Impact of deep convection scheme (and resolution) on deep convection

Sander Tijm

Lisa Bengtsson

Overview of presentation

- Why this study?
- Daily cycle of convection study
  - Description of case
  - Model and model domain
  - Impact of resolution on resolved deep convection
  - Impact of deep convection scheme
- Discussion (should and can we do an intercomparison?)

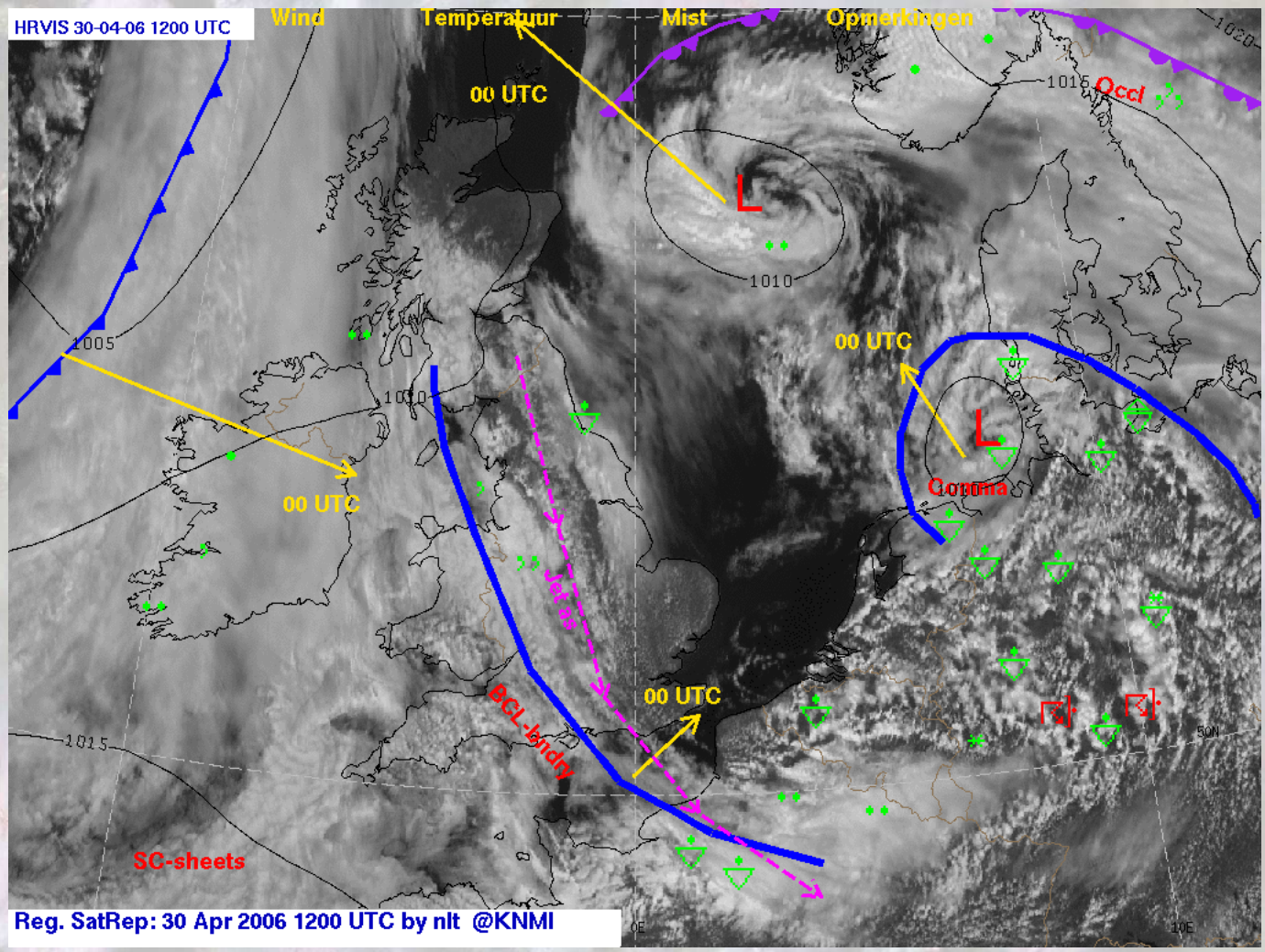
Why this study?

- Problems in AROME (outflow, too strong deep convection)
- Study case in depth, search for possible causes of AROME problems
- ALARO shares same dynamic core, simpler microphysics, including deep convection scheme
- Reference for future studies (impact of changes)

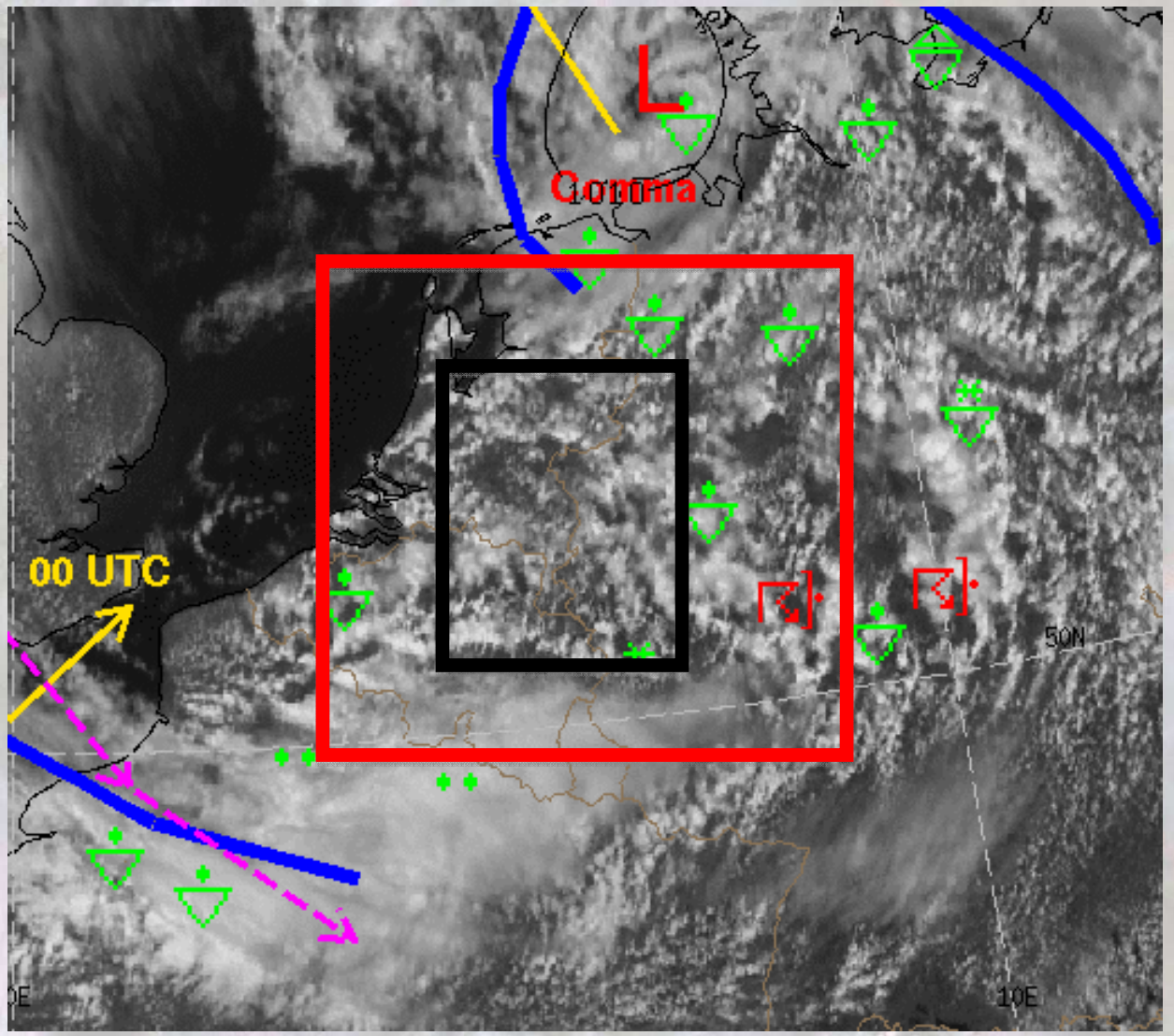
ALARO/AROME case study

- Case with daily cycle of deep convection over Netherlands, 30-04-2006
- Relatively weak advection, surface main forcing for deep convection
- Moderate deep convection, no large CAPE
- Case from HARMONIE database
- Use mainly ALARO (with and without 3MT) at different resolutions, comparison with AROME at 2 km
- Results are very fresh!

ALARO/AROME case study

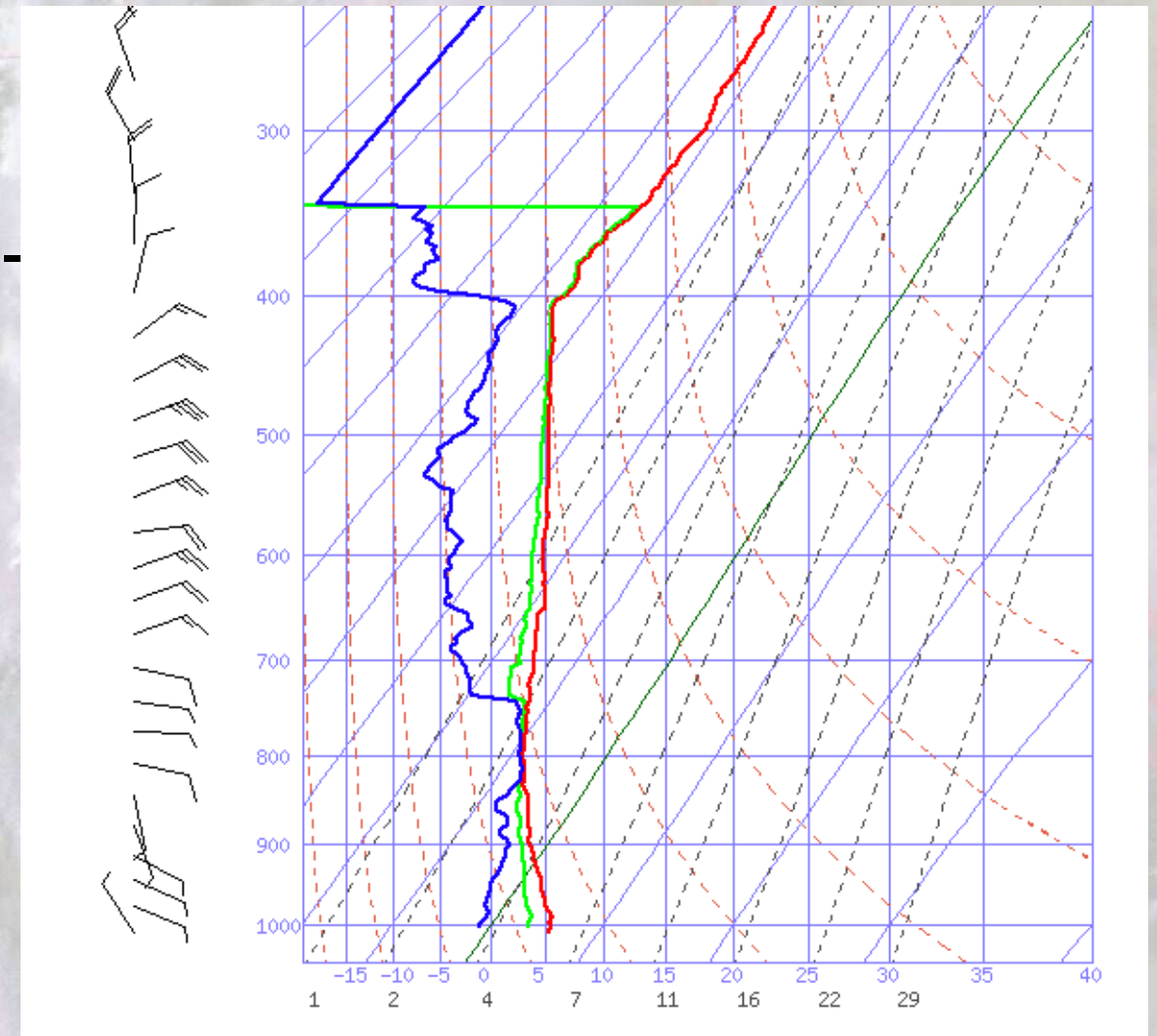


Model & analysis domain



Description of case

- Radio sounding 12 UTC 30-04-’06



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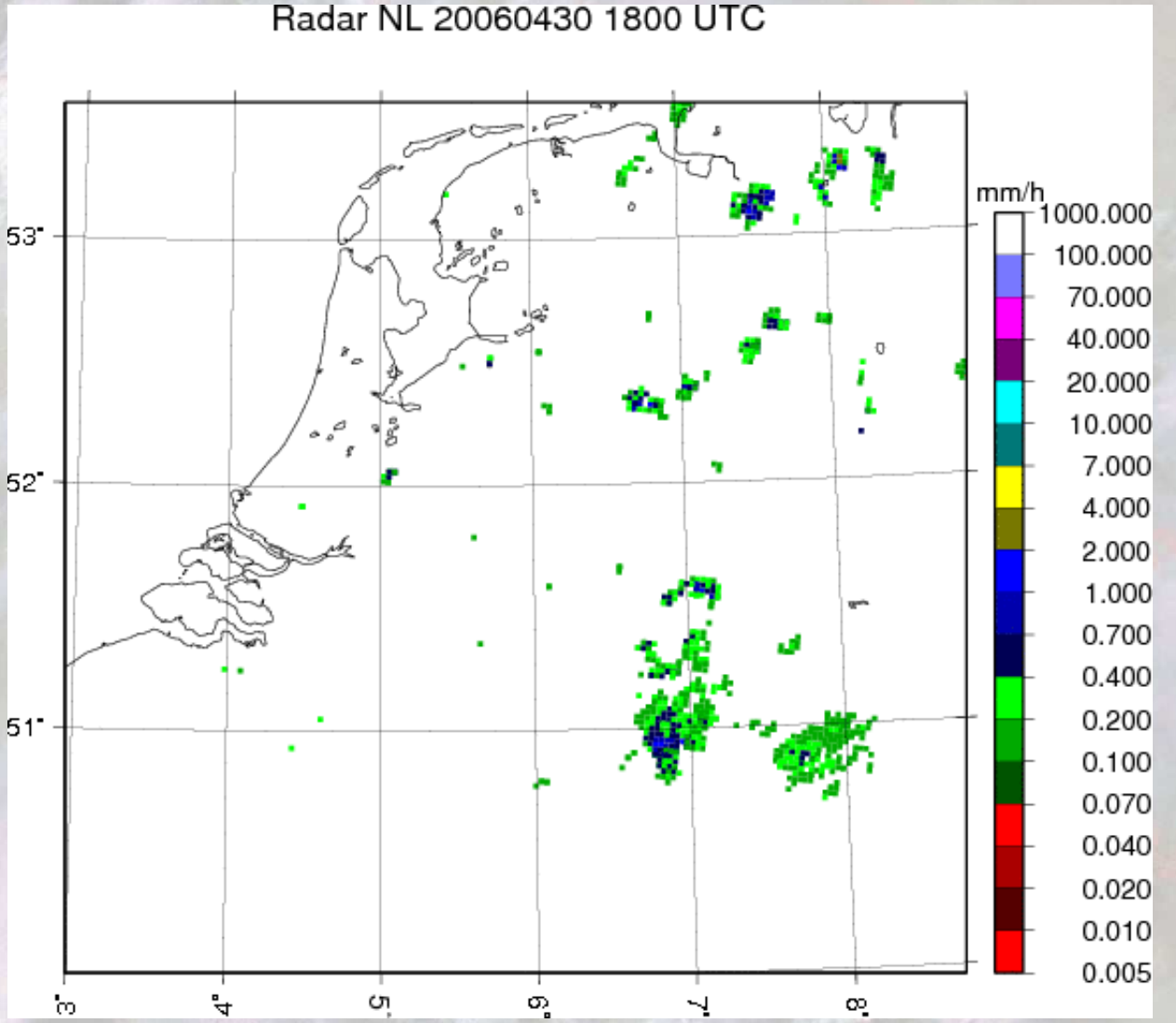
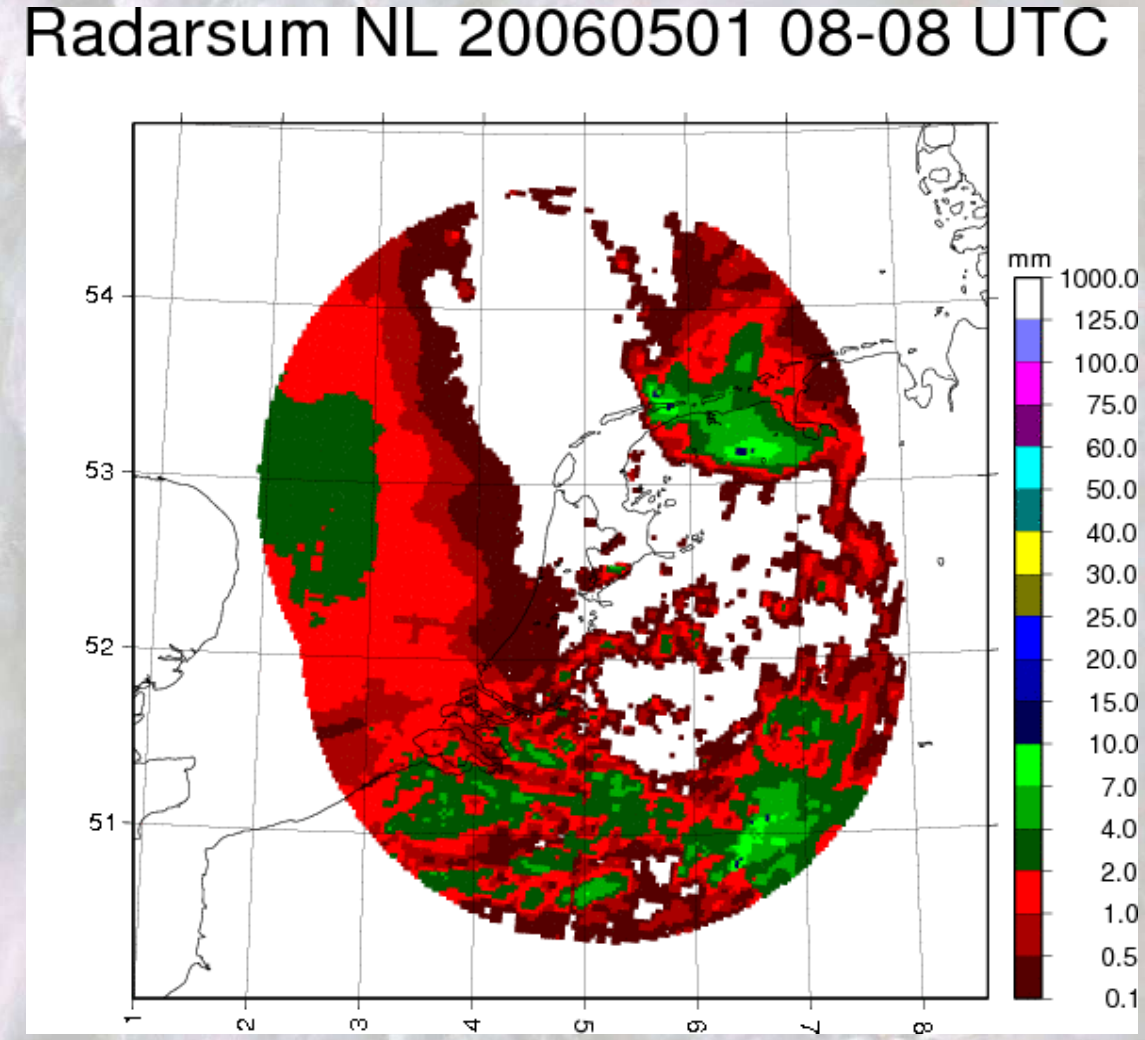


Radar accumulation



ALARO/AROME case study

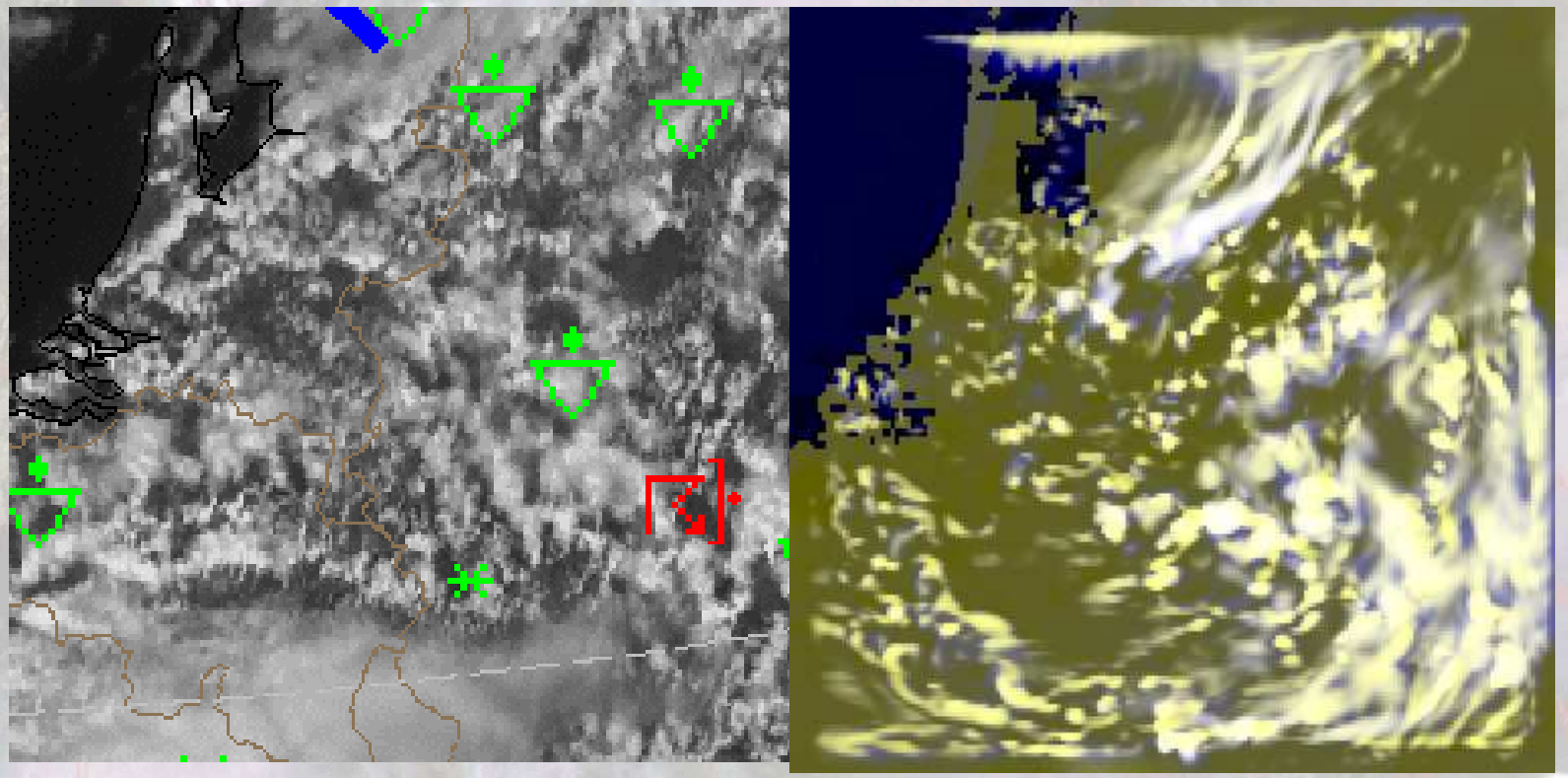
- 2, 1 and 0.5 km over 400x400 km domain
- Diagnostic domain 2.5 (EW)x2 (NS) degr
- Start 00 UTC, forecast to +18h
- Initial conditions and boundaries HIRLAM (6-hourly, weak advection over boundaries, long interval no problem)
- Differing surface schemes in ALARO/AROME
- All in HARMONIE version 35h1
- Results different from Utrecht (correct diffusion)

Impact deep convection scheme

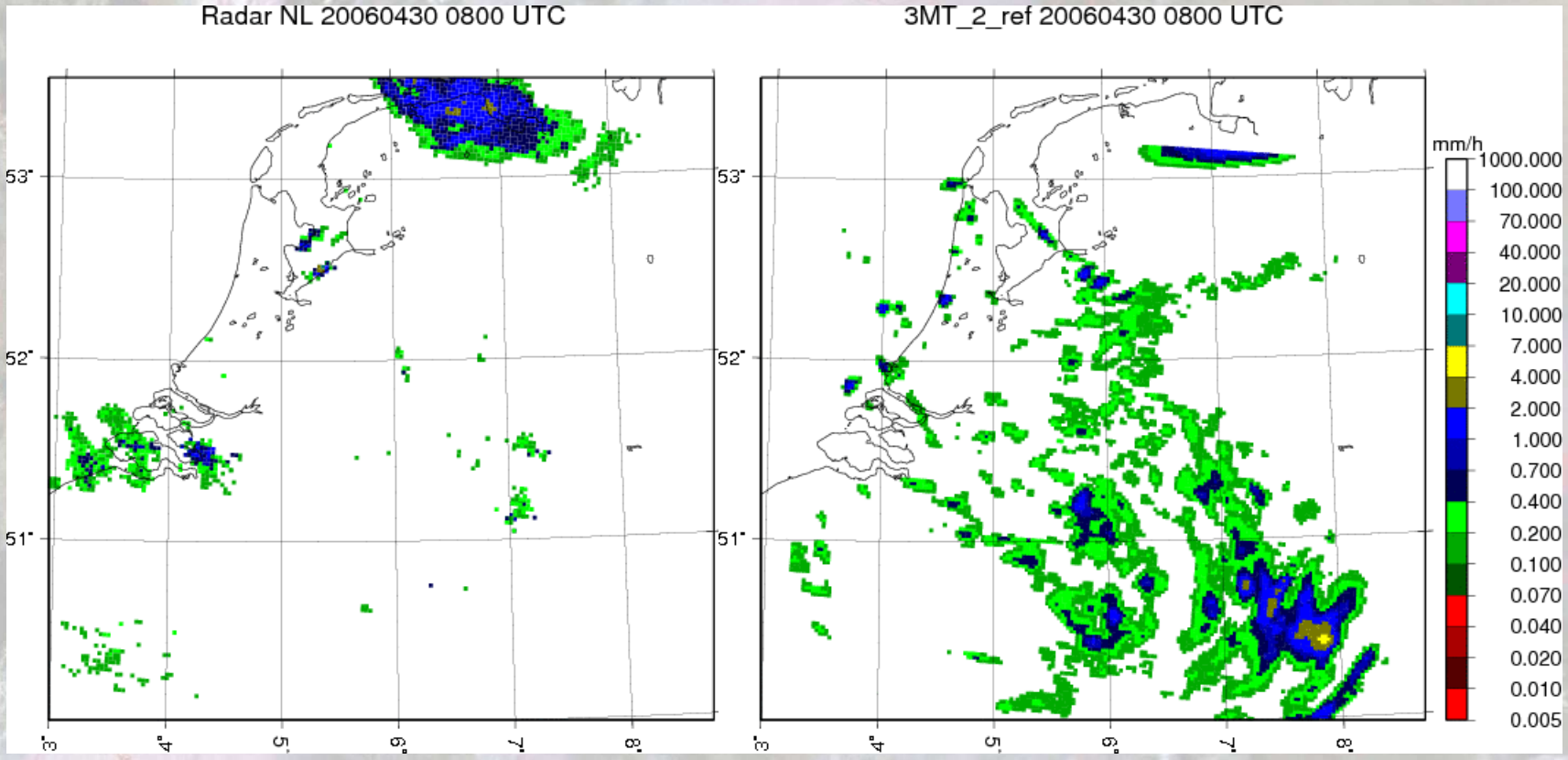
- Runs at 2 km
- ALARO + 3MT, ALARO without deep convection scheme (NO3MT), AROME
- ALARO runs different physics interface
- ALARO runs different surface scheme
- Use of ALARO outside resolution range it was meant for
- Caution with interpretation of radar rain intensities, can be a factor of 2 wrong
- Some features not caught due to missing history

Comparison with satellite

- Satellite 3MT, NO3MT, AROME



Comparison with radar



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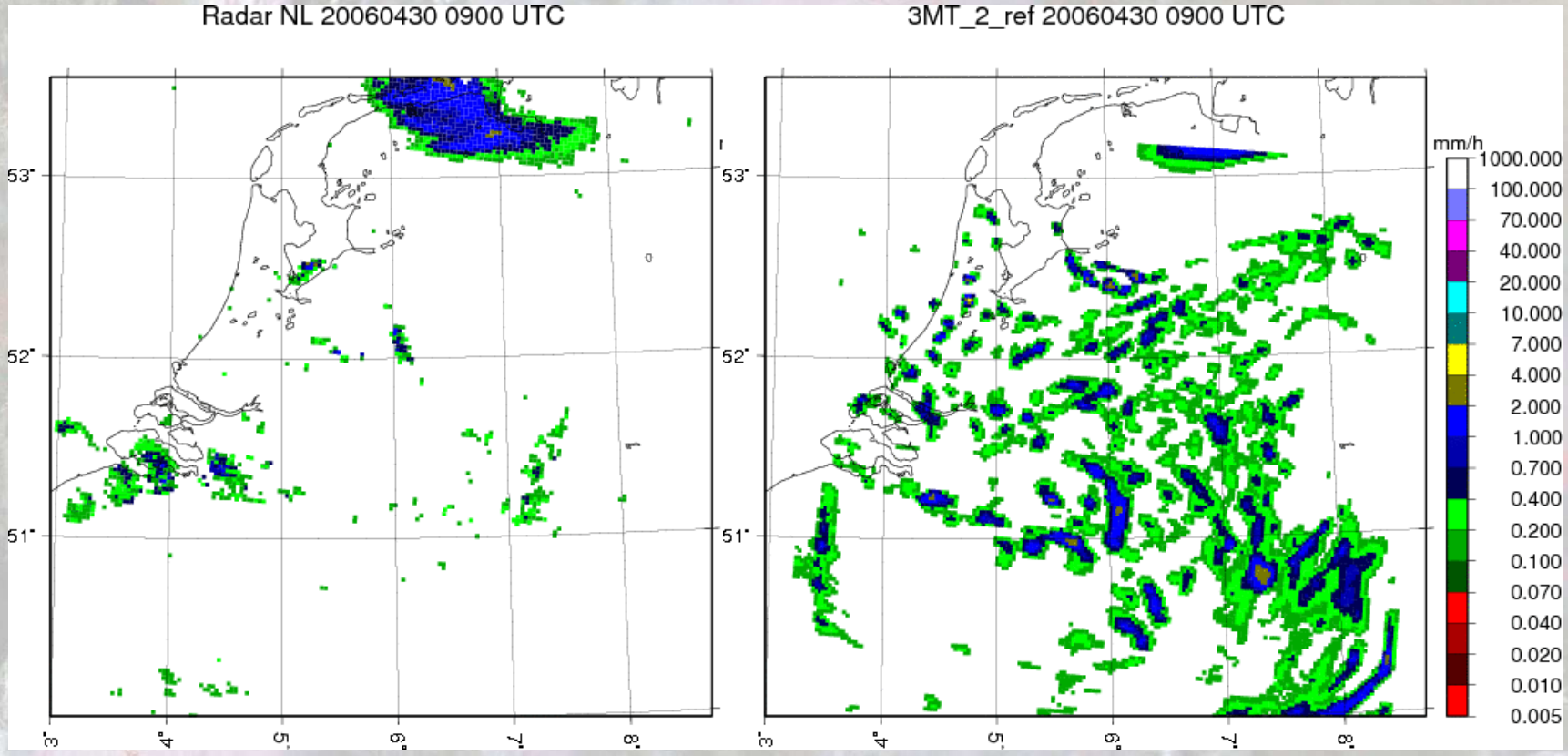

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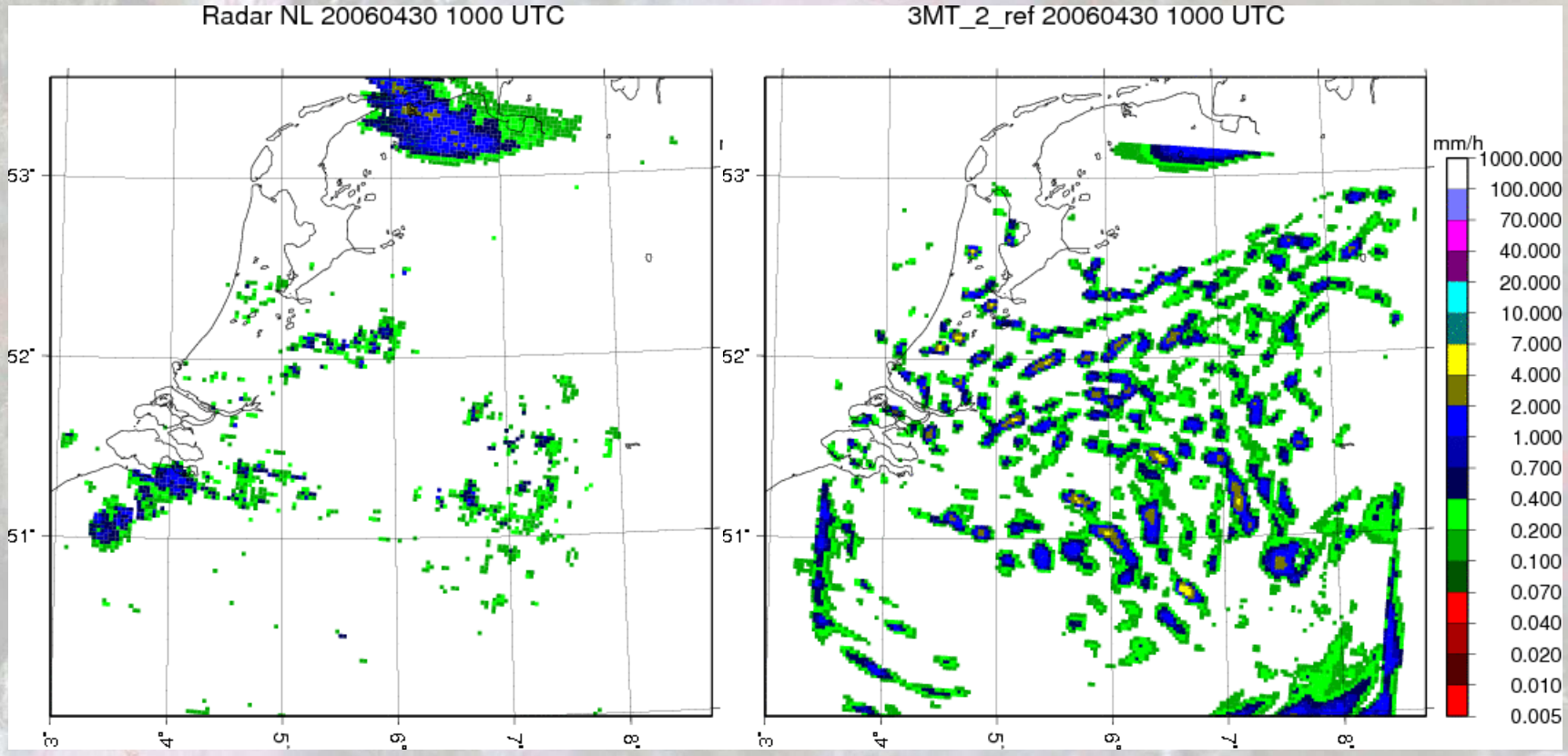

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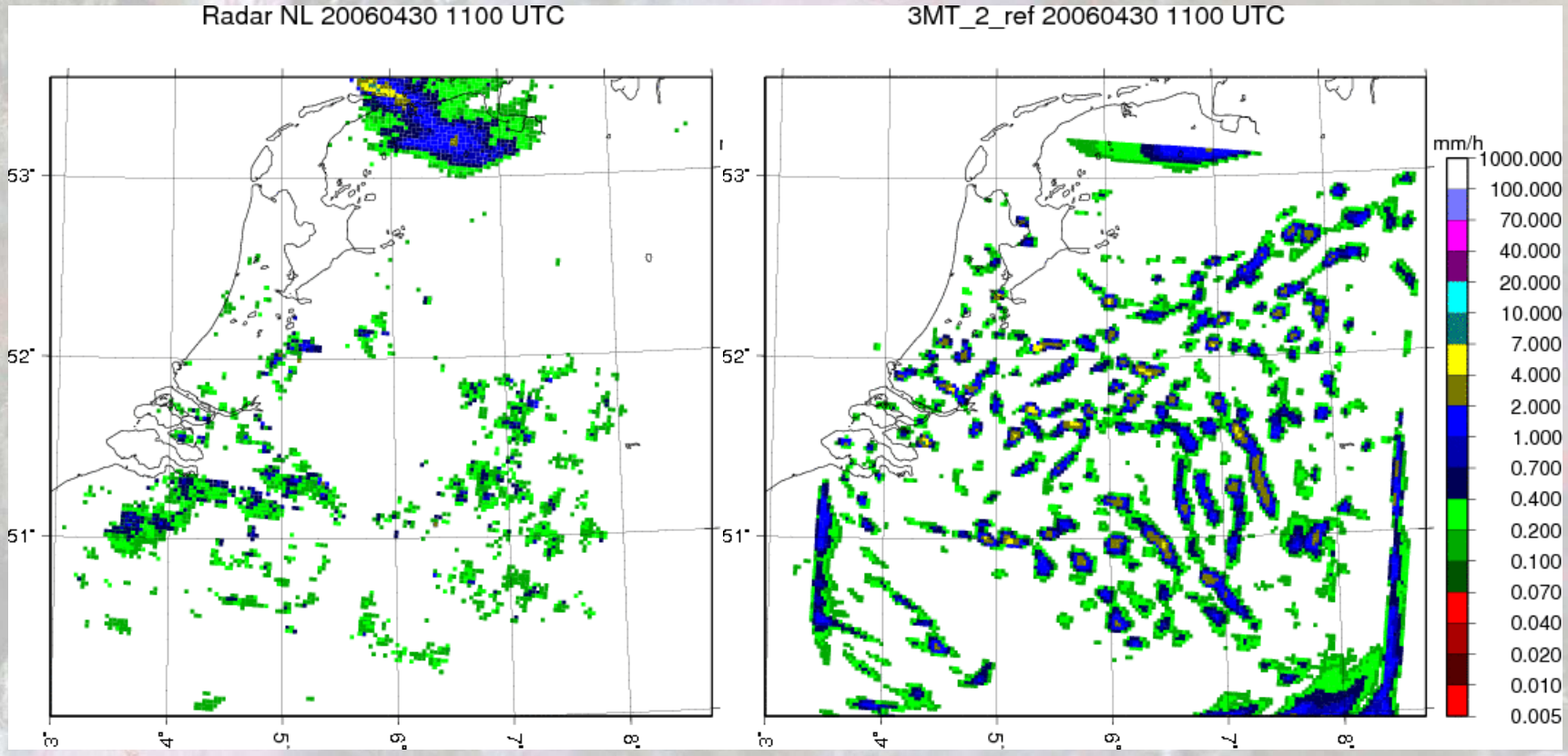

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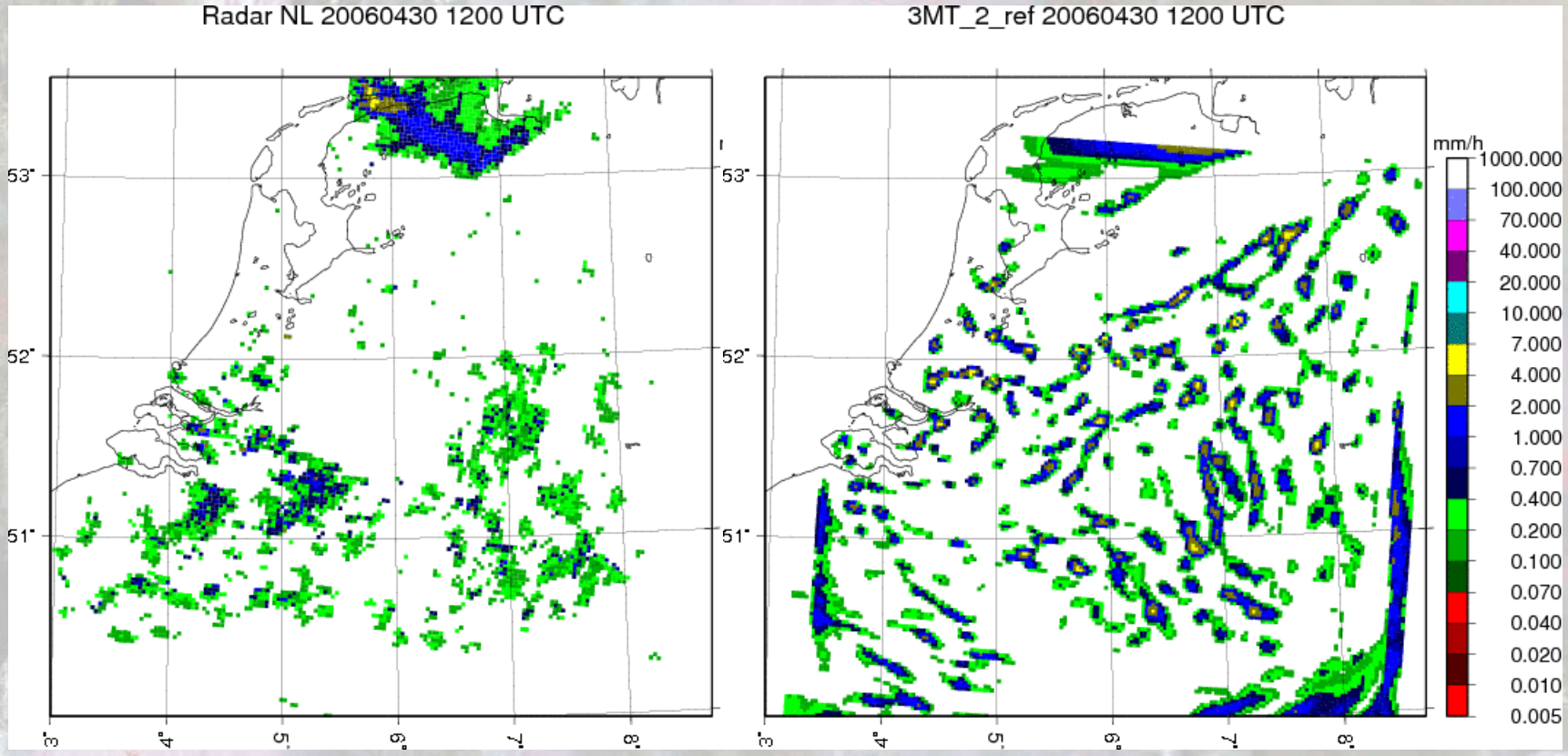

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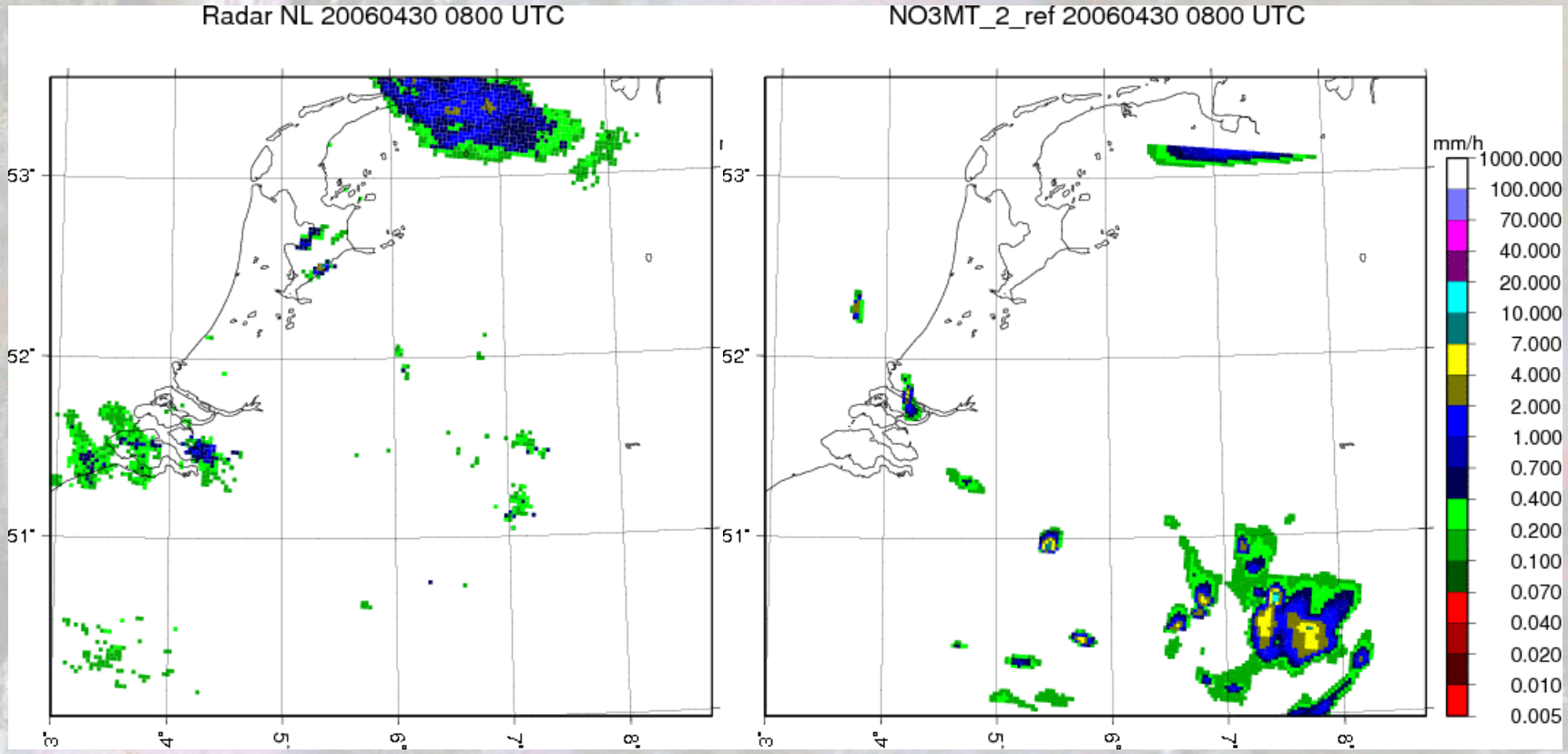

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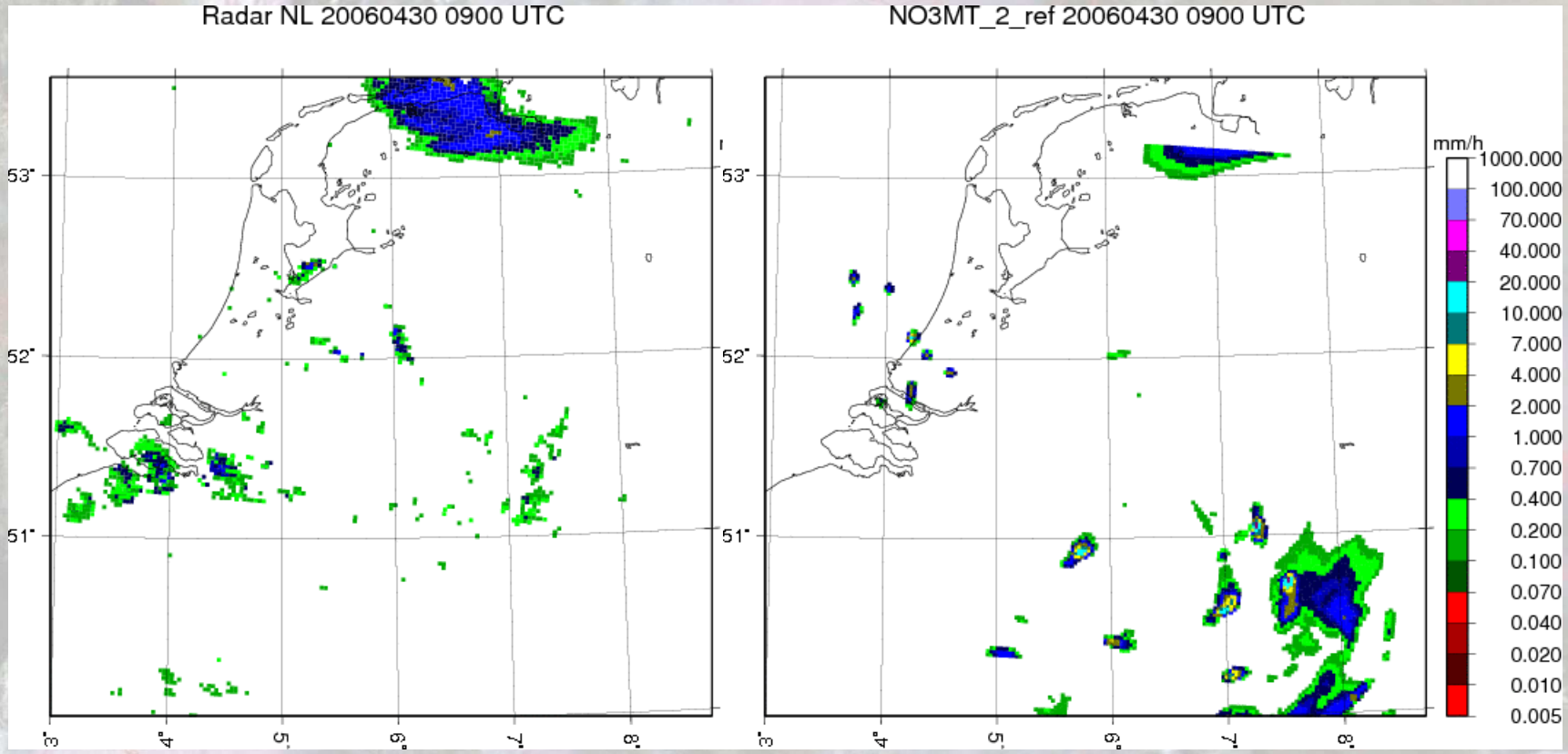

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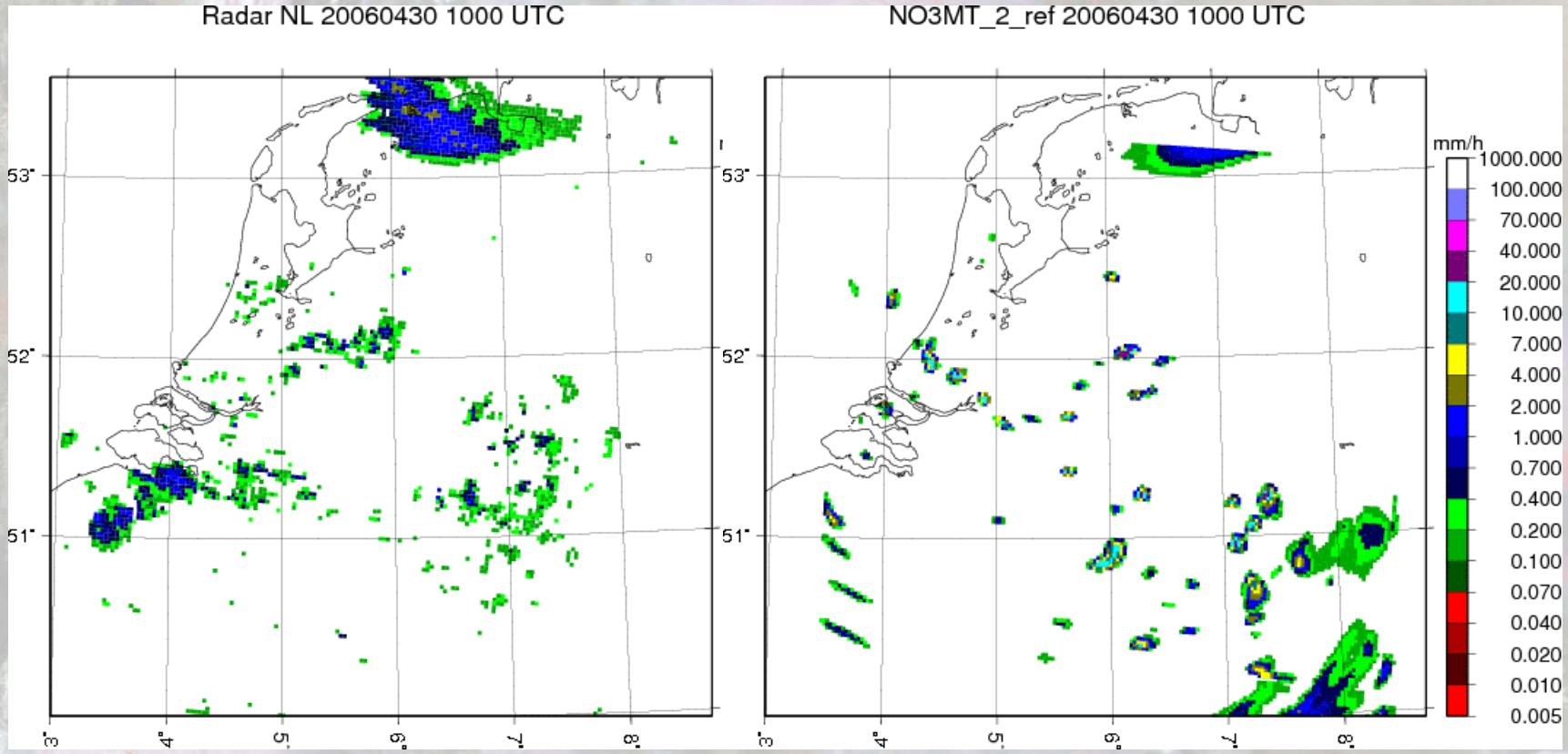

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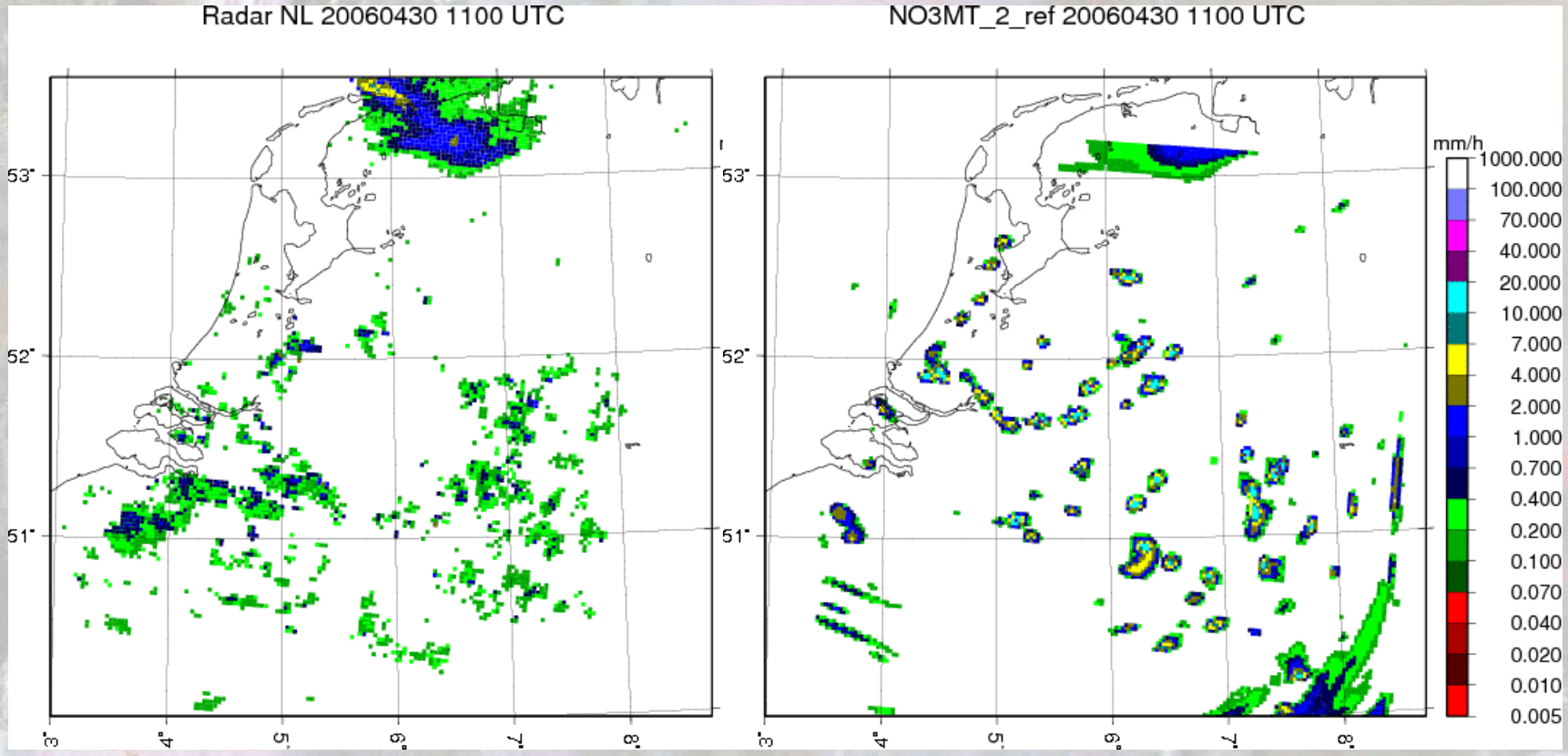

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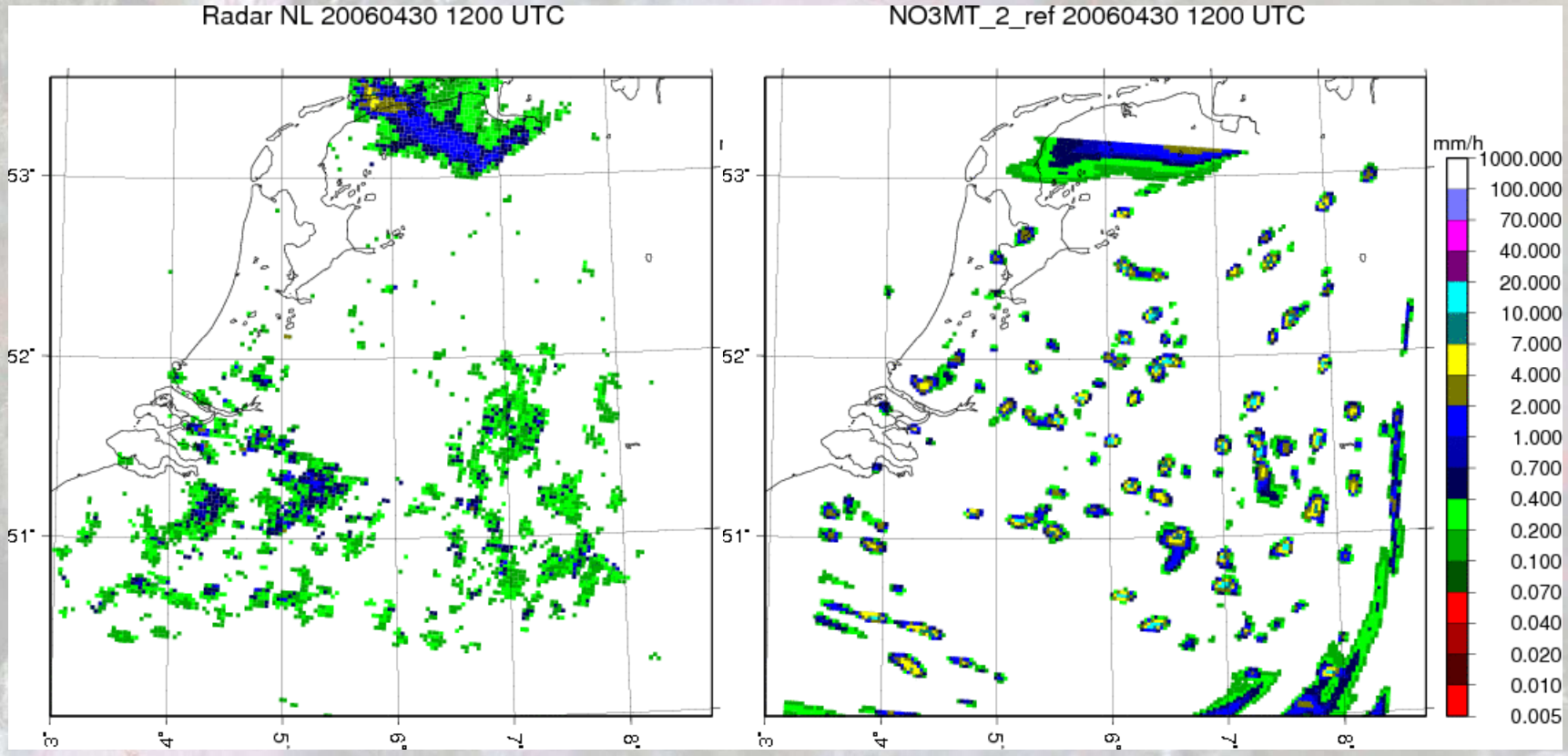

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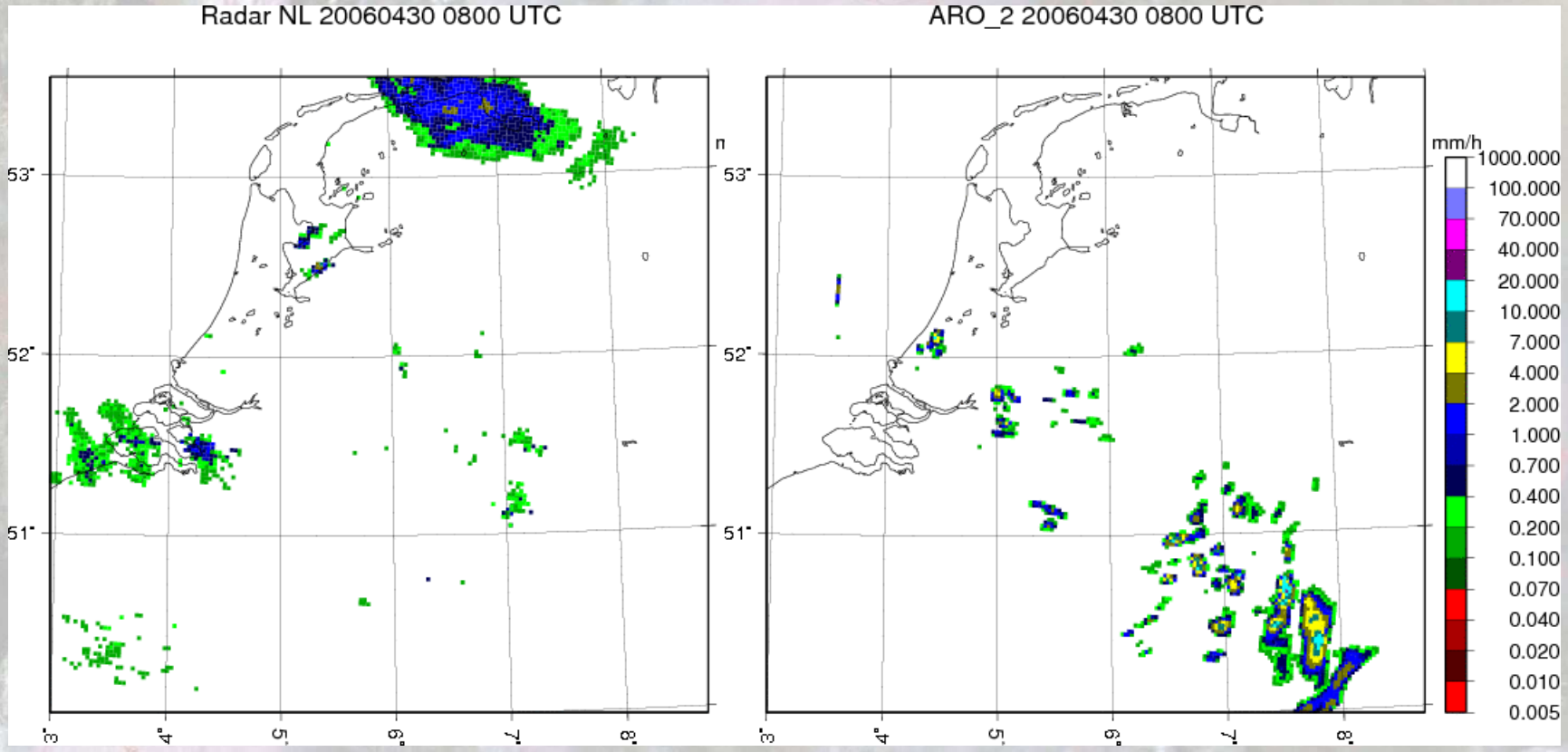

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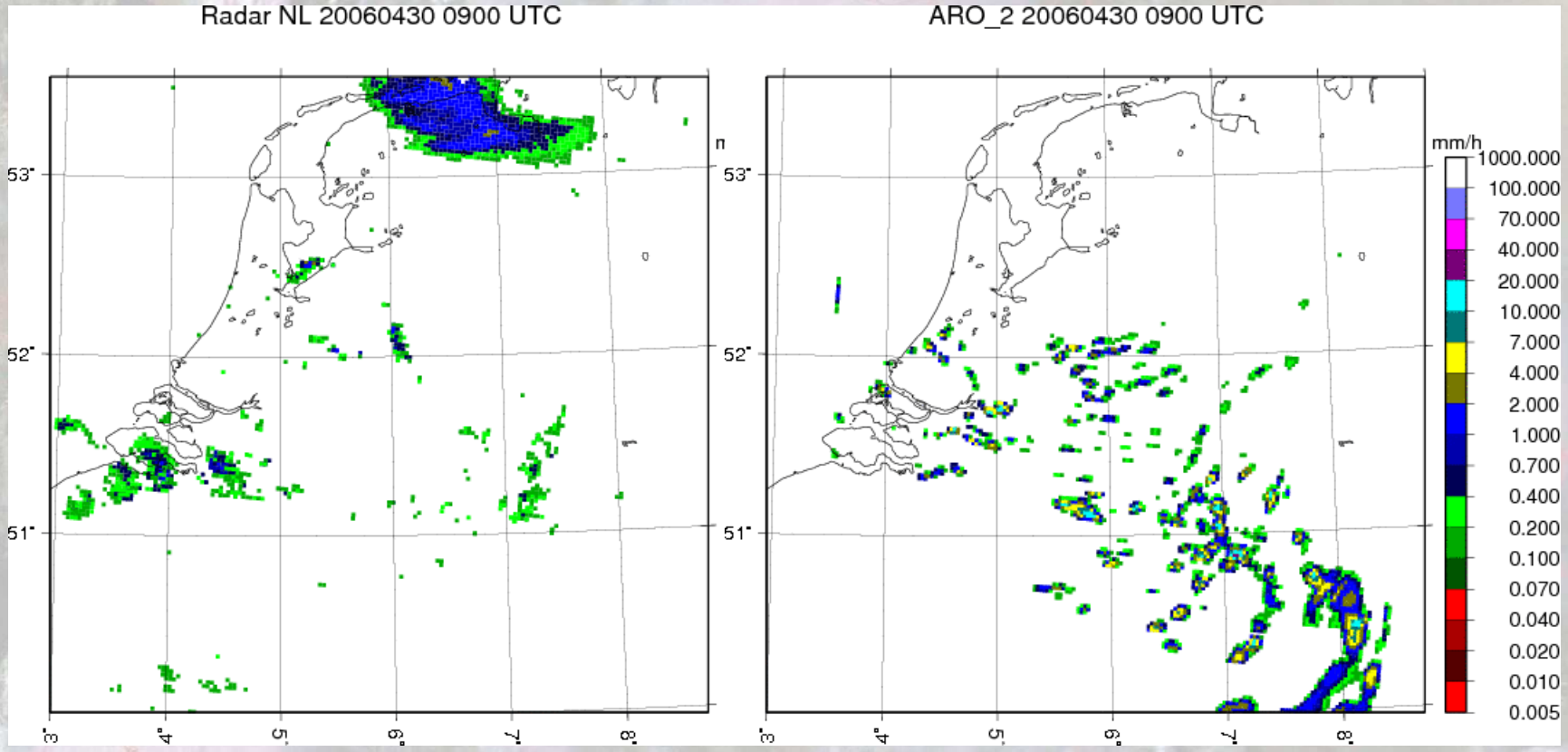

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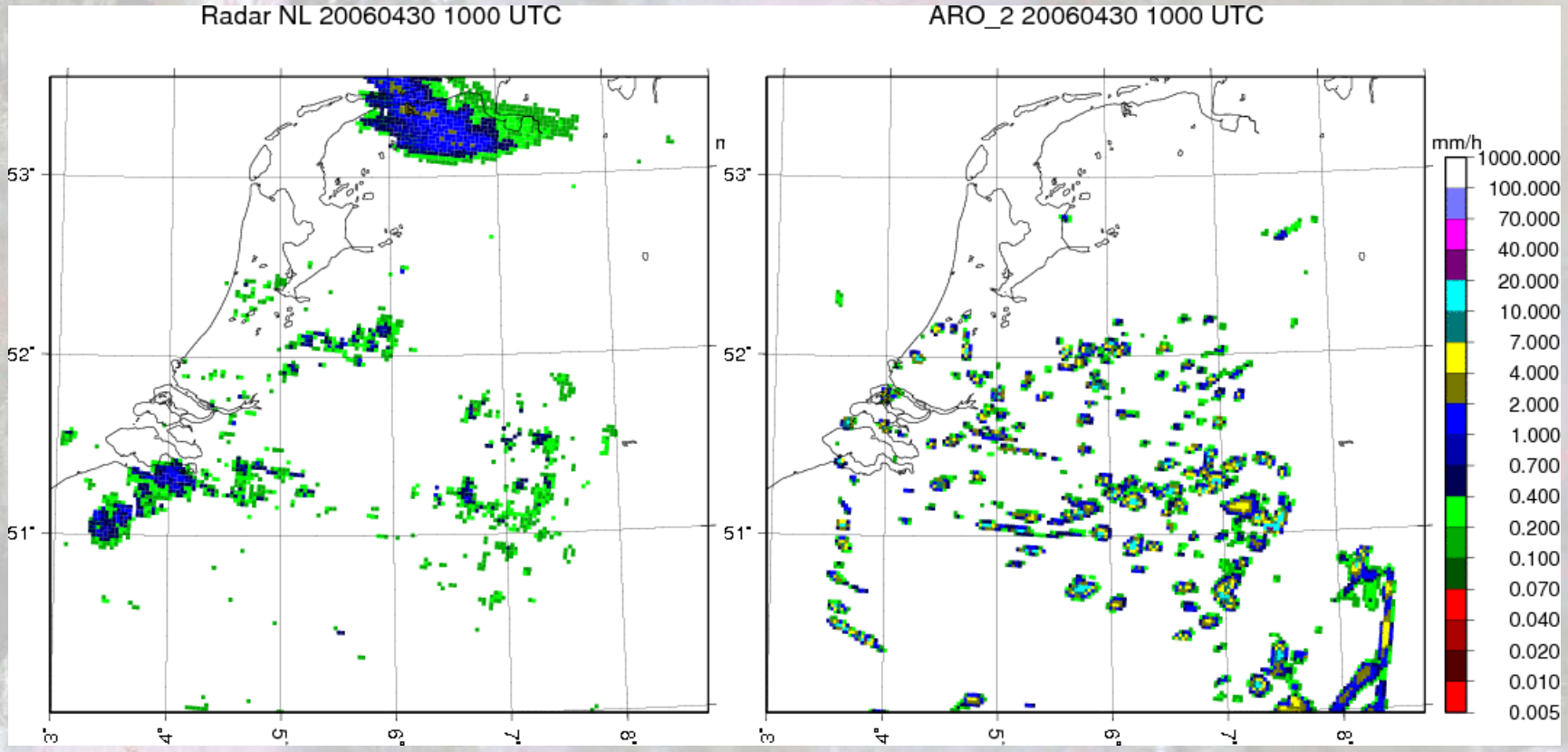

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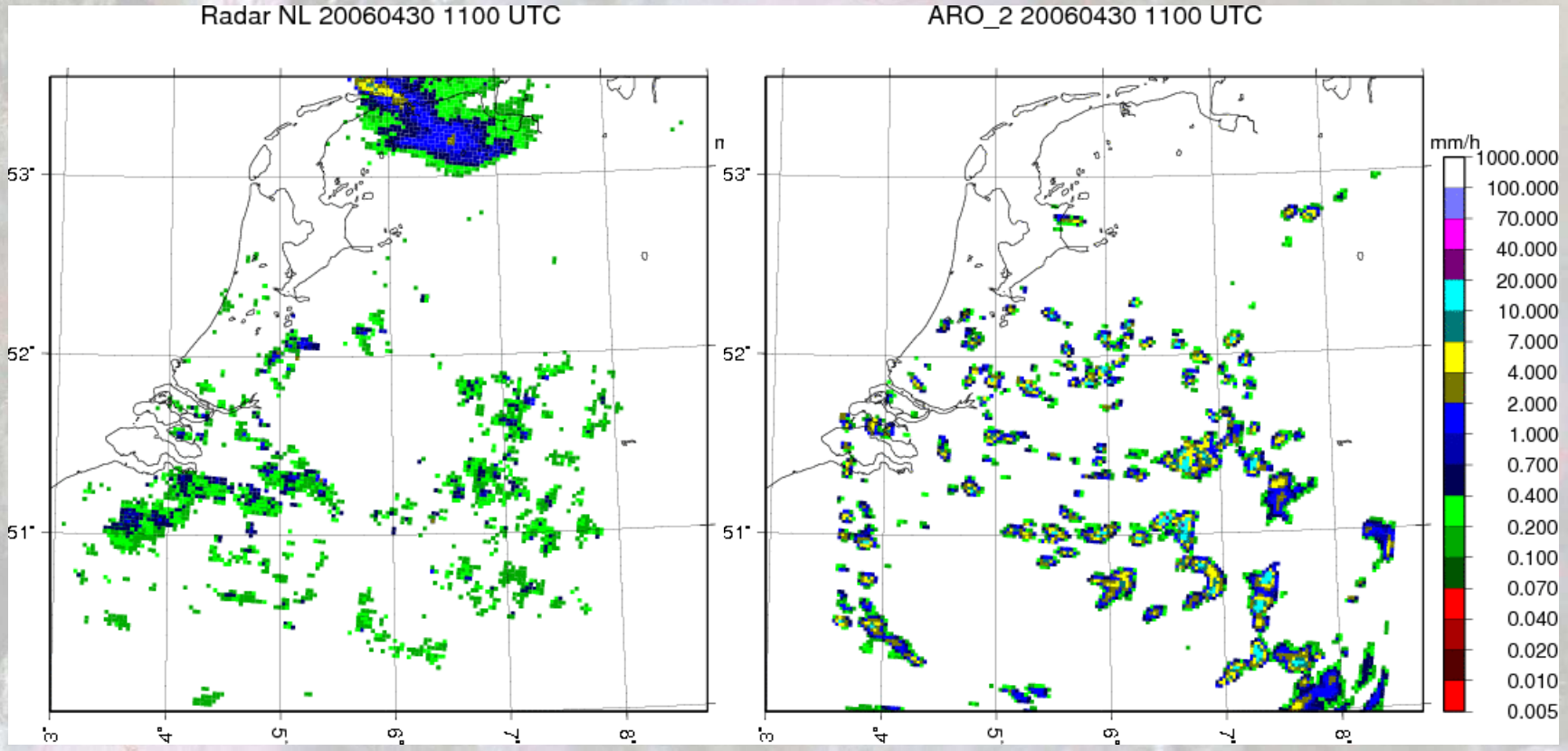

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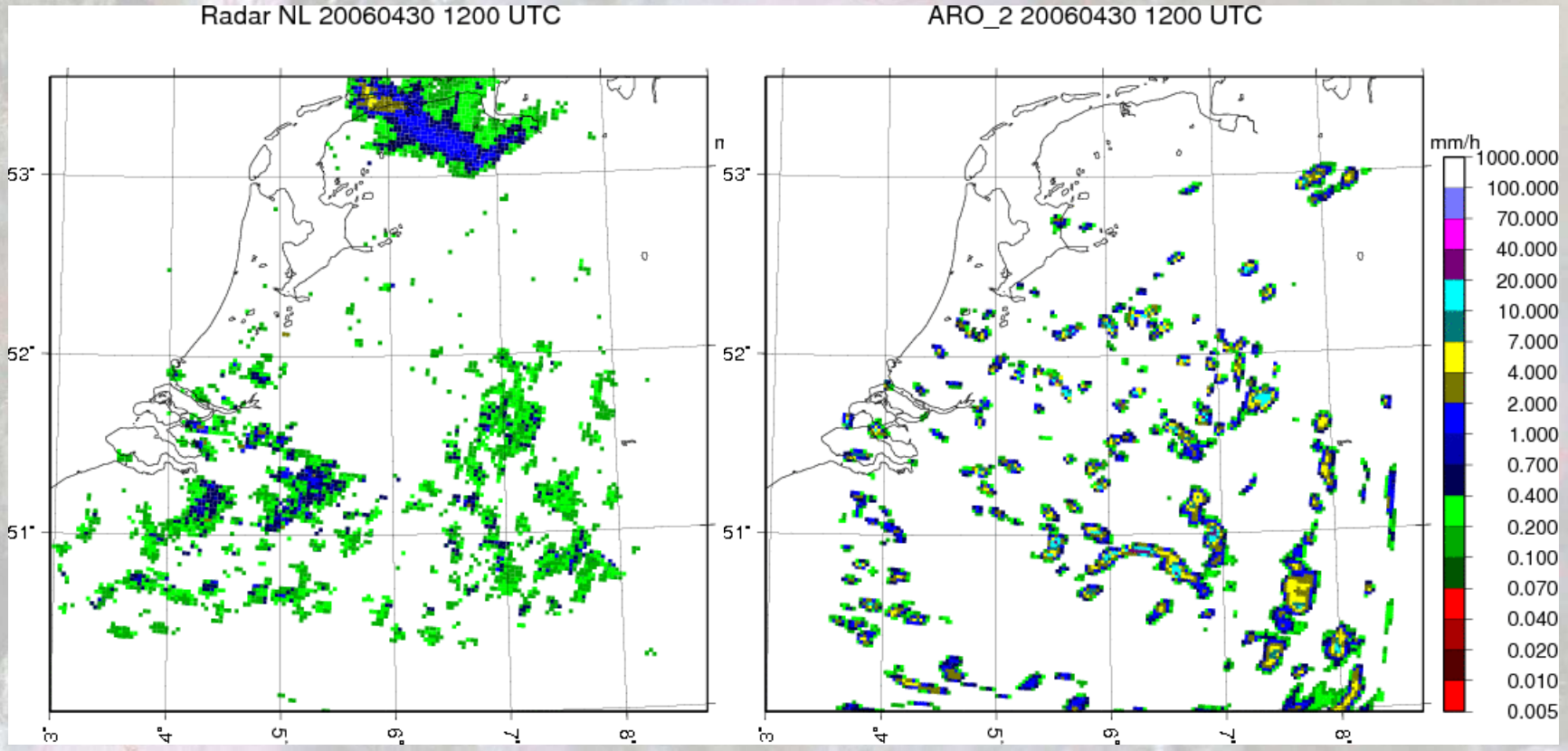
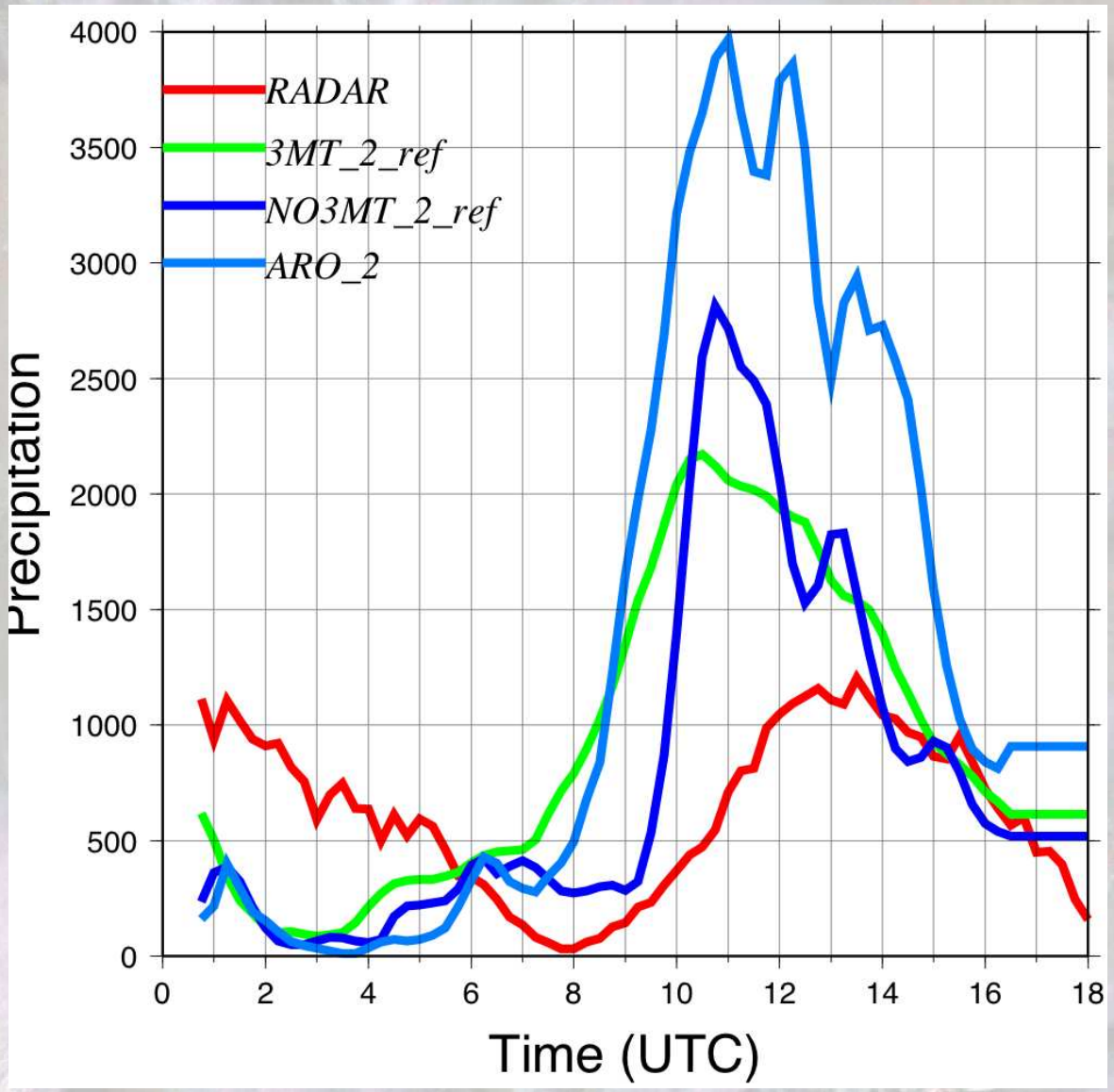


Impact deep convection scheme



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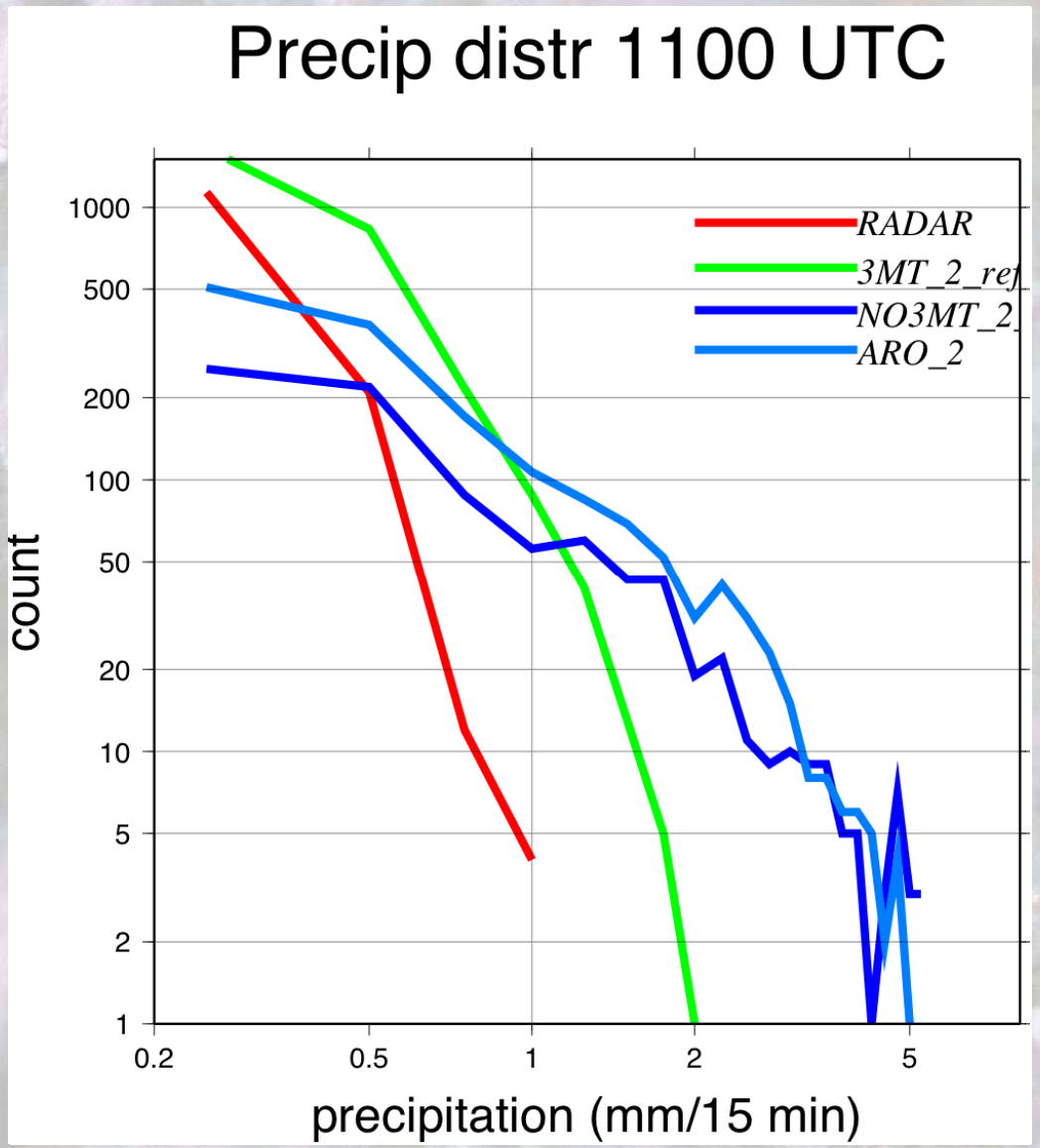
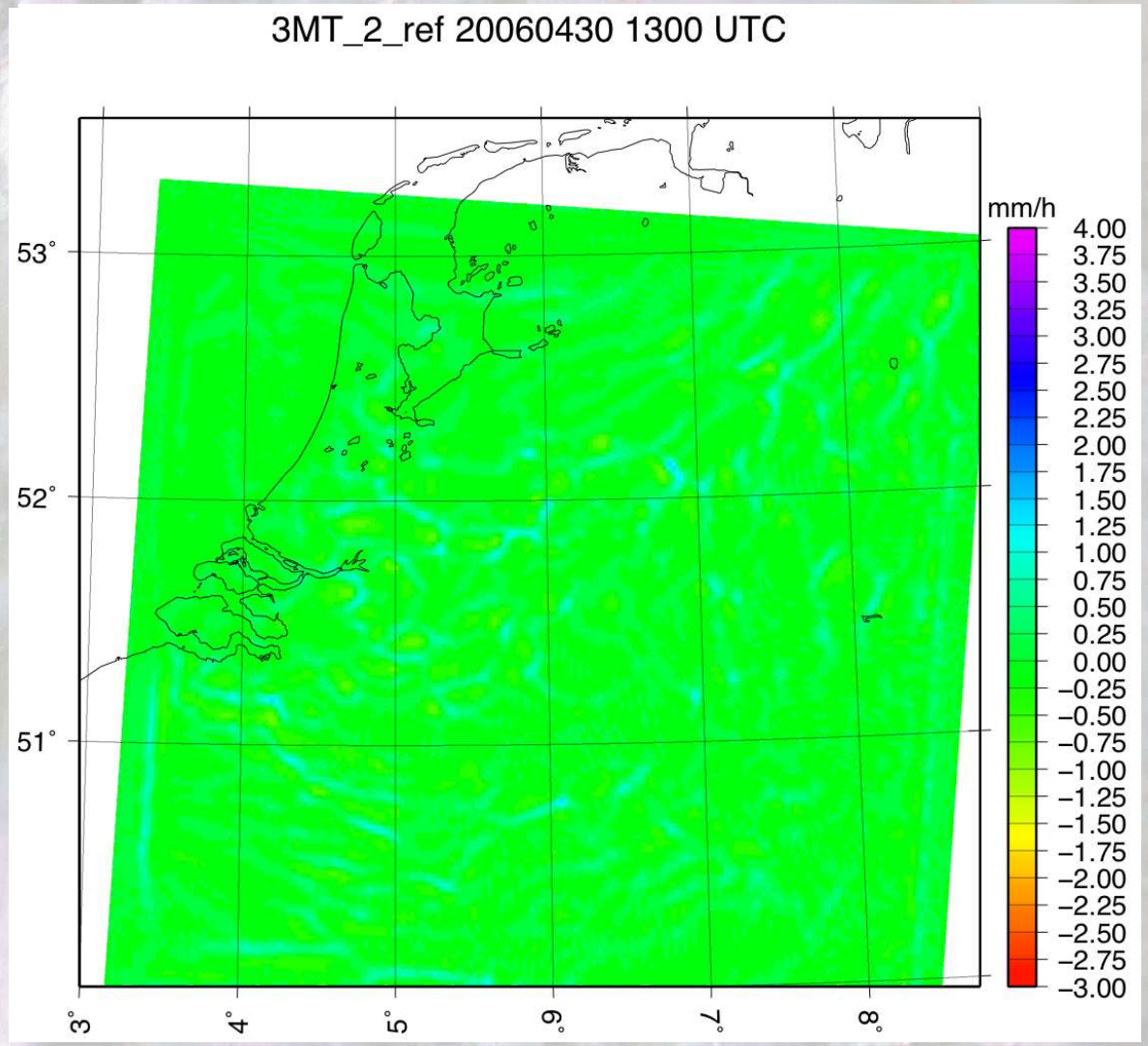


Impact deep conv. scheme

- Convection starts earlier and peaks earlier
- Convection less intense
- Precipitation area overestimated
- Precipitation amount similar to run without deep convection scheme
- Entrainment with history may help
- Where do local maxima (in time) in precipitation intensity come from?

Intensity fluctuations



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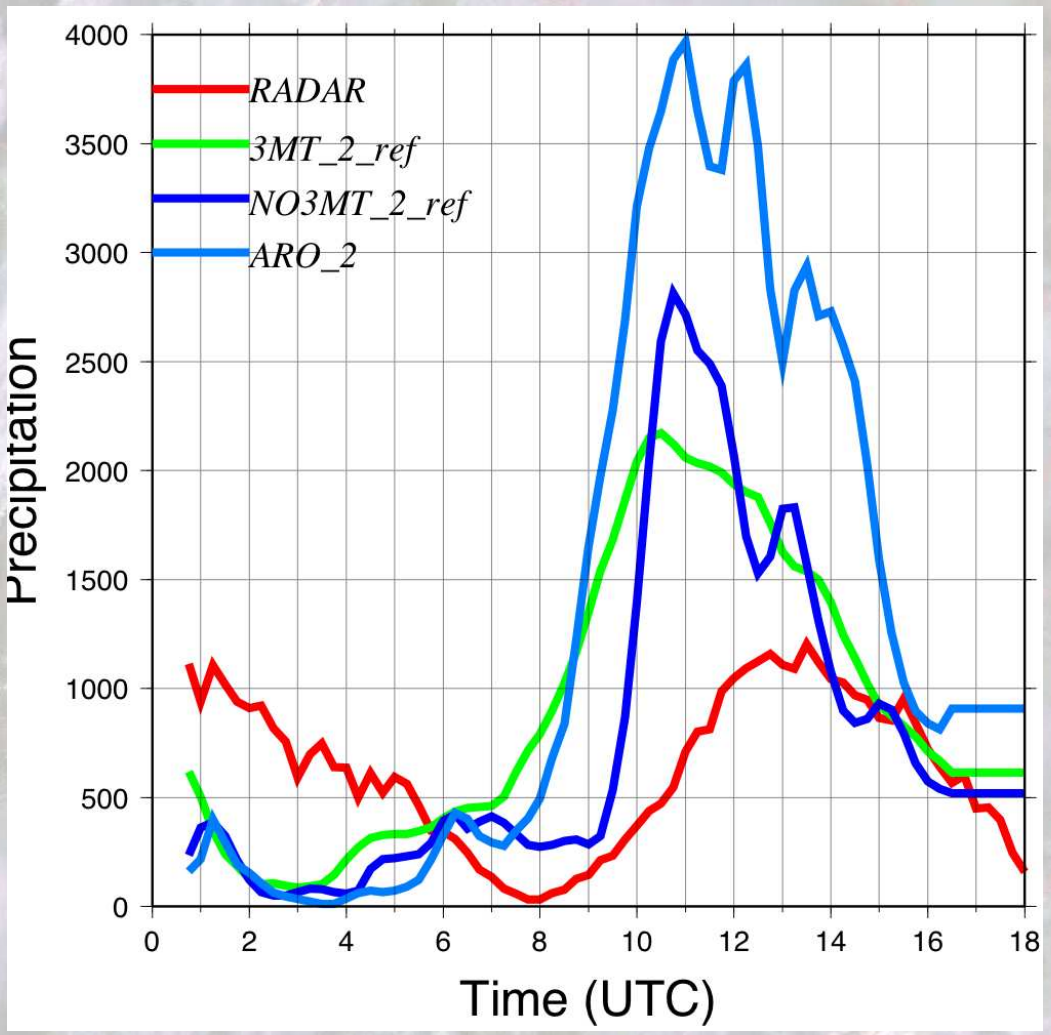
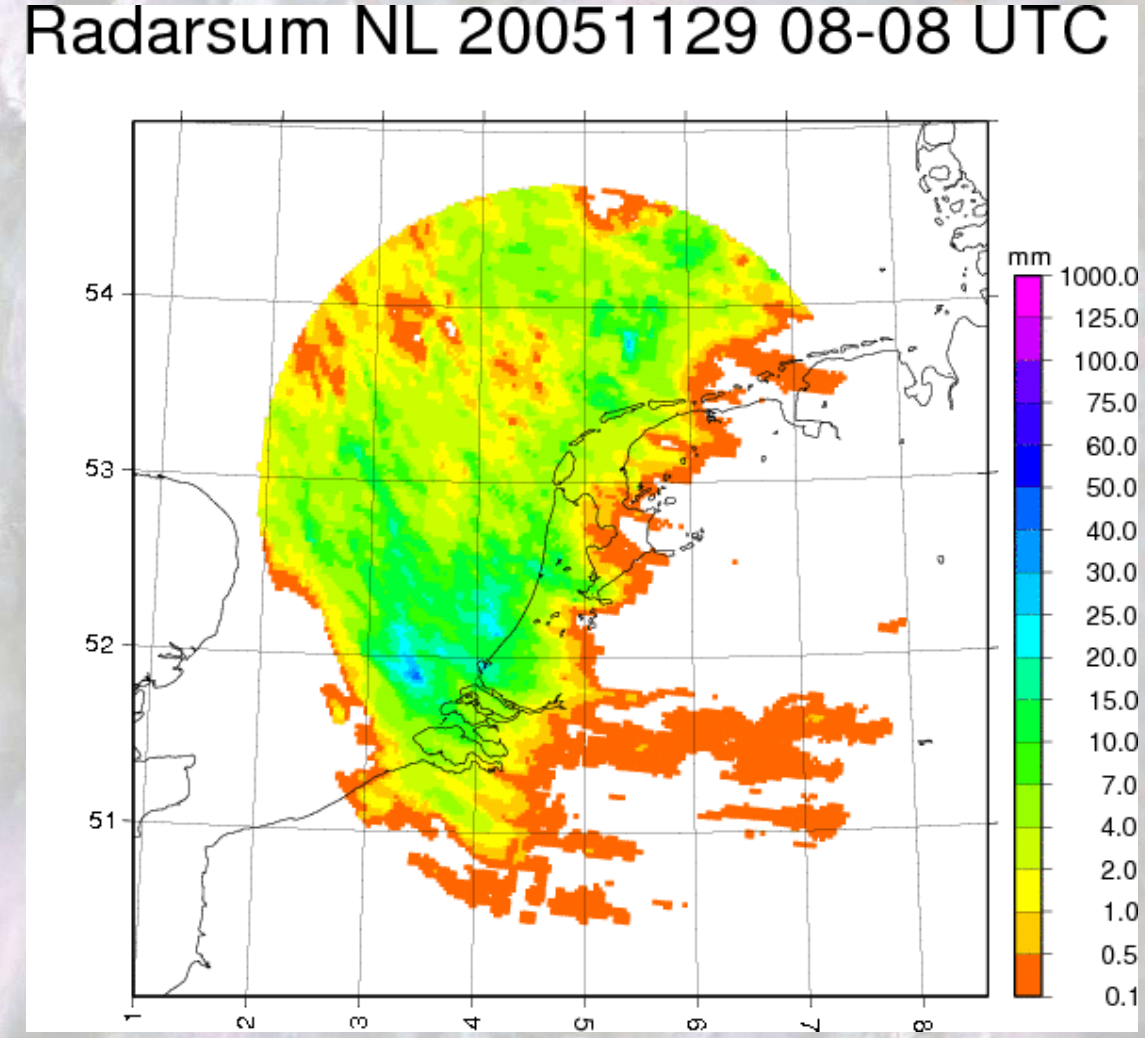


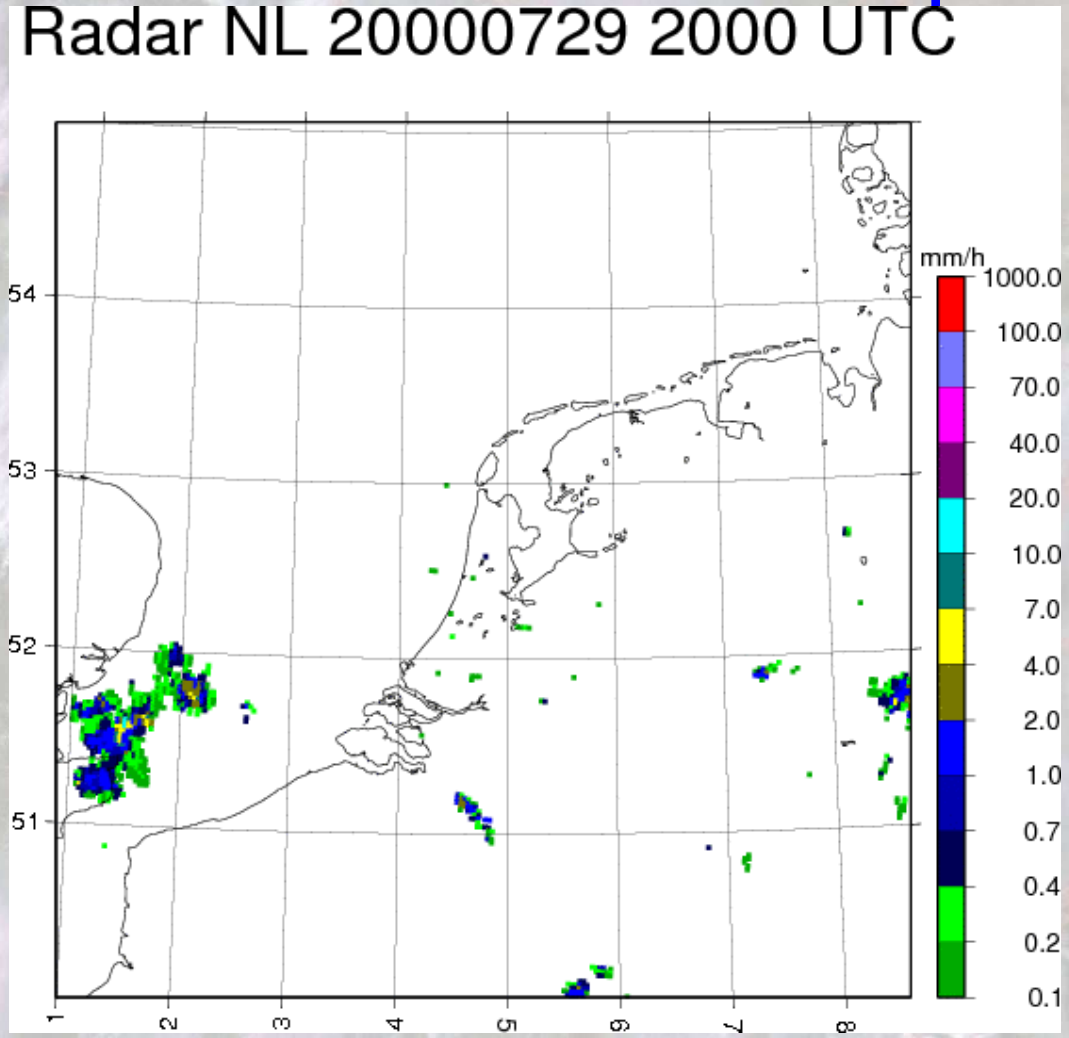
Summary and discussion

- Cold pool generation mechanism for secondary maxima?
- Onset of deep convection shared problem?
- Intercomparison of single or few cases way forward to learn from each other and to increase knowledge basis for attacking these problems (discussion this afternoon)
- Initial idea to have shallow to deep convection intercomparison (rain forest case)

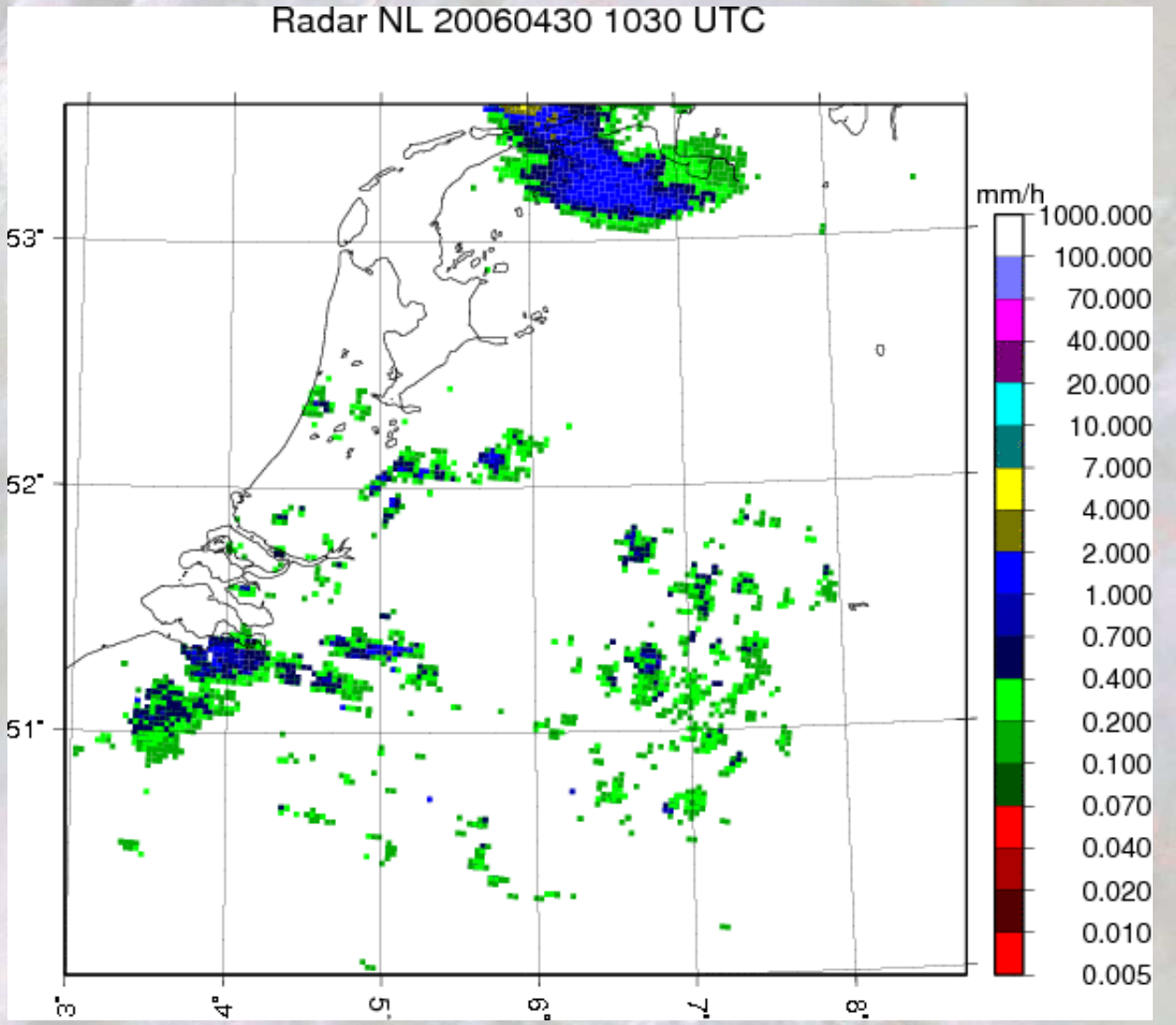
Example: convection dying inland



Convection PBL development



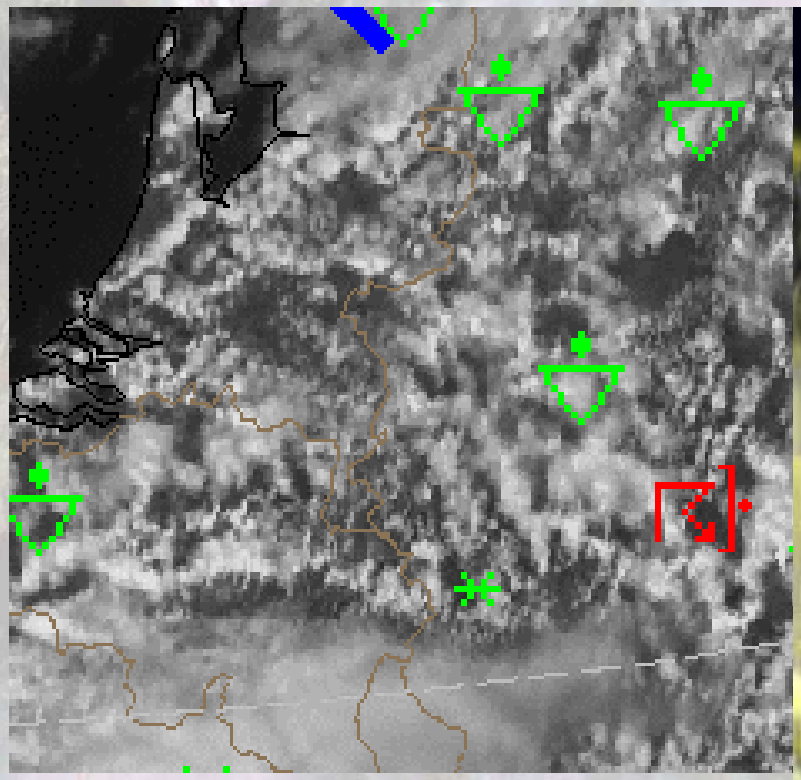
Impact resolution

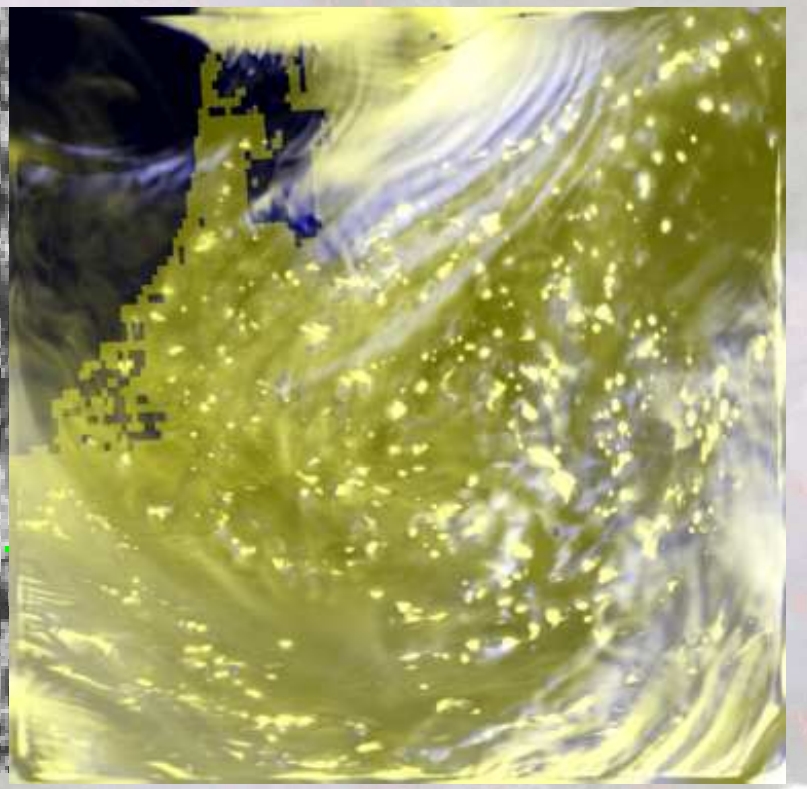


Comparison with satellite

- Satellite

2, 1, 0.5 km





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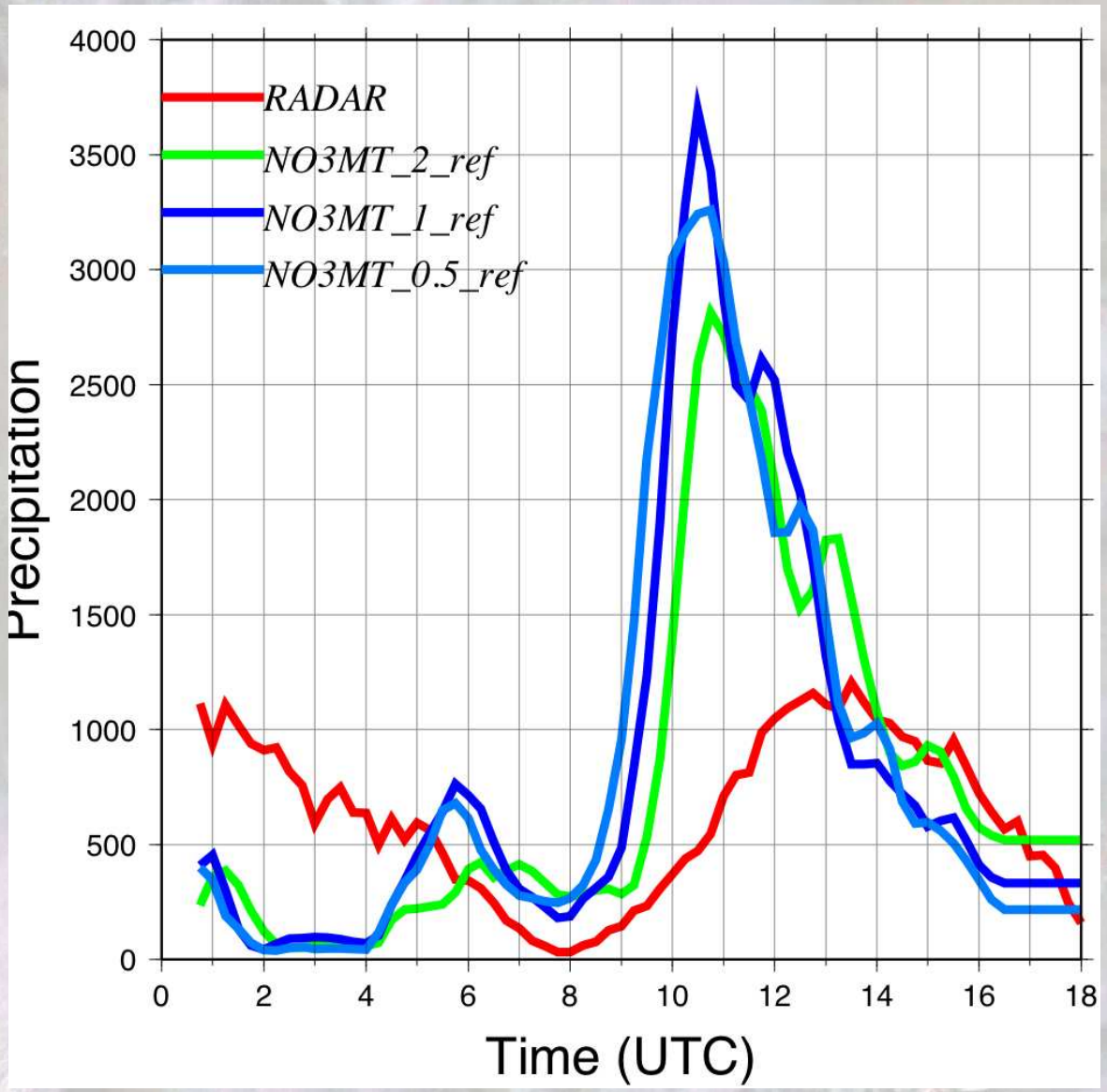

Impact resolution

- Increasing resolution increases maximum precipitation, decrease from 1 -> 0.5 km. What happens at even higher resolution?
- Higher resolution shows fewer extremes, smaller and weaker but more numerous cells
- Scales are not going to observed open cell scales
- Impact on onset of deep convection relatively small
- Scales become smaller with decreasing resolution
- All resolutions show secondary maxima