Impact of parameterized convection in HIRLAM/ALADIN on explicit clouds in AROME

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Coupling concerns

- OROGRAPHY (RESOLUTION)
- PHYSICS
- DYNAMICS
- COUPLING FREQUENCY
- SHARPNESS OF COUPLING (RELAXATION) AREA

What to do in HARMONIE

Important to make a conscious choice of nesting configuration
(resolution, physics, relaxation zone...)

- Several cases of varying weather type have been tested using AROME nested into the following models:
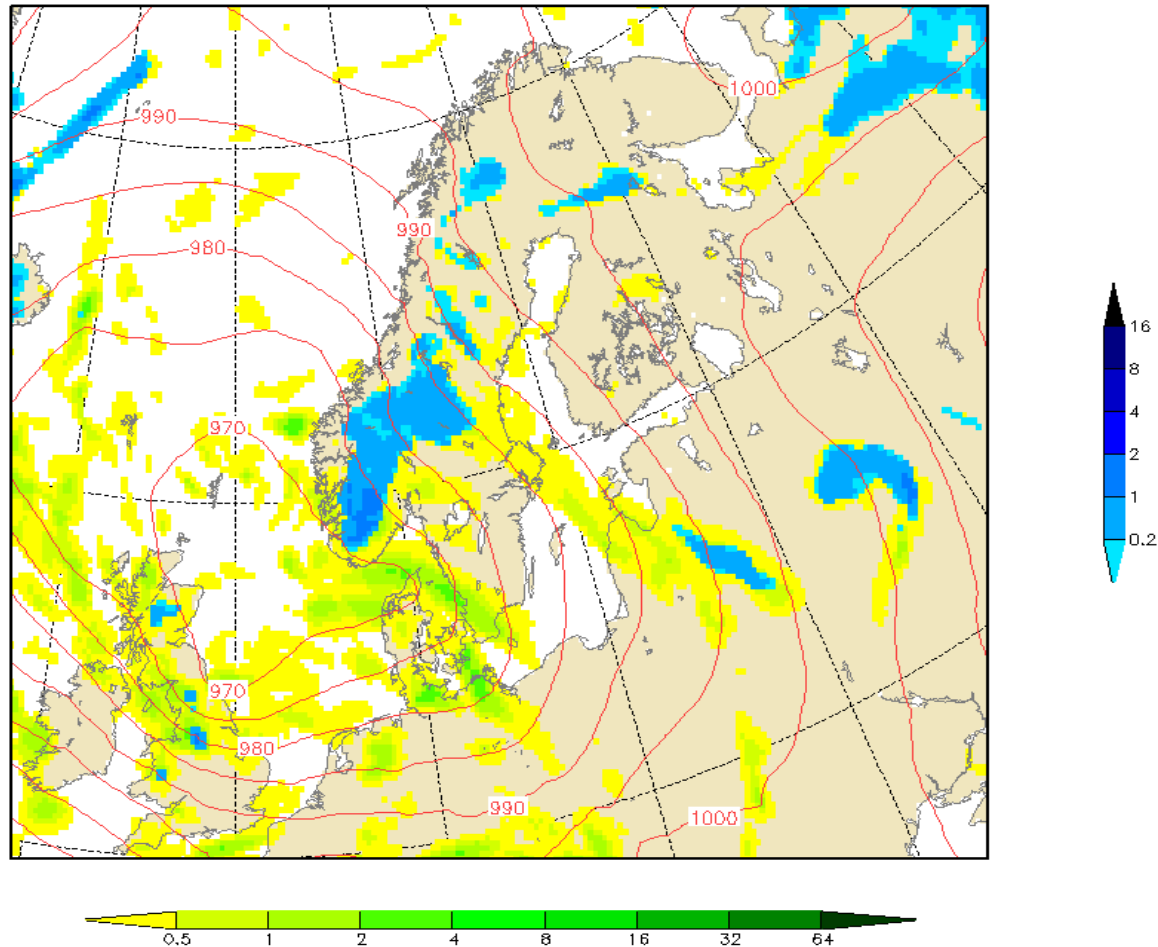
  HIRLAM – KFRK (7.1.3)

  HIRLAM – STRACO (7.1.3)

  ALADIN (no data assimilation) (32h3)

  ALARO   (no data assimilation) (32h3)

  Horizontal resolution of host model is 7.5 km

Size of domain

Pmsl and hourly prec. (mm) green:rain blue:snow
initial: 00Z10MAR2008 valid: 06Z12MAR2008

Nesting Strategy for physics

- Specific humidity is the only moist variable coupled. All other hydrometeors (cloud water, cloud ice, rain, snow and graupel) are 0 initially and goes to 0 with David's relaxation at the boundaries.

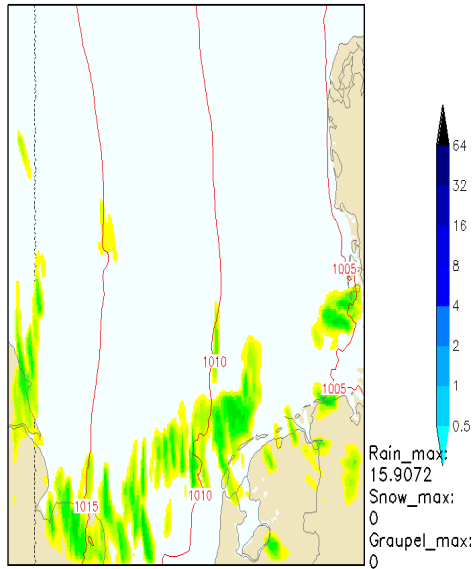- TKE is coupled initially but no coupling is done on the lateral boundaries.

Cases in this presentation

- 20070918 North Sea - Open Cell convection
- 20060803 Southern Sweden – Mixed frontal/convection
- 20070822 Southern Finland – MCS

CASE 1 – North Sea open cell convection
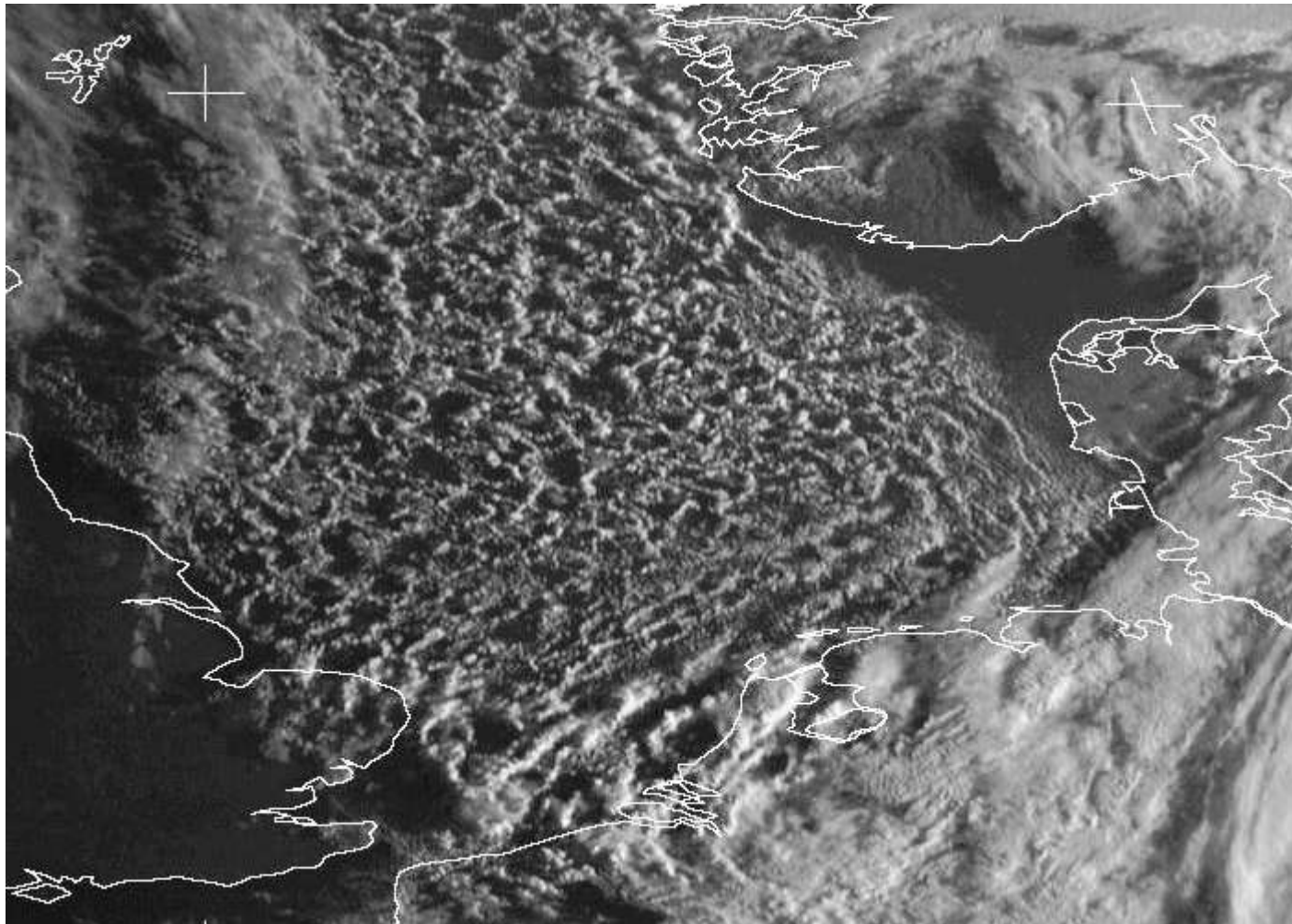
CASE 1 – 2007091800 + 04 h

AROME–
STRACO
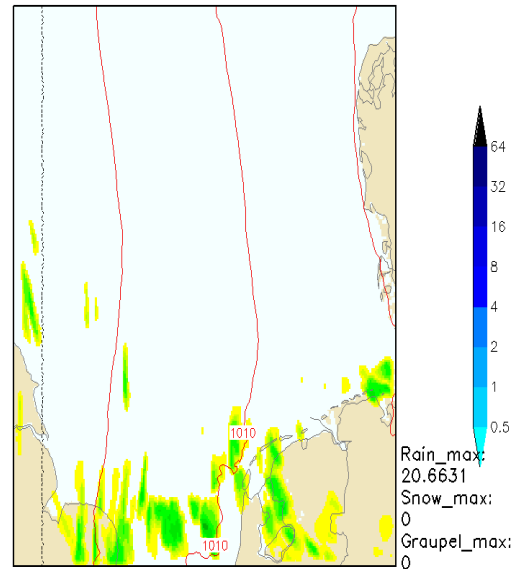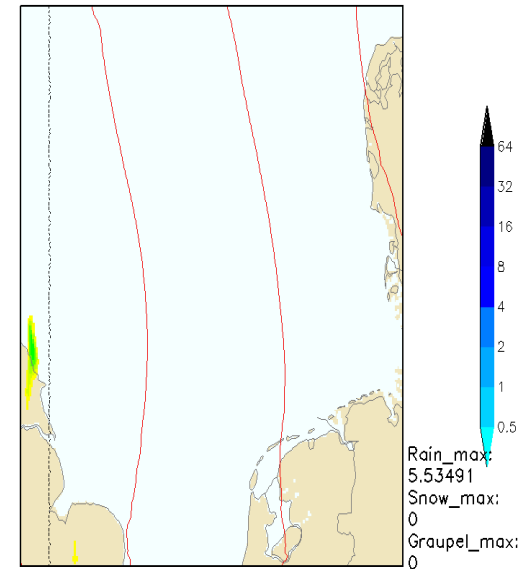
AROME–
KFRK

AROME–
ALADIN

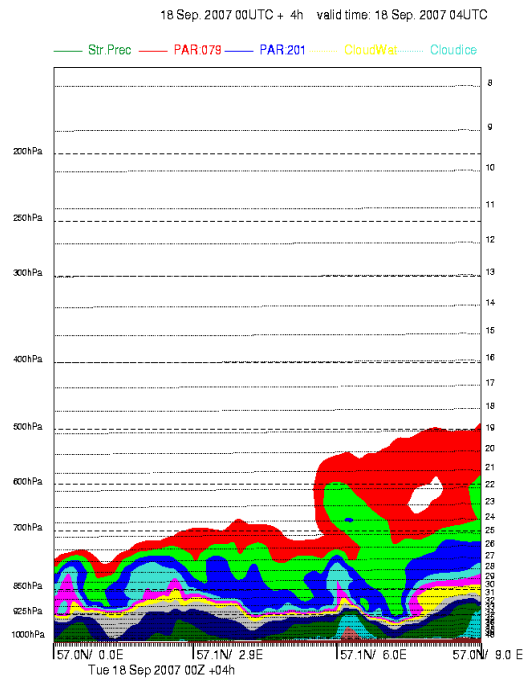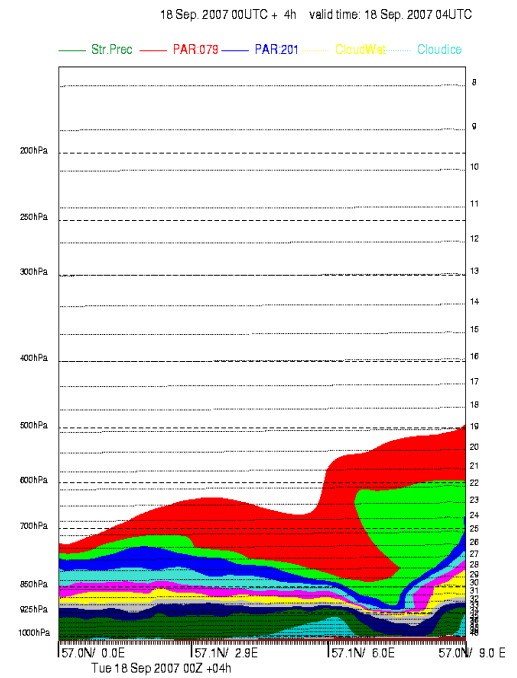# Eqv. Pot. Temperature
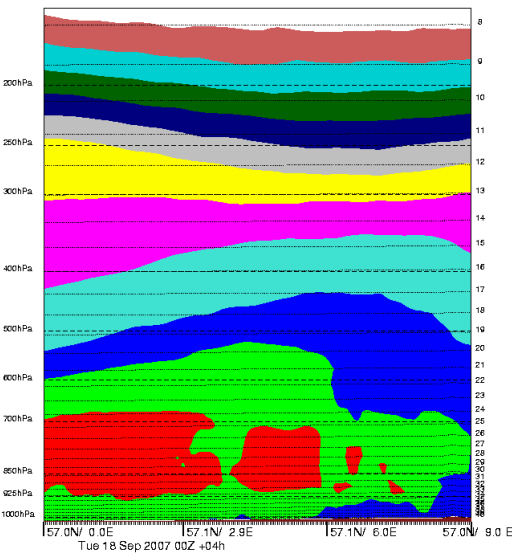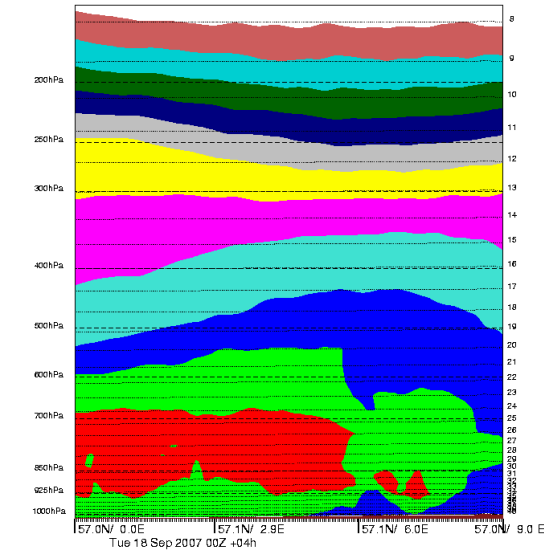
AROME–
STRACO
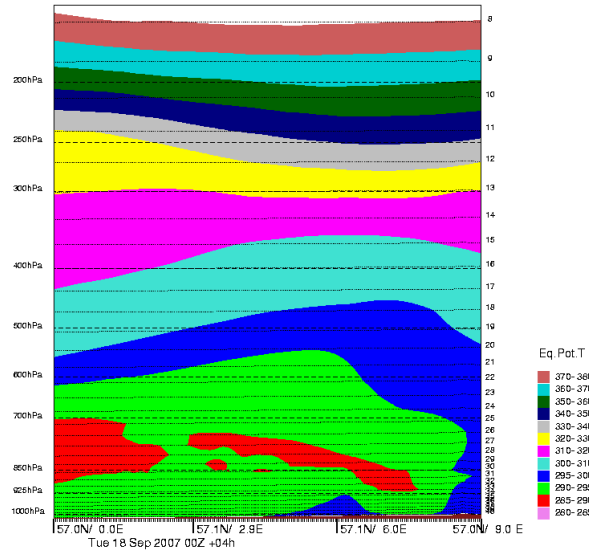
AROME–
KFRK

AROME–
ALADIN

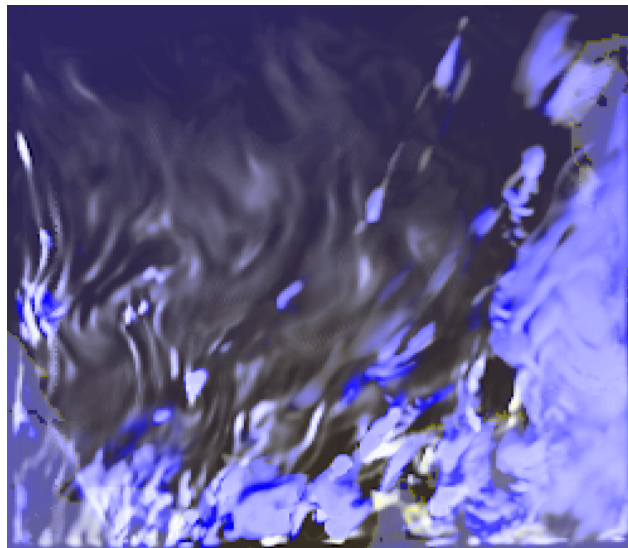# Specific Humidity
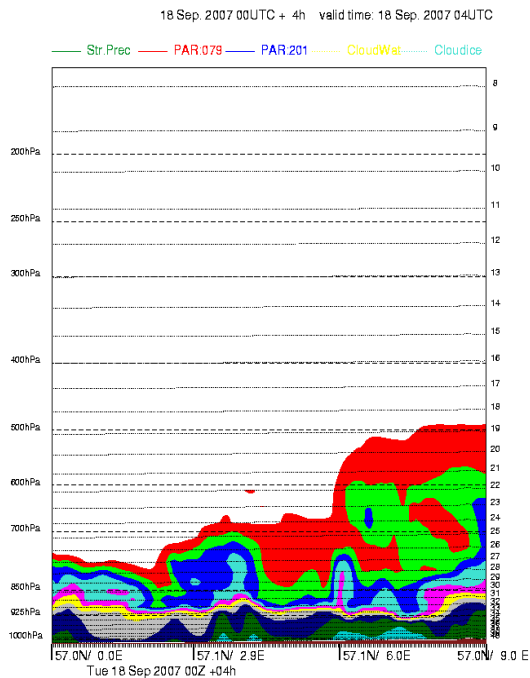
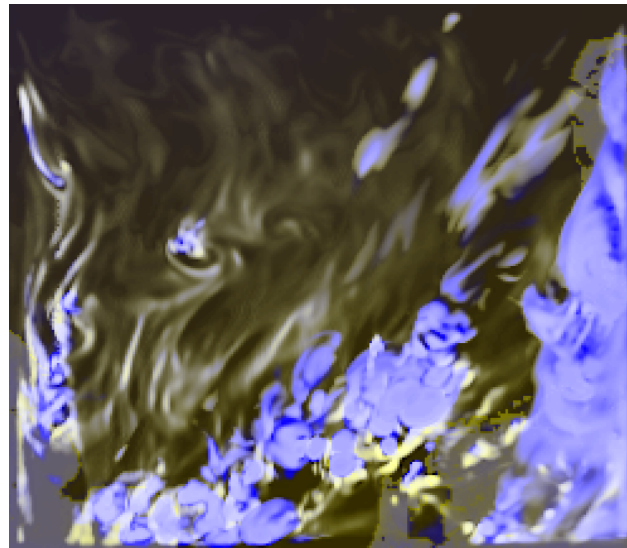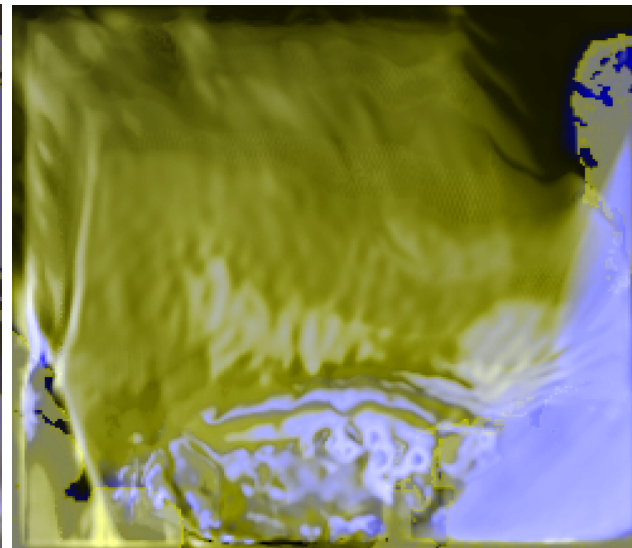AROME – STRACO

AROME – KFRK

AROME – ALADIN

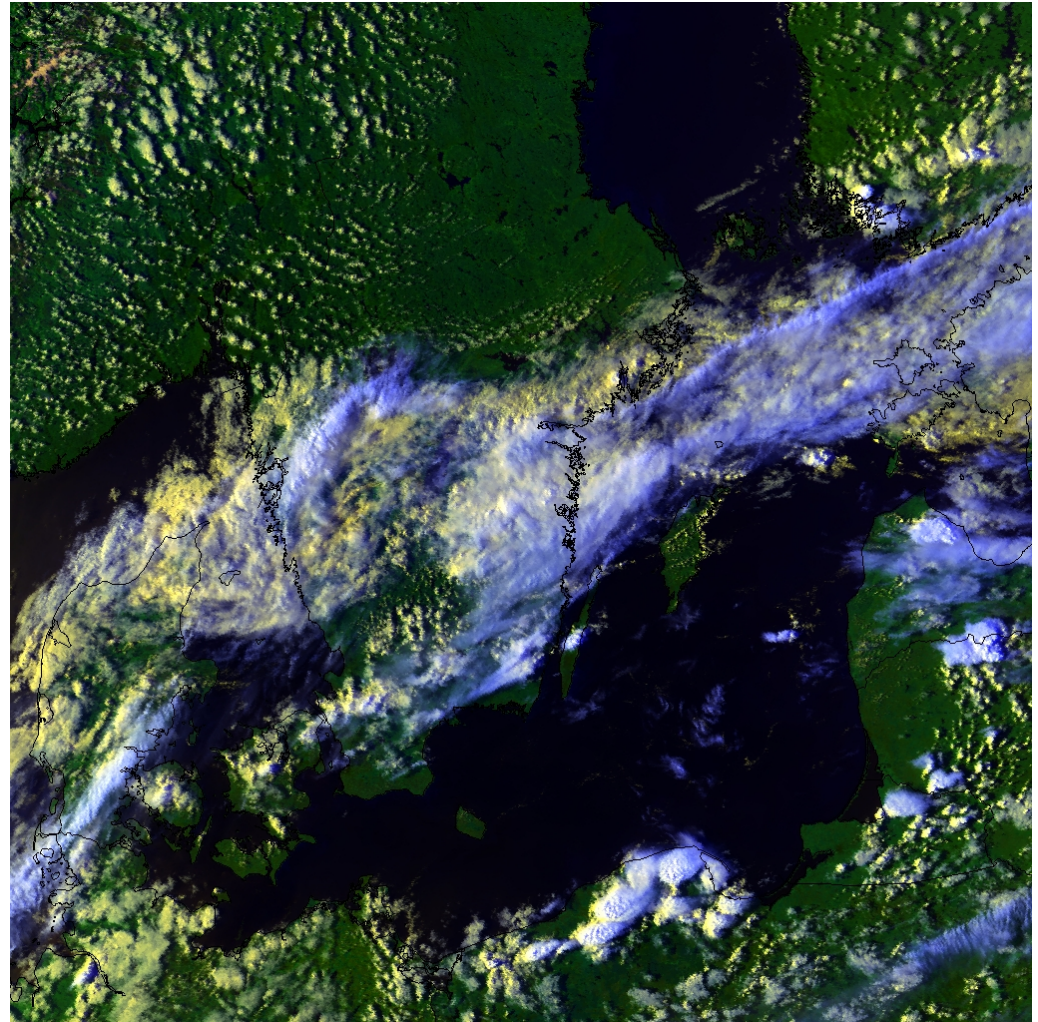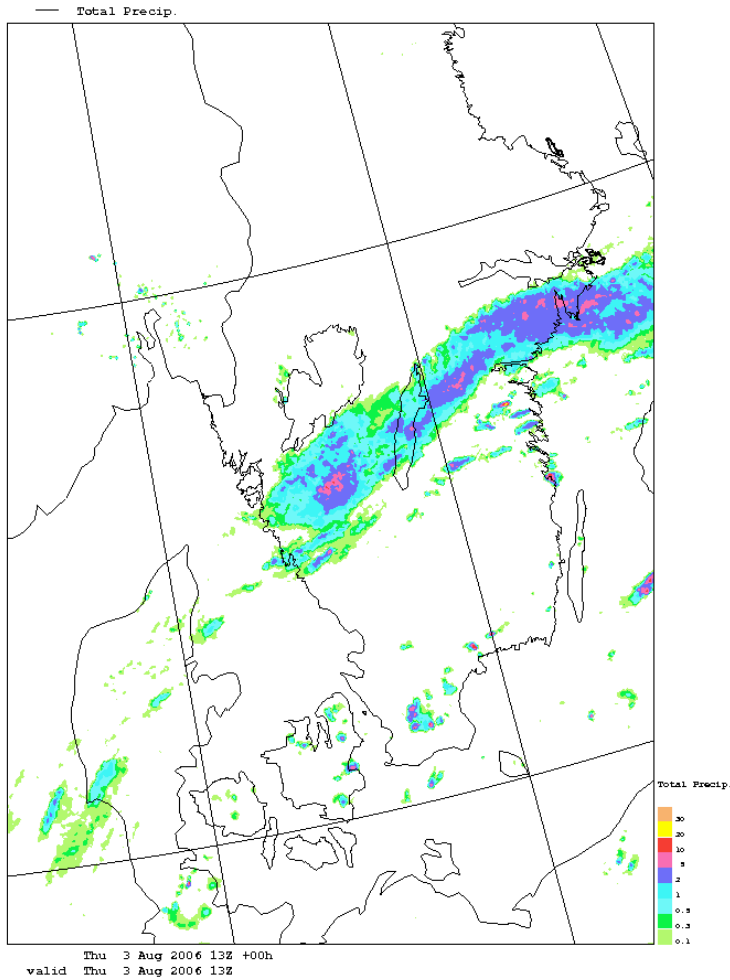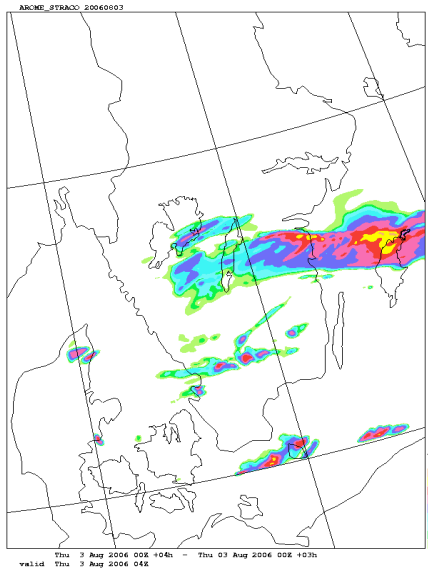# "Visible-RGB Satellite" image 2007091800 + 04 h

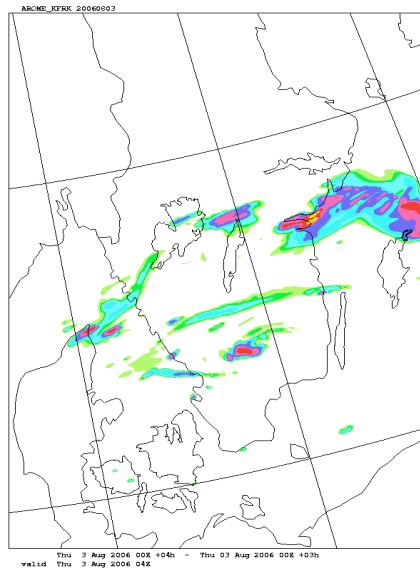
AROME–
STRACO

AROME–
KFRK

AROME–
ALADIN

CASE 2 – Mixed Frontal convective case over Sweden.

CASE 2 – 2006080300 + 04 h

AROME-STRACO

AROME-KFRK

AROME STRACO - INITIAL KFRK - LBC

1 hour RADAR

CASE 2 – 2006080300 + 12 h

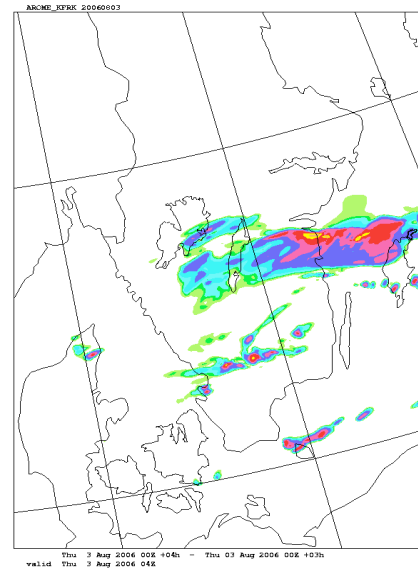
AROME-
STRACO

AROME-
KFRK

AROME
STRACO - INITIAL
KFRK - LBC

1 hour
RADAR

CASE 2 – 2006080300 + 21 h

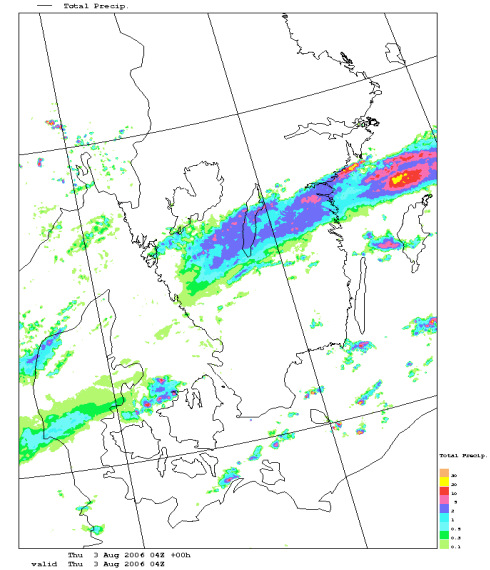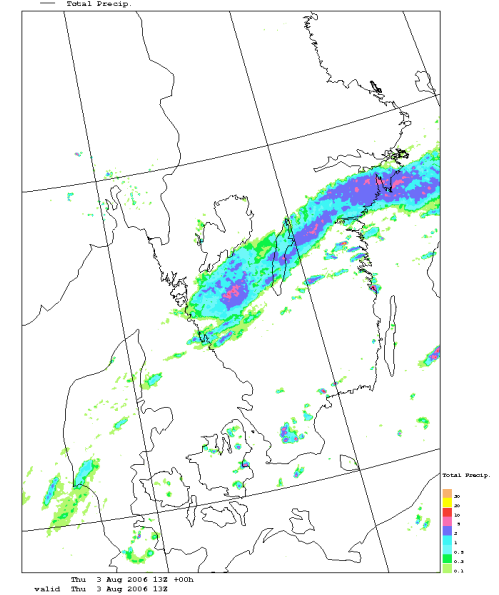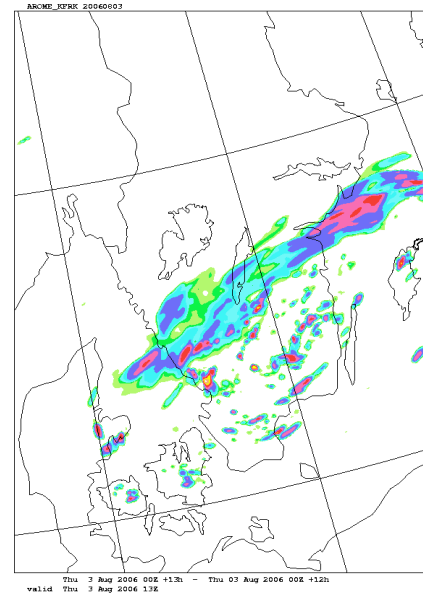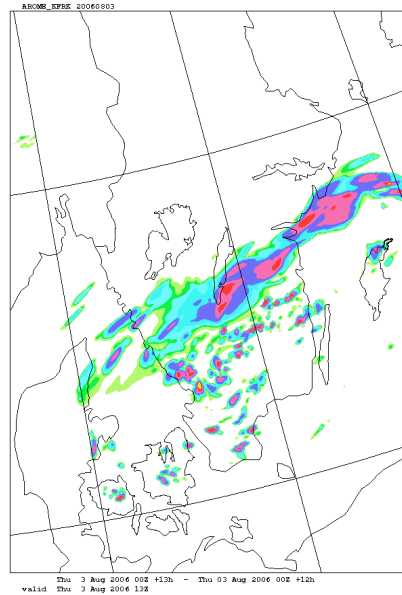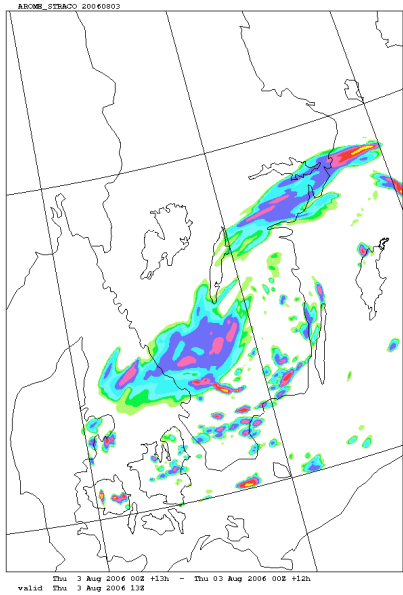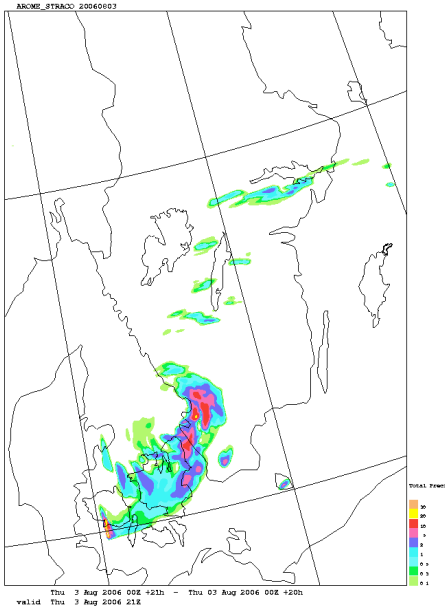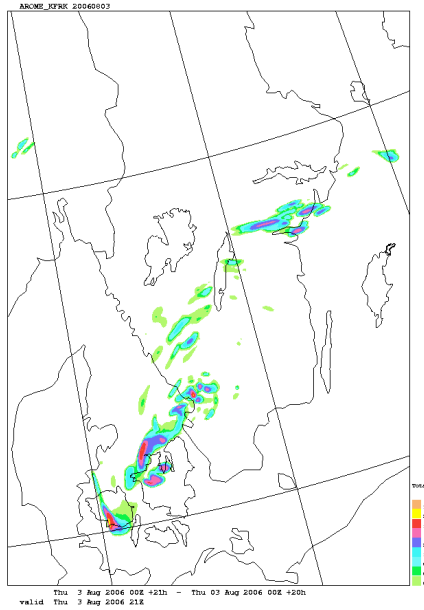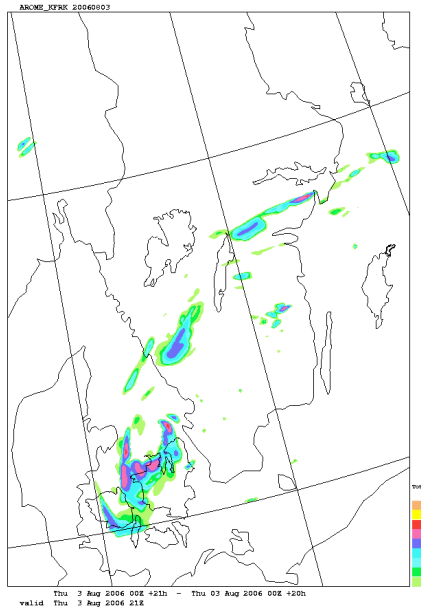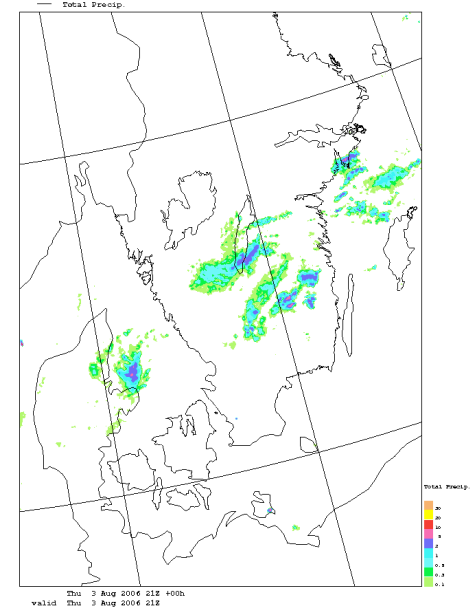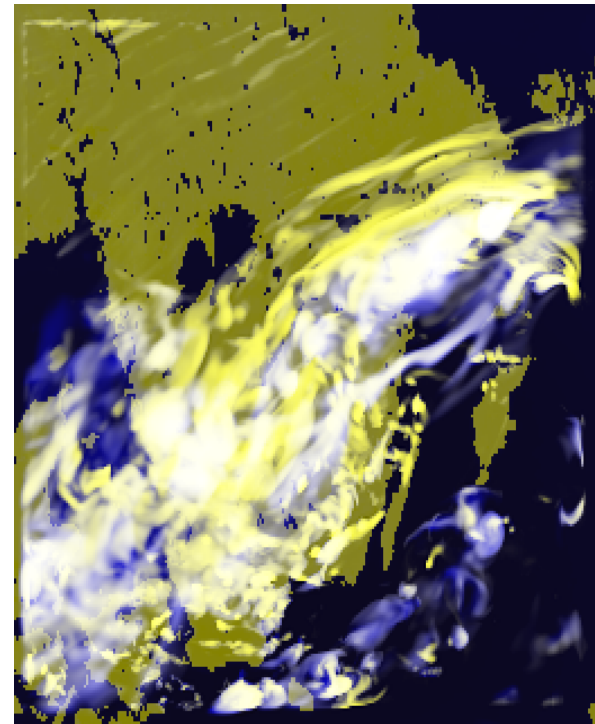AROME-
STRACO

AROME-
KFRK

AROME
STRACO - INITIAL
KFRK - LBC

1 hour
RADAR

"Visible-RGB Satellite" image

AROME-
STRACO
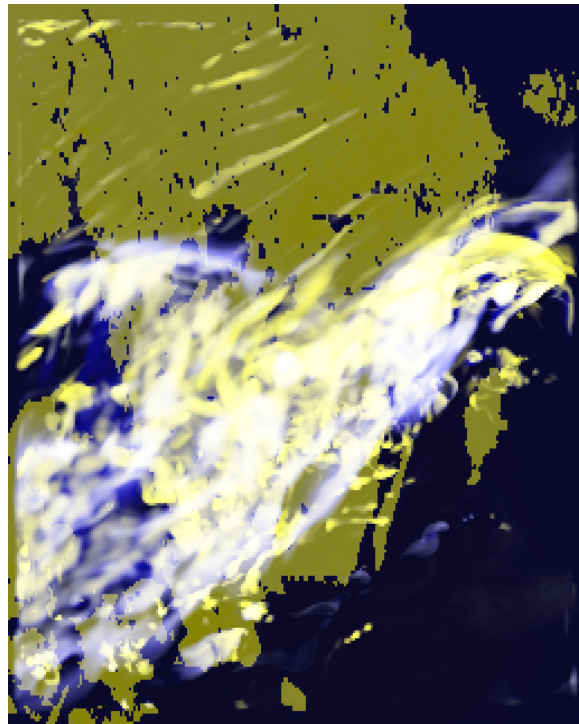
AROME-
KFRK
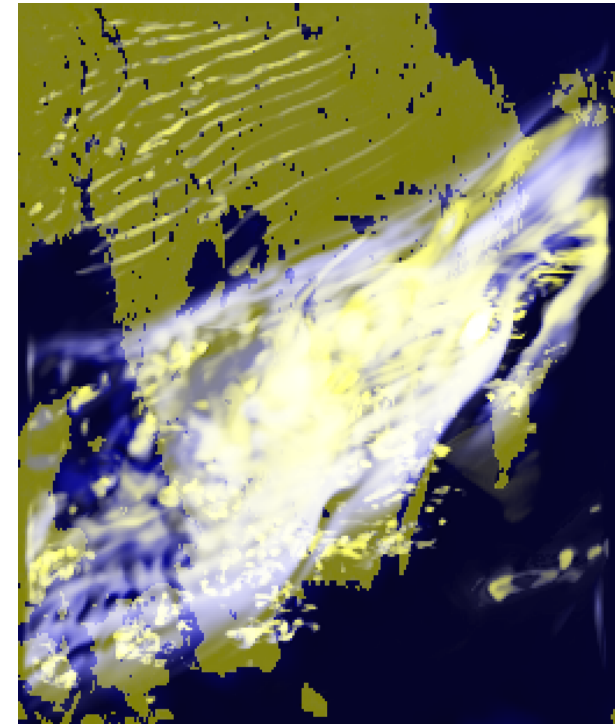
AROME-
ALADIN

CASE 3 – MCS FINLAND 20070822
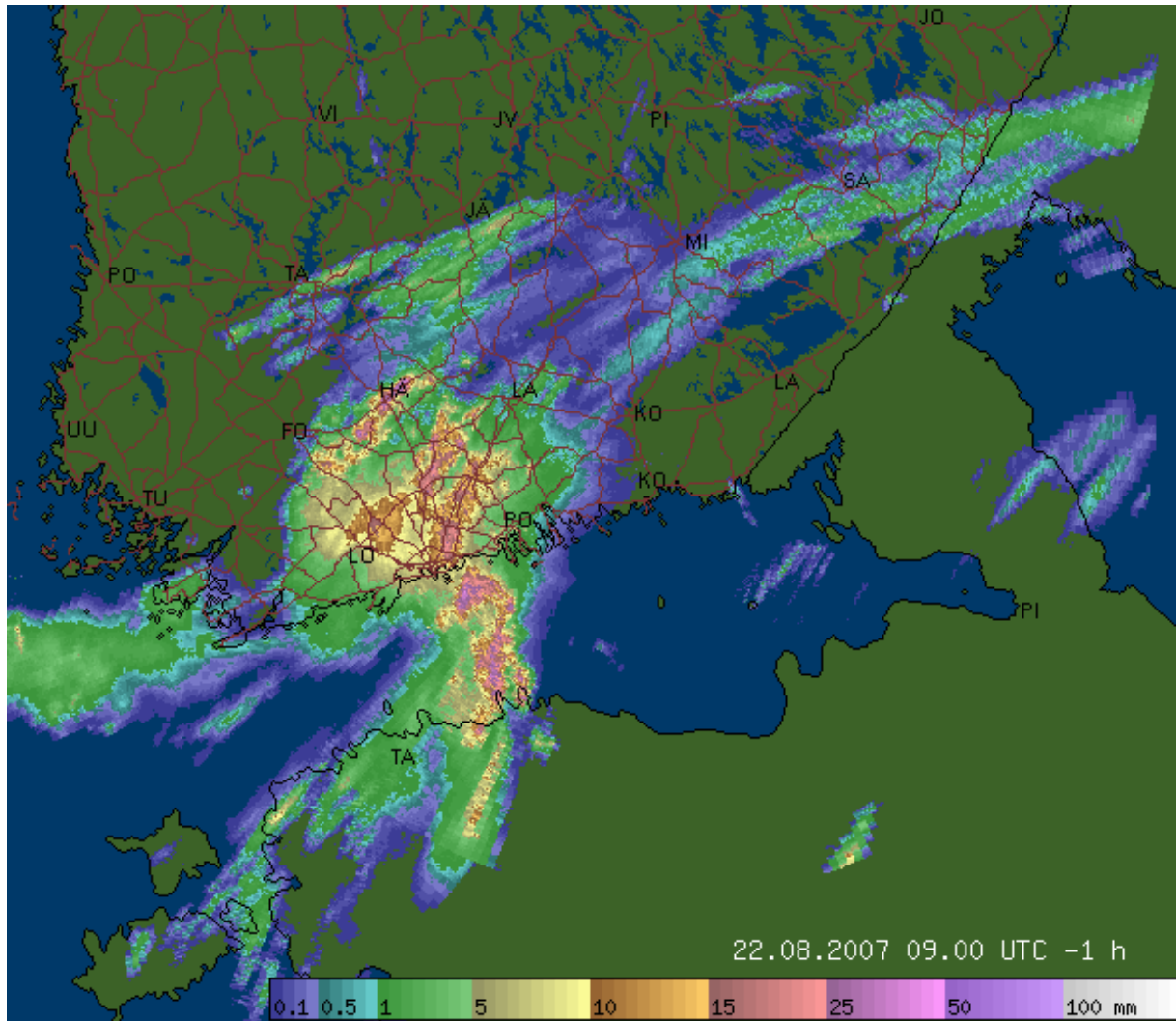
CASE 3 – 2007082200 + 09 h

AROME 22AUG2007 00 UTC Forecast. Precipitation [mm h^{-1}]
22AUG2007 09:00 UTC (AROHS,2.5km)

Rain_max:
105.781
Snow_max:
0
Graupel_max:
0

AROME – STRACO

AROME 22AUG2007 00 UTC Forecast. Precipitation [mm h^{-1}]
22AUG2007 09:00 UTC (AROHK,2.5km)

Rain_max:
15.1299
Snow_max:
0
Graupel_max:
0

AROME – KFRK

CASE 3 – 2007082200 + 09 h

AROME 22AUG2007 00 UTC Forecast. Precipitation [mm h⁻¹]
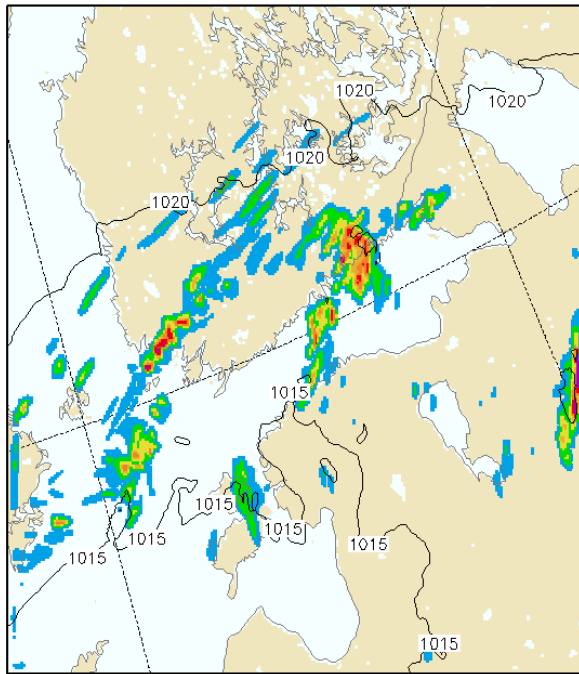22AUG2007 09:00 UTC (AROHK2,2.5km)

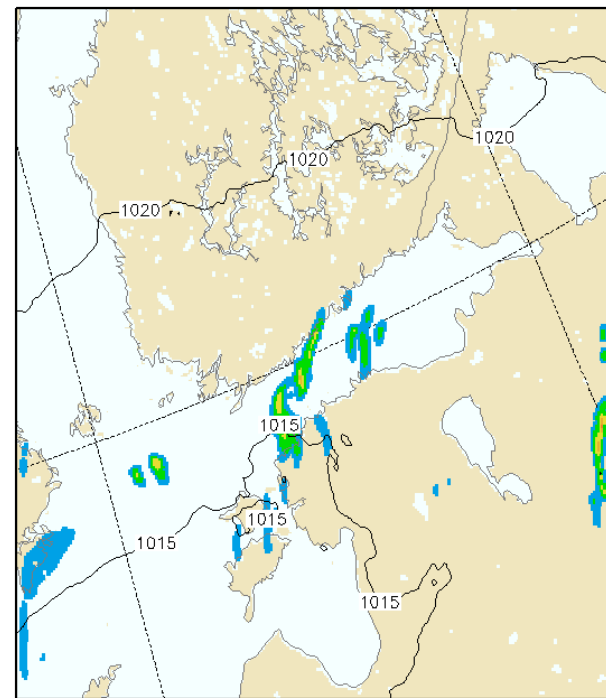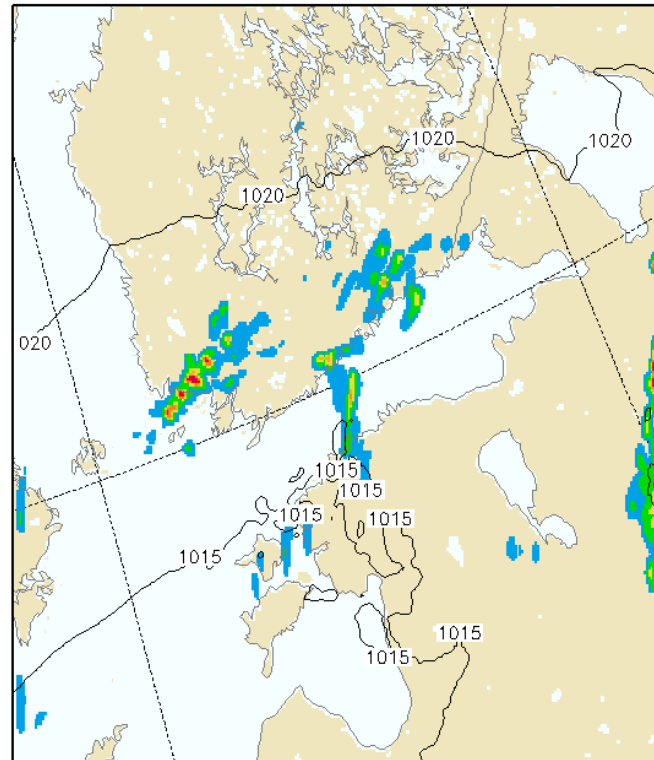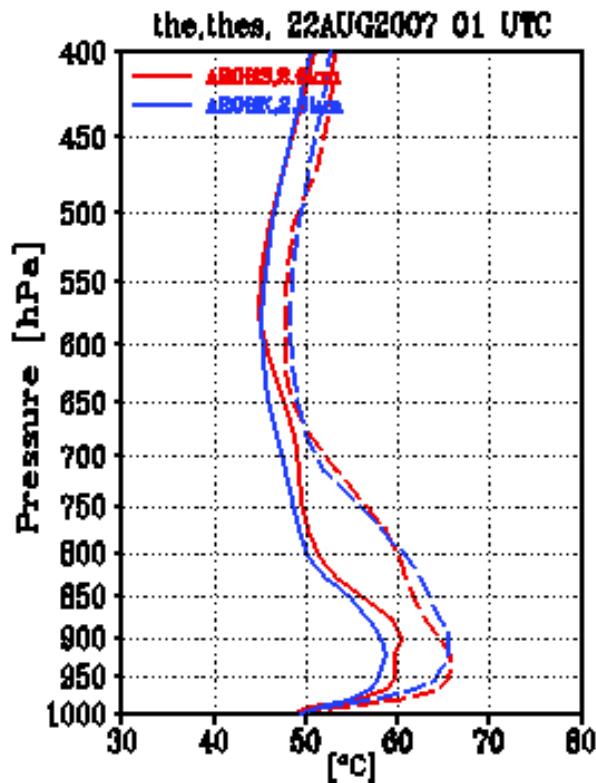AROME, STRACO - INITIAL, KFRK - LBC

CASE 3 – 2007082200 + 01 h

the,thes, 22AUG2007 01 UTC

RED – AROME/STRACO
BLUE – AROME/KFRK

Conclusions so far

- AROME is sensitive to initial and lateral boundary conditions. More so when there is strong advection in to the model domain.

- The initial stratification and moisture profile are important for the "onset" of convection

- Some "spin-up" time for hydrometeors is needed, depending on the moisture available initially.

- The initial state defines the first ~9-12 hours, LBC becomes increasingly important.

- Important with Data Assimilation of moist variables.

- Experiments with atmosphere/surface initial conditions suggests that the atmospheric initial condition is dominating the "influence" on the forecast.

Concerns -> Short term plans

- VERIFICATION!
- Nesting configuration
- Sufficient size of AROME domain?