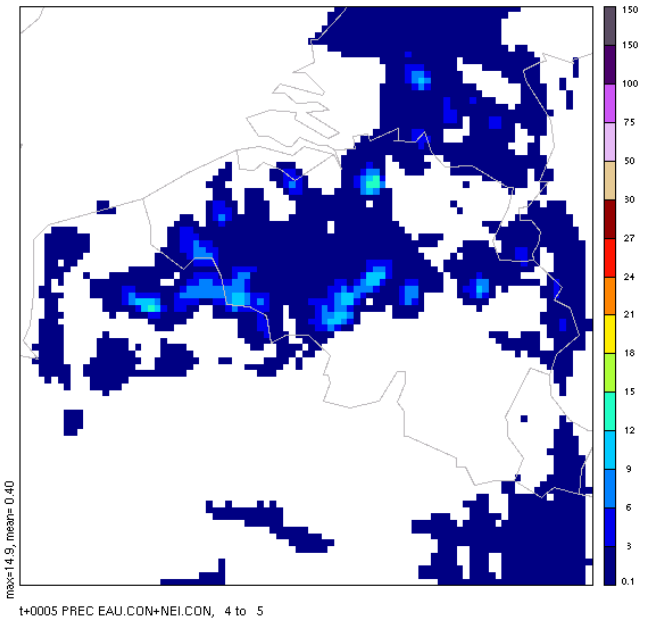
t4F : 2005/9/10 z12:0 +5h



t4F : 2005/9/10 z12:0 +5h

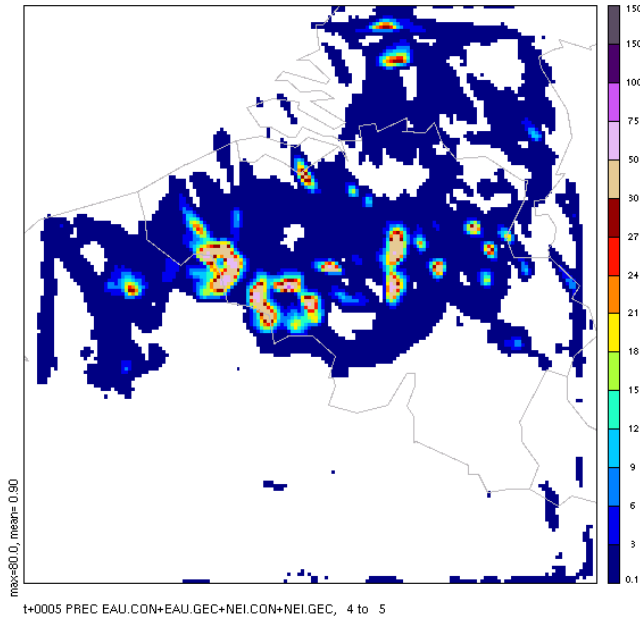


t4F : 2005/9/10 z12:0 +5h

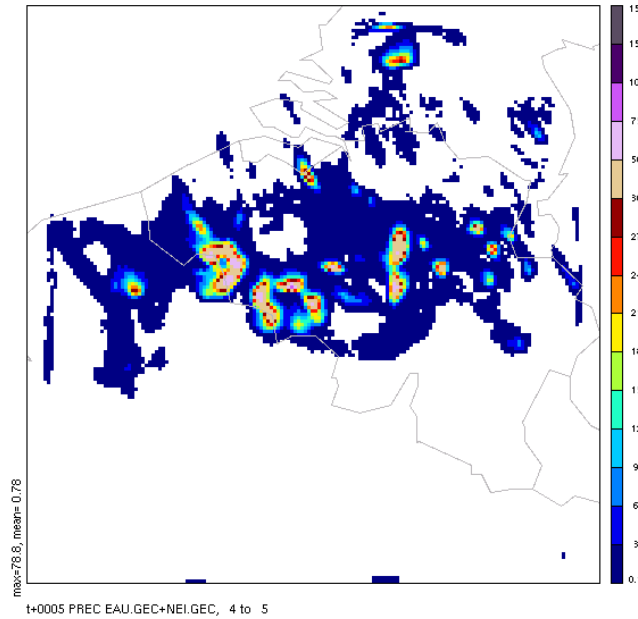


# 3D multi-scale study

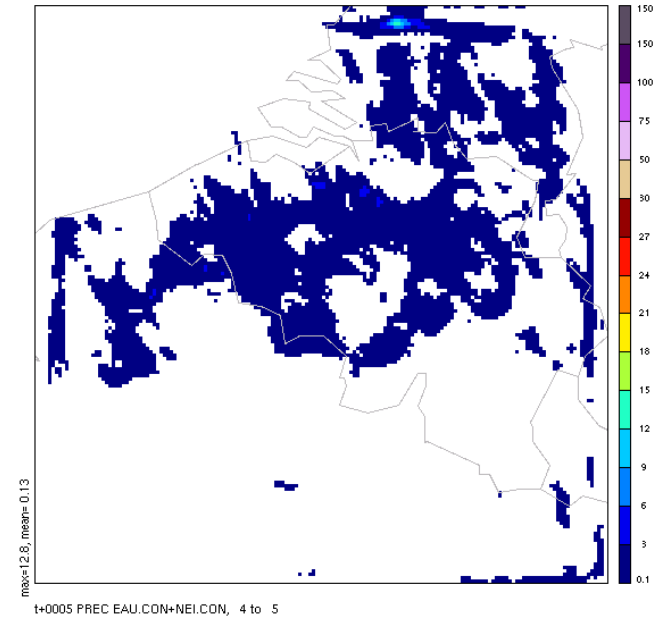
t2F : 2005/9/10 z12:0 +5h



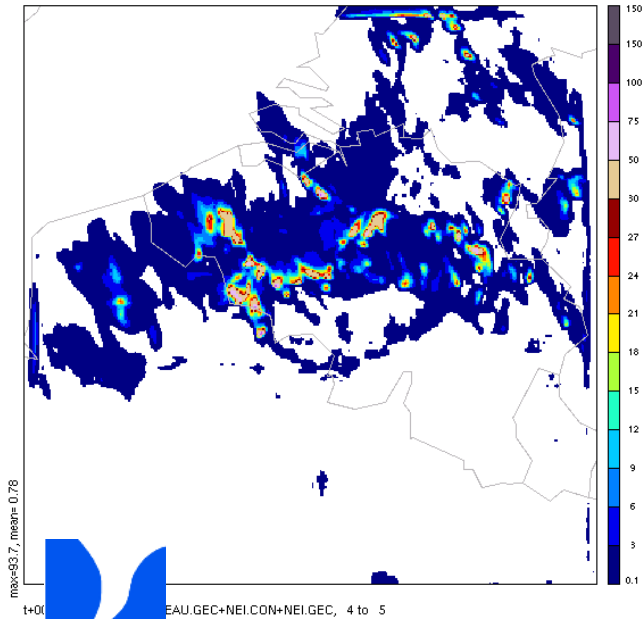
t2F : 2005/9/10 z12:0 +5h



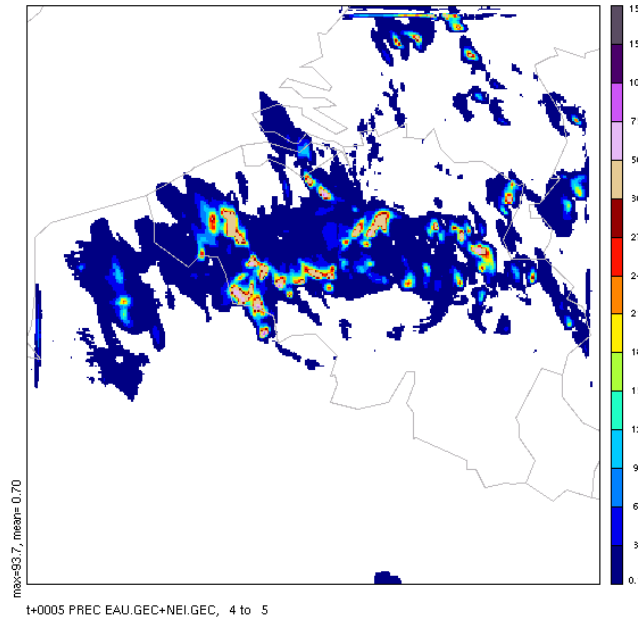
t2F : 2005/9/10 z12:0 +5h



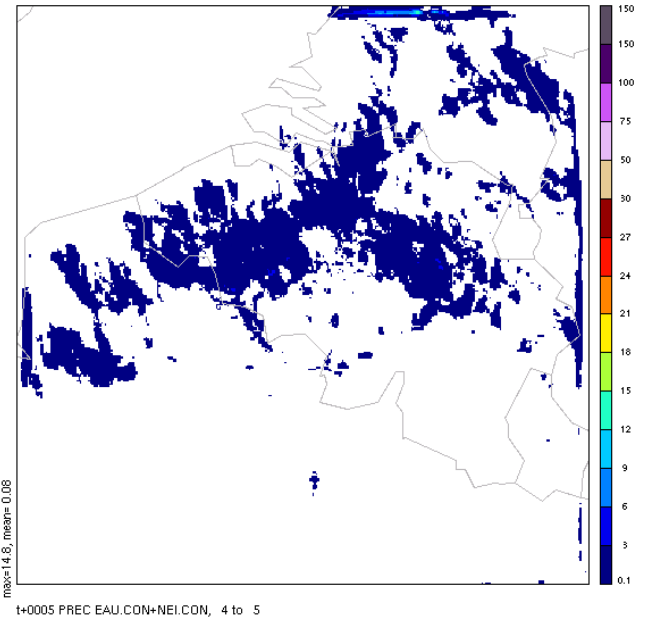
t1F : 2005/9/10 z12:0 +5h



t1F : 2005/9/10 z12:0 +5h



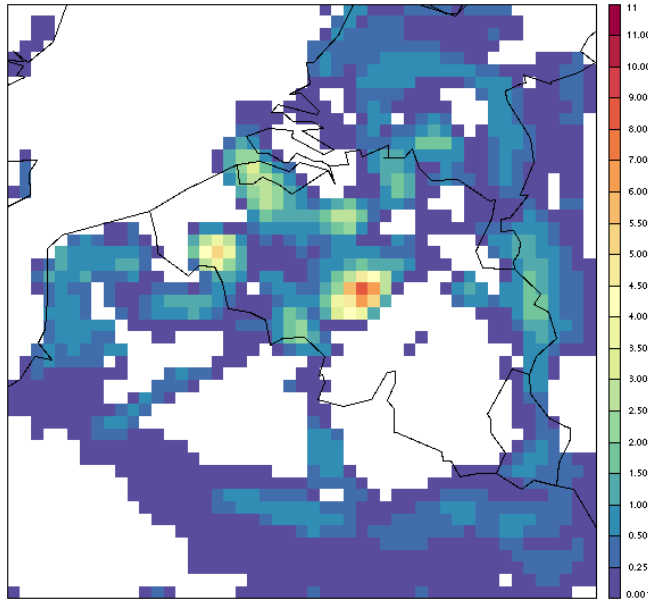
t1F : 2005/9/10 z12:0 +5h



# Instantaneous diagnostics

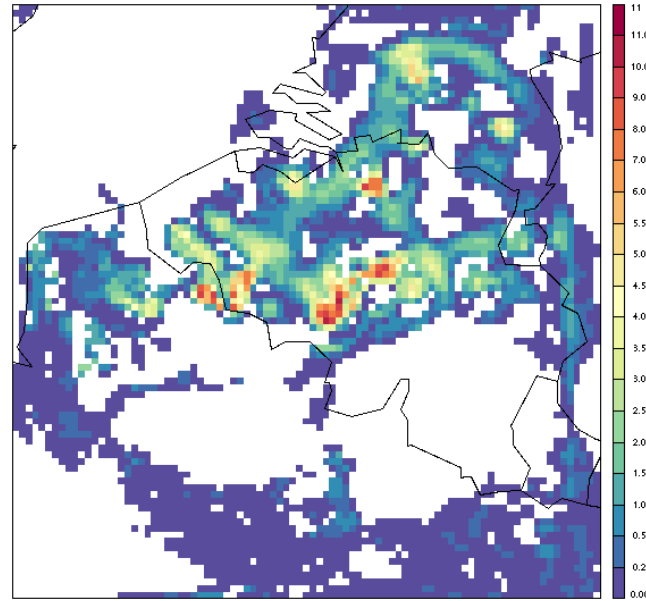
# Instantaneous diagnostics

max 10-41 S010ZFORA1\_ACCVU  
2005/9/10 z12:0 +5h



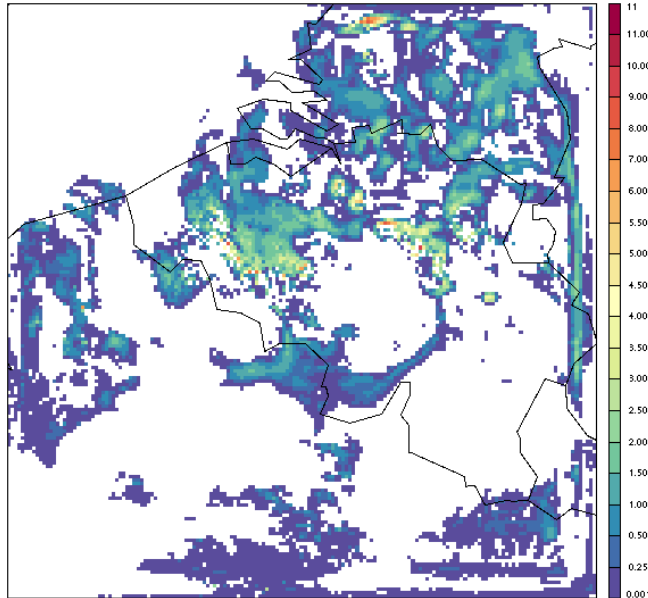
0<= Mu<= 8.55 Pa/s, average= 0.25 Pa/s

max 10-41 S010ZFORA1\_ACCVU  
2005/9/10 z12:0 +5h



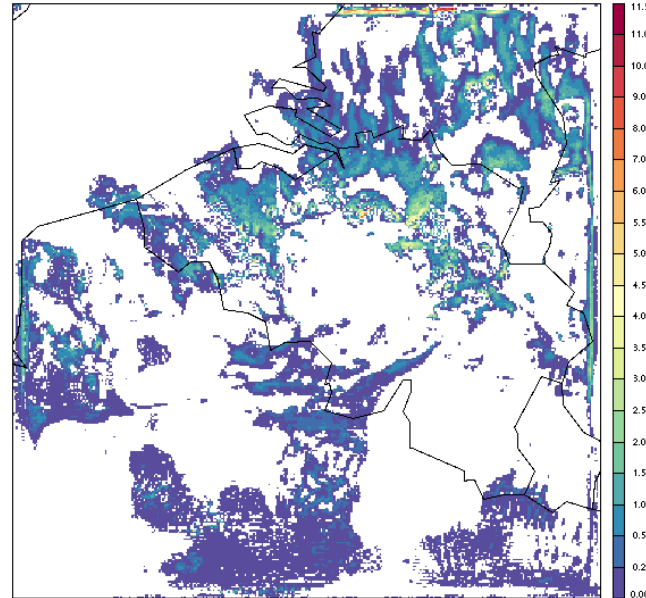
0<= Mu<= 10.5 Pa/s, average= 0.318 Pa/s

max 10-41 S010ZFORA1\_ACCVU  
2005/9/10 z12:0 +5h



0<= Mu<= 9.89 Pa/s, average= 0.176 Pa/s

max 10-41 S010ZFORA1\_ACCVU  
2005/9/10 z12:0 +5h

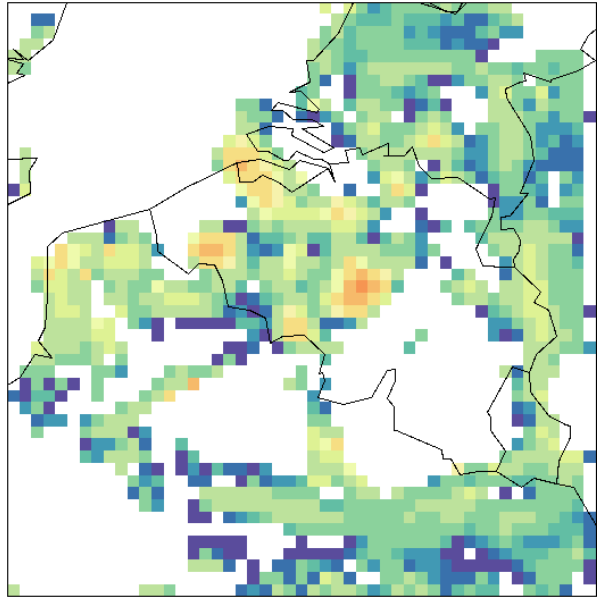


0<= Mu<= 11.6 Pa/s, average= 0.126 Pa/s

Maximum  
updraught  
mass flux  
in the column

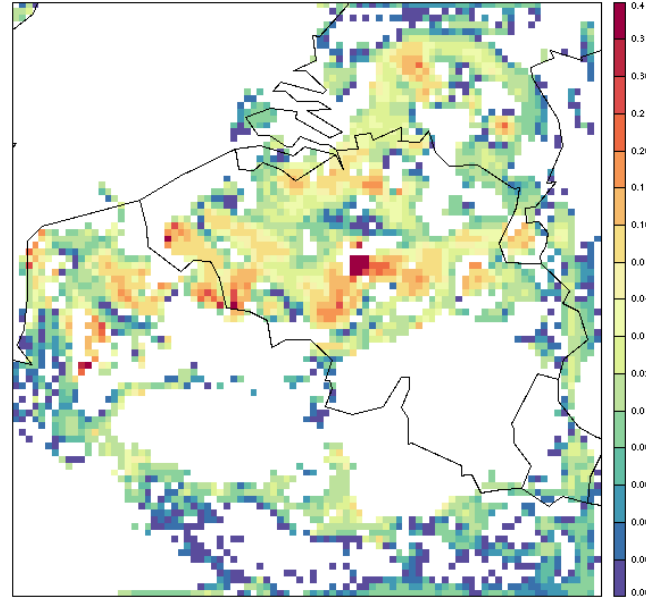
# Instantaneous diagnostics

max 10-41 S010PUDAL1\_ACCVU  
2005/9/10 z12:0 +5h



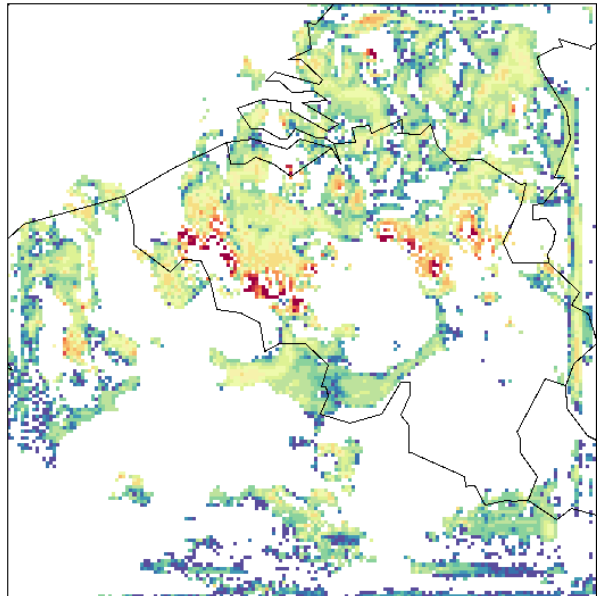
$0 \leq s_u \leq 0.175$ , average= 0.00648

max 10-41 S010PUDAL1\_ACCVU  
2005/9/10 z12:0 +5h



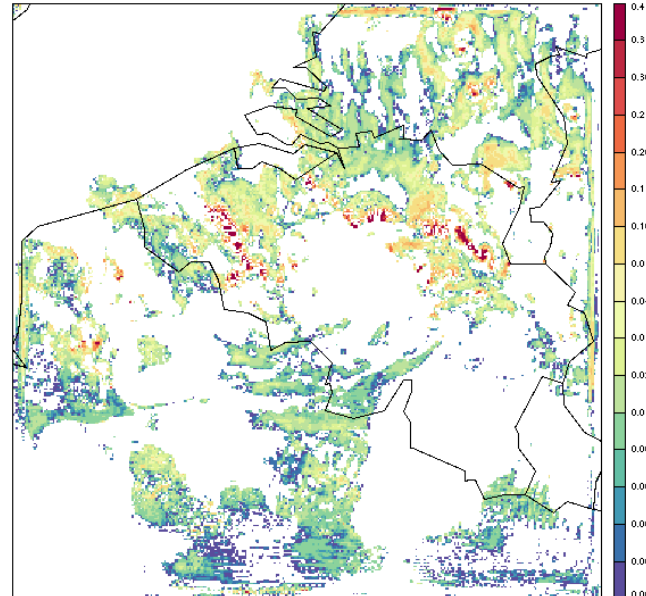
$0 \leq s_u \leq 0.4$ , average= 0.0103

max 10-41 S010PUDAL1\_ACCVU  
2005/9/10 z12:0 +5h



$0 \leq s_u \leq 0.4$ , average= 0.00838

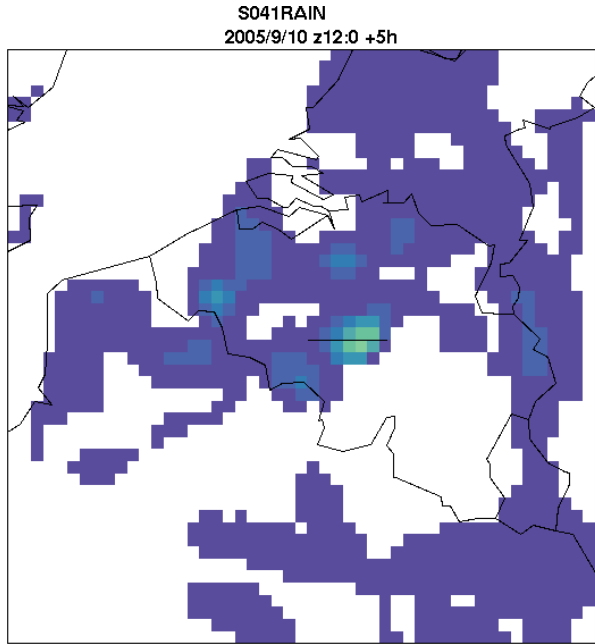
max 10-41 S010PUDAL1\_ACCVU  
2005/9/10 z12:0 +5h



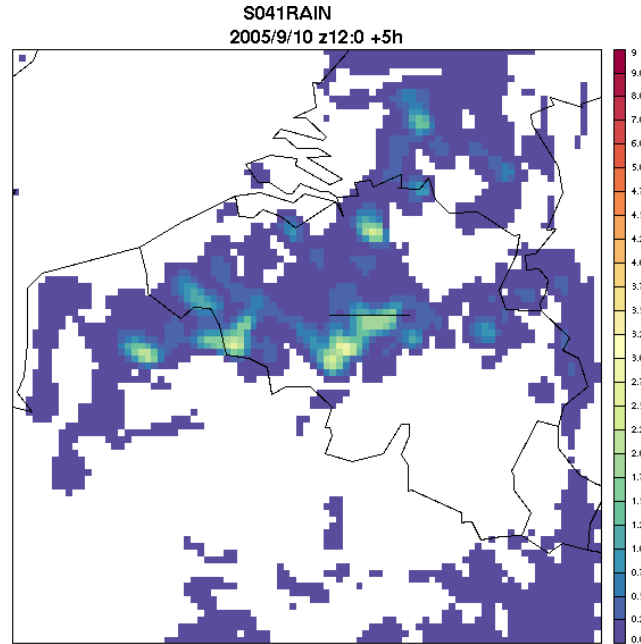
$0 \leq s_u \leq 0.4$ , average= 0.00715

Maximum  
updraught  
mesh fraction  
in the column

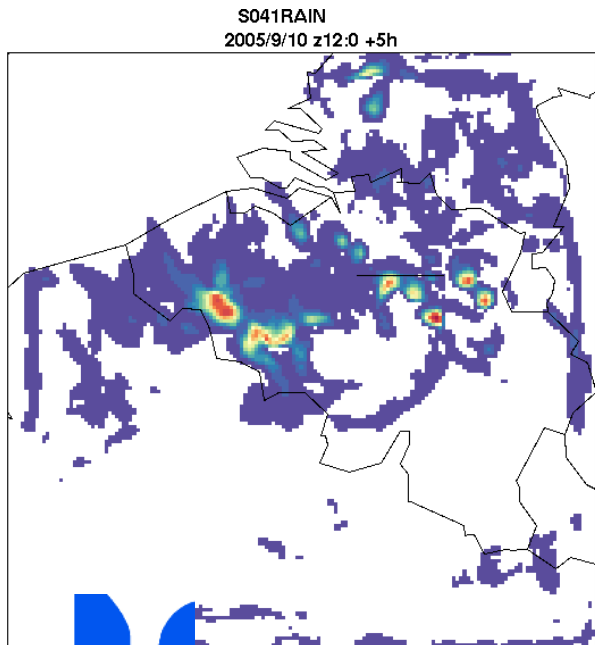
# Choice of vertical sections



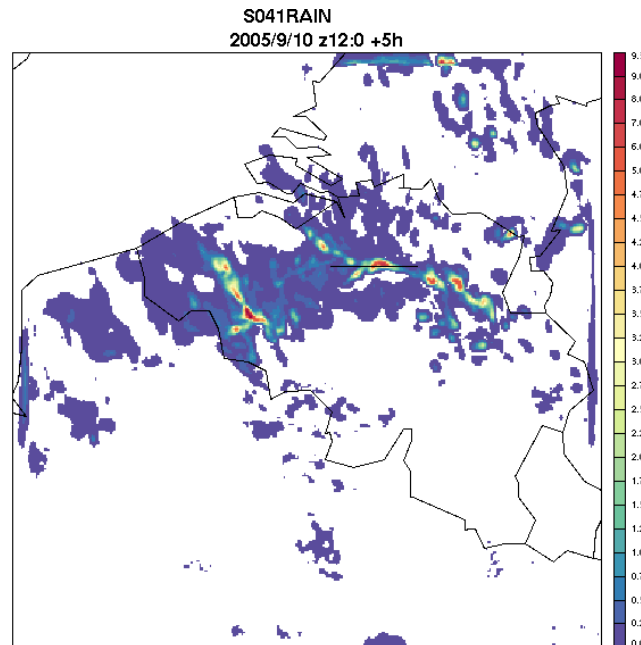
rain content <= 1.7 g/kg, average= 0.615



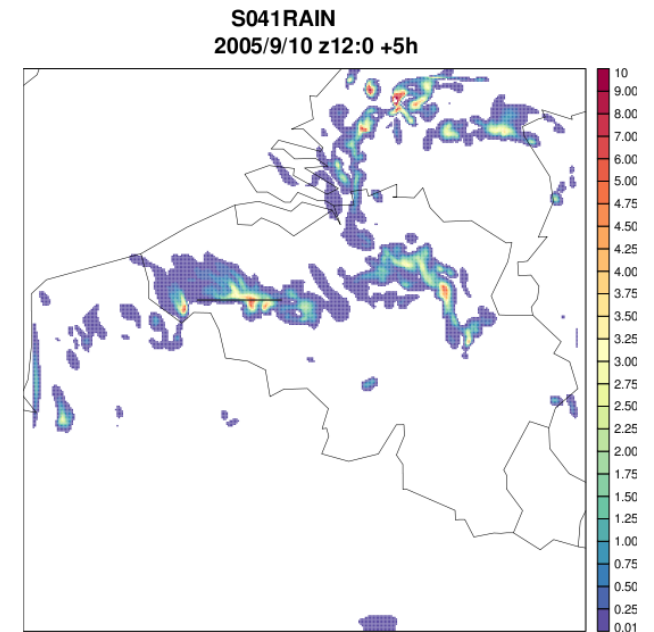
rain content <= 2.84 g/kg, average= 0.526



content <= 8.4 g/kg, average= 0.418



rain content <= 9.37 g/kg, average= 0.39

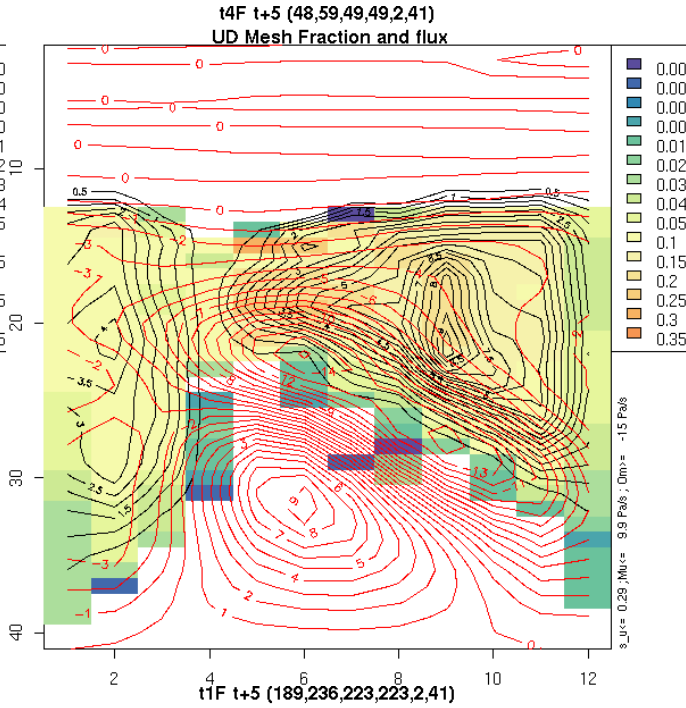
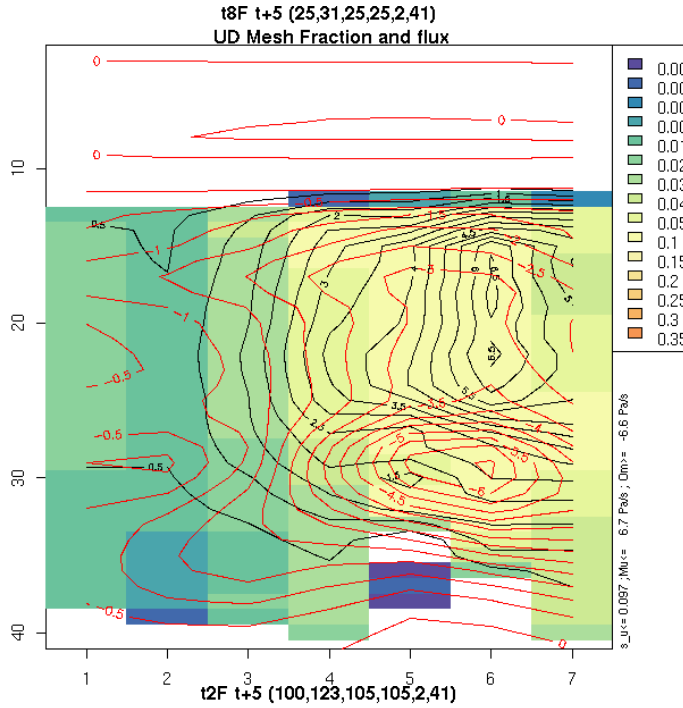


rain content <= 11.7 g/kg, average= 0.136

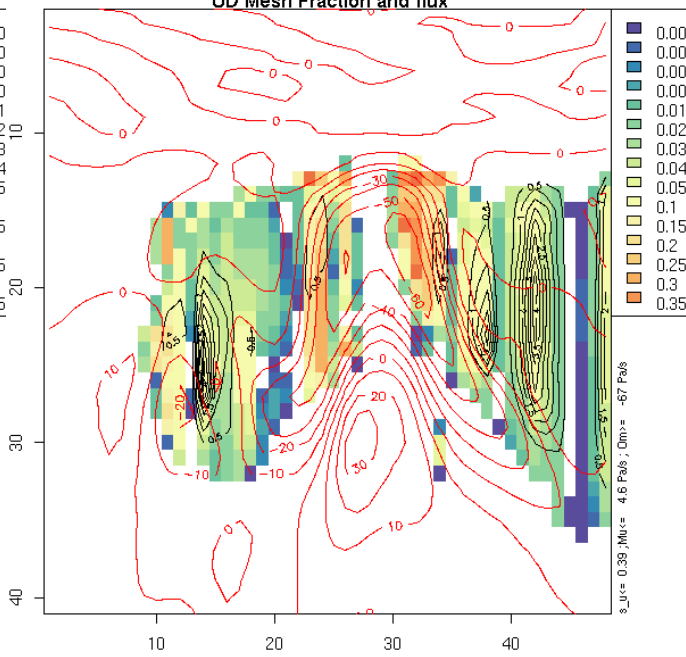
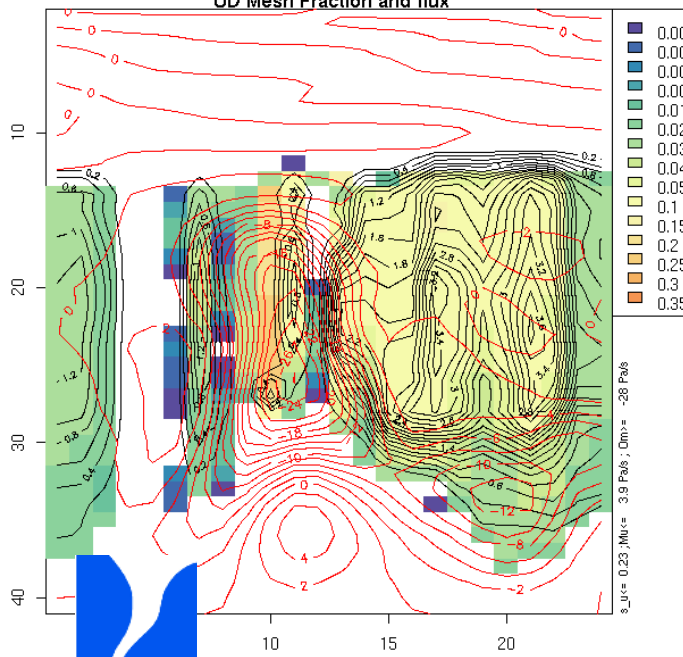


# Vertical structure

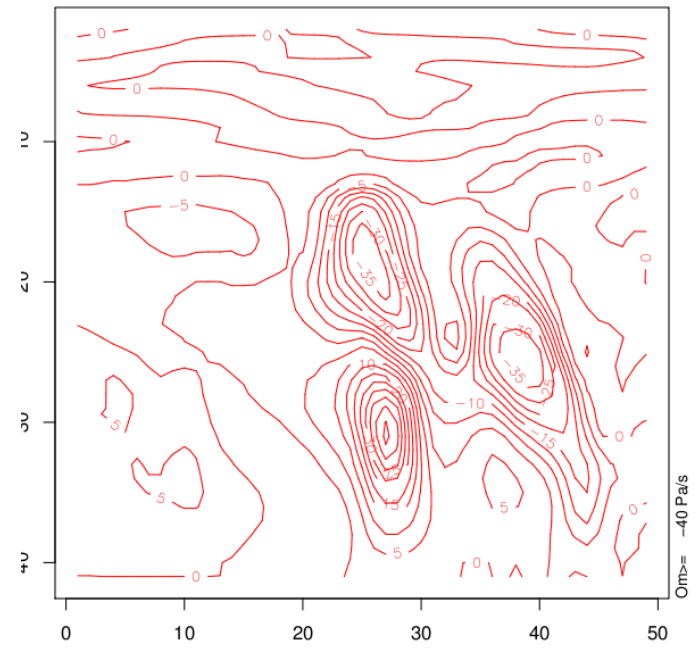
# Vertical structure



$\sigma_u$ ,  
 $M_c$  (Pa/s),  
 $\bar{\omega}$  (Pa/s)



1km nopc (cy32/xr)

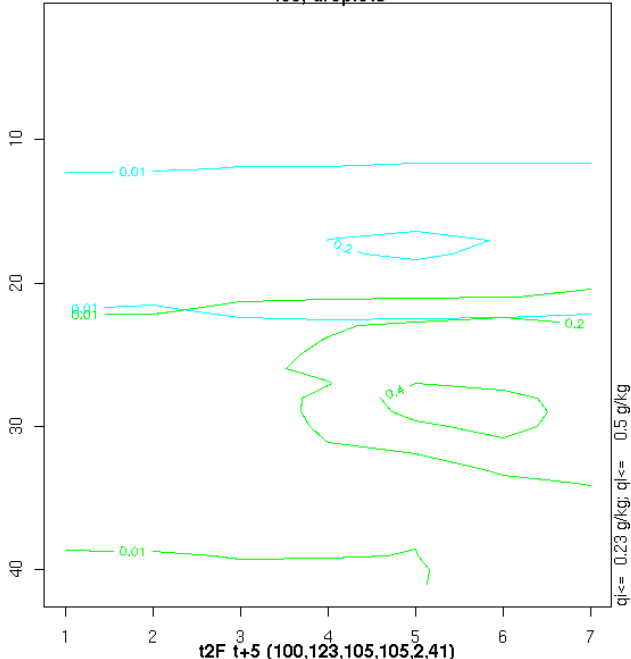




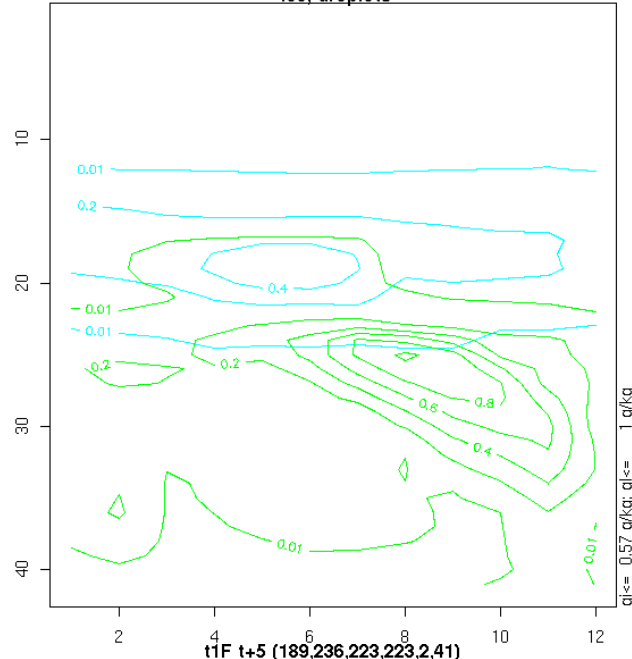
# Vertical structure

Cloud ice  
and droplet  
contents (g/kg)

t8F t+5 (25,31,25,25,2,41)  
Ice, droplets

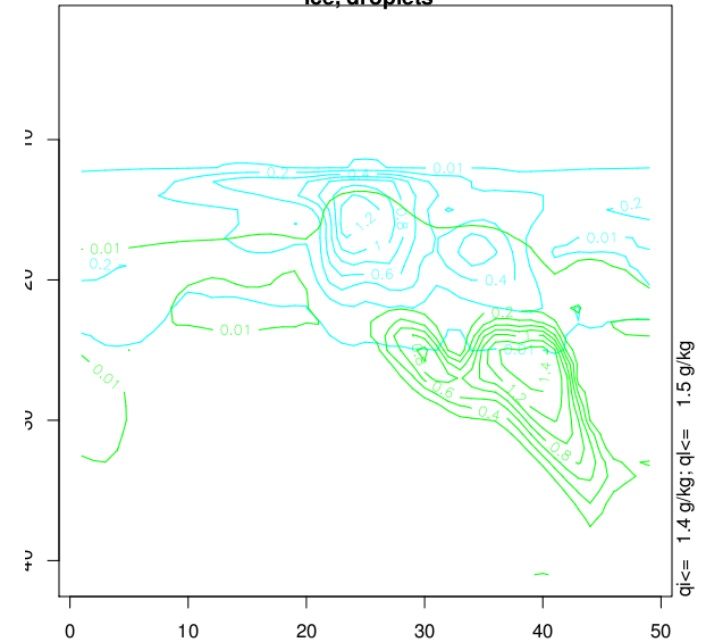


t4F t+5 (48,59,49,49,2,41)  
Ice, droplets

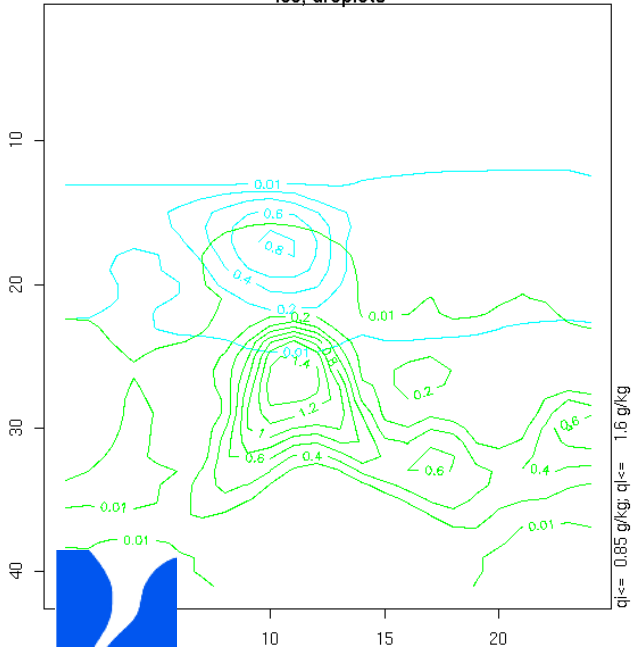


1km nocr (cy32/xr)

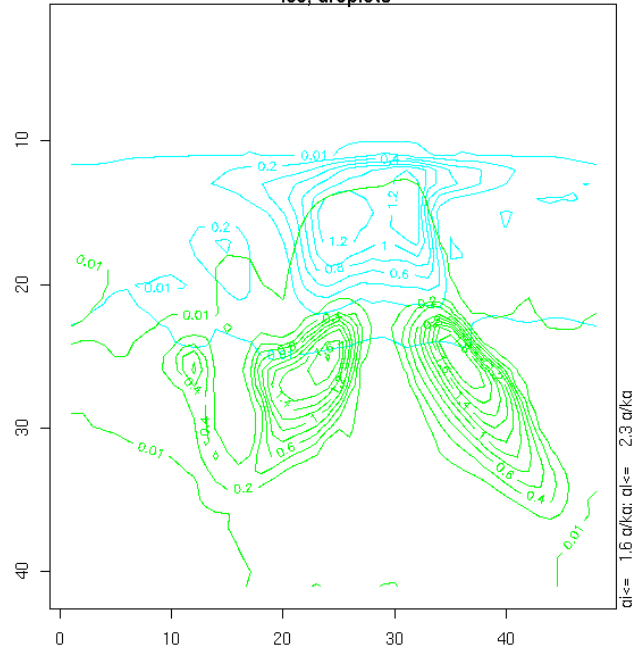
Ice, droplets



t2F t+5 (100,123,105,105,2,41)  
Ice, droplets

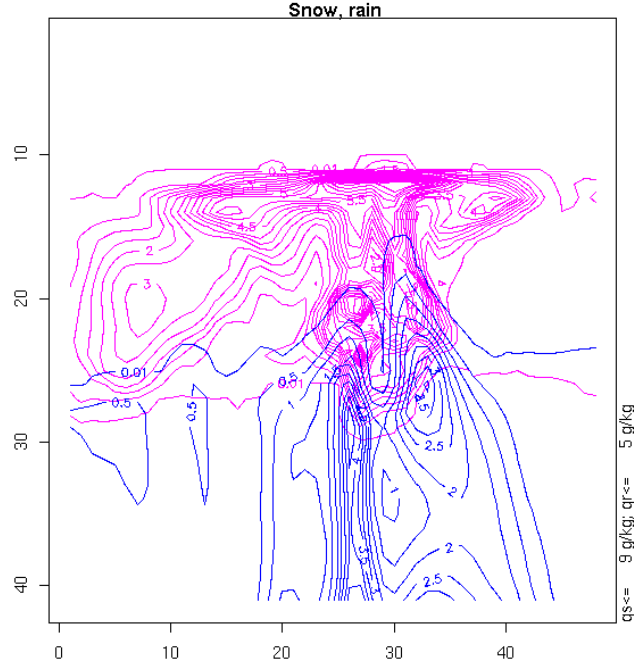
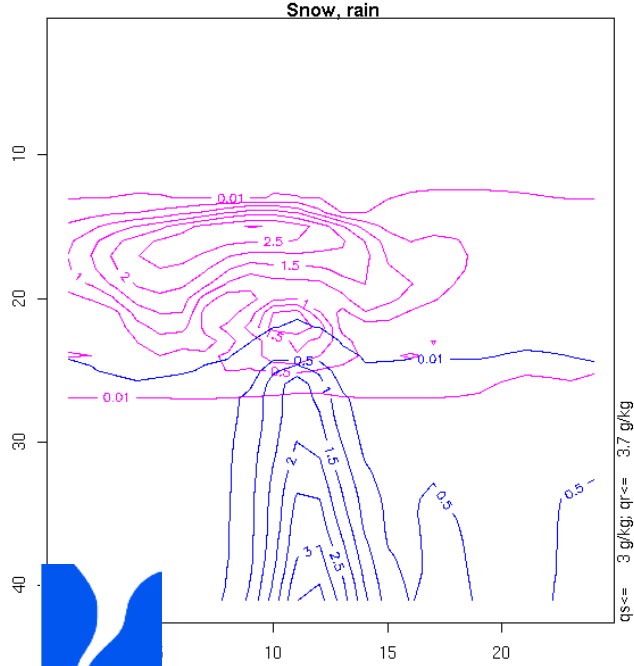
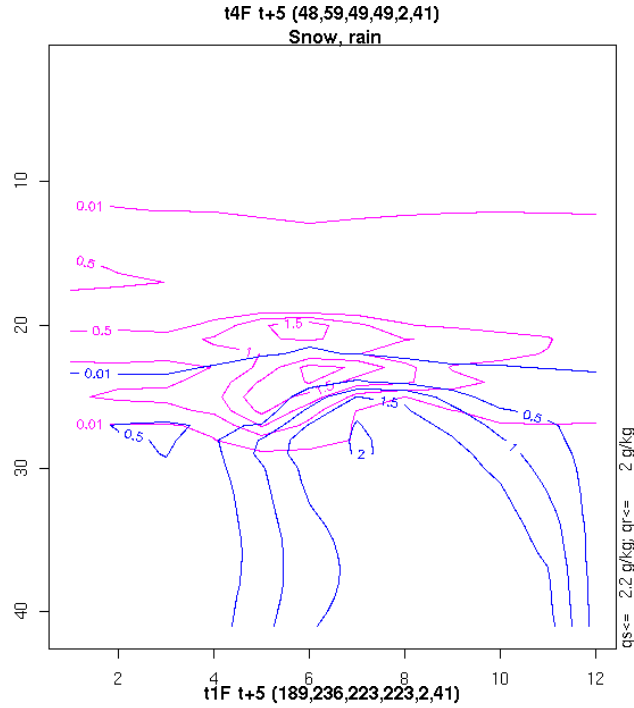
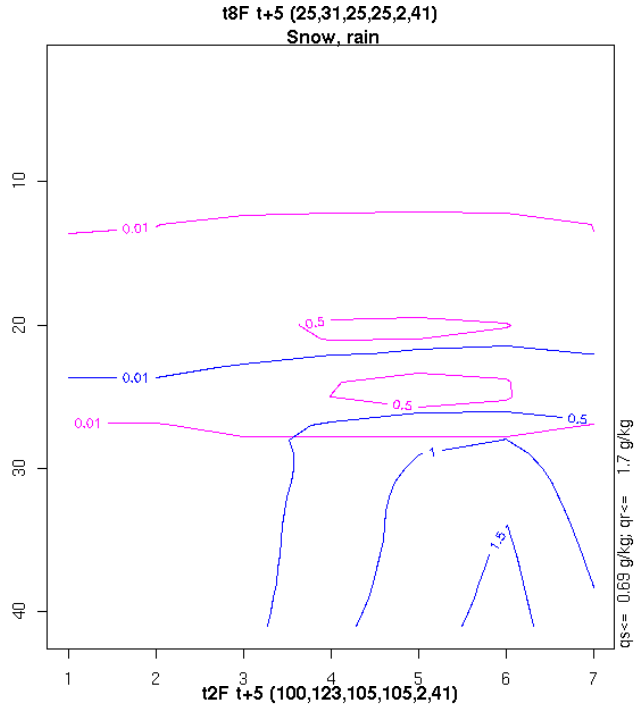


t1F t+5 (189,236,223,223,2,41)  
Ice, droplets



# Vertical structure

Snow and rain contents (g/kg)



1km nosp (cy32/xr)

