HCLIM activities

Danijel Belušić and the HCLIM team

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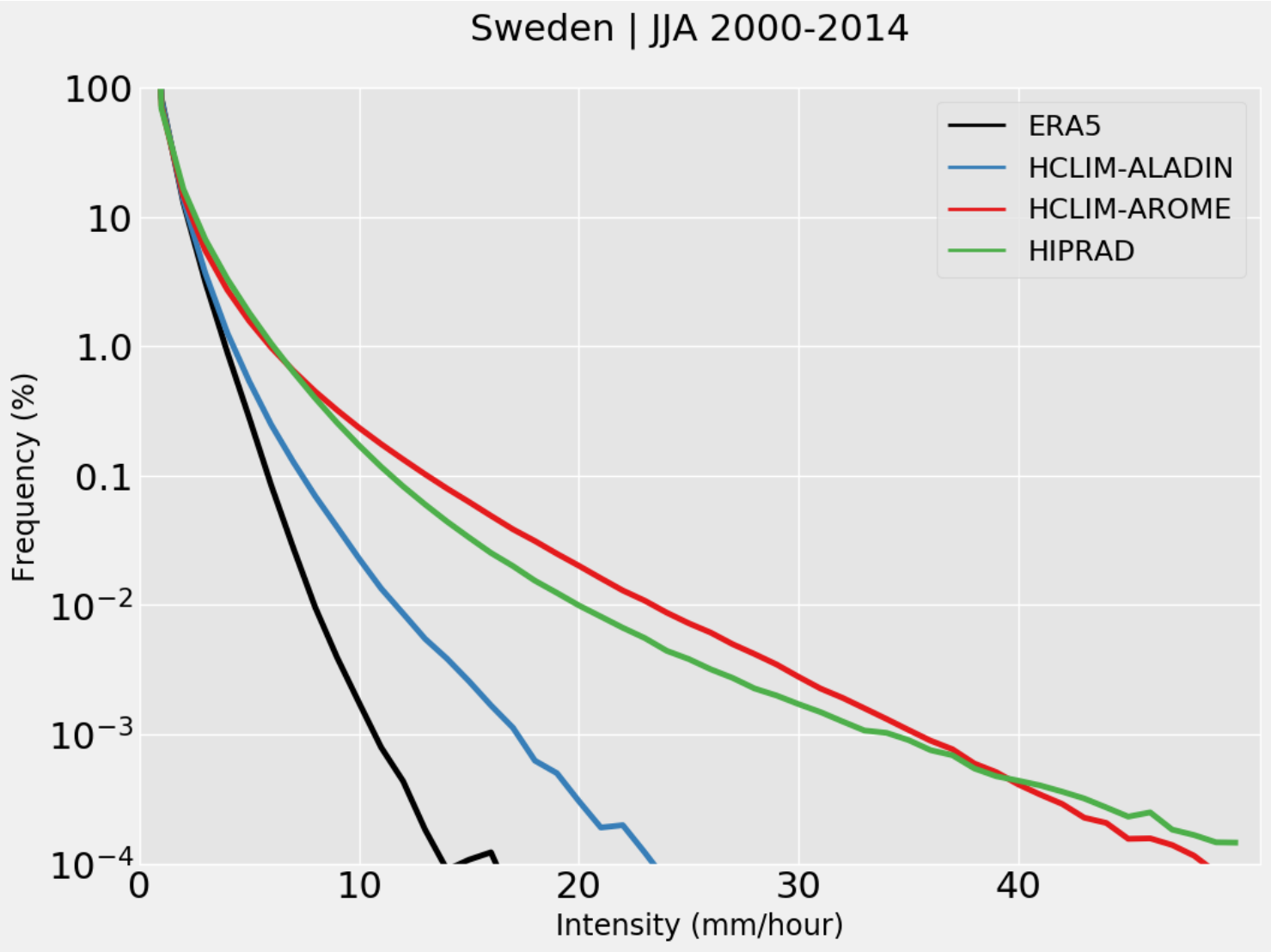
Why?


Sweden | JJA 2000-2014
ERA5
HCLIM-ALADIN
HCLIM-AROME
HIPRAD
Frequency (%)
100
10
1.0
0.1
10^{-2}
10^{-3}
10^{-4}
0
10
20
30
40
Intensity (mm/hour)

HCLIM consortium

The main idea:

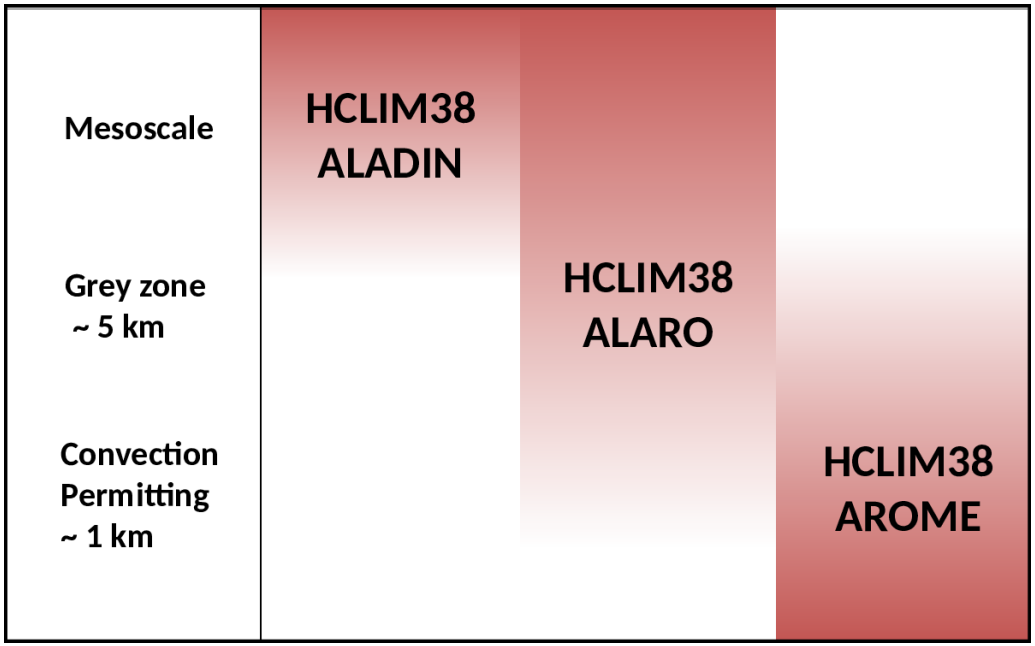
Improve the communication and collaboration between climate groups using HCLIM

MoU signatories:

- *AEMET*
- *DMI*
- *FMI*
- *KNMI*
- *Met Éireann*
- *MET Norway*
- *SMHI*

HCLIM38 paper

Belušić et al. 2020. *HCLIM38: a flexible regional climate model applicable for different climate zones from coarse to convection-permitting scales*, GMD, doi: 10.5194/gmd-13-1311-2020.



HCLIM38 paper

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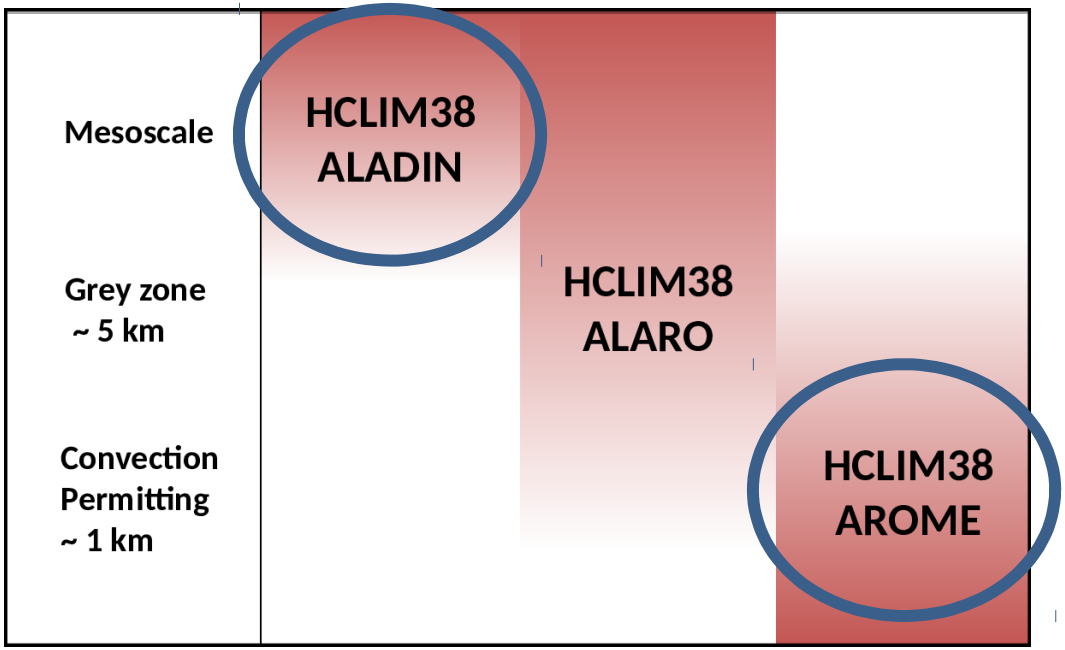
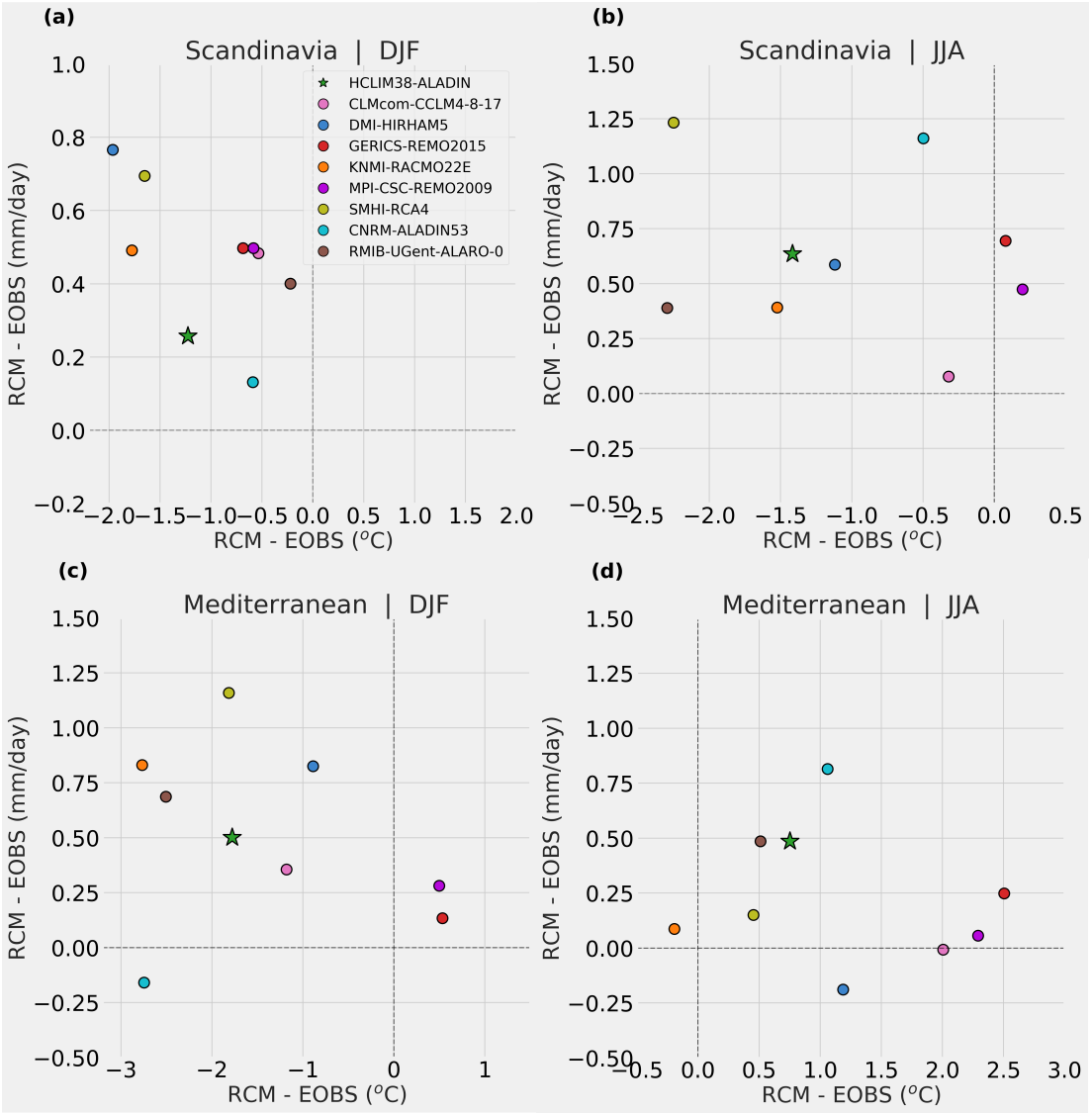


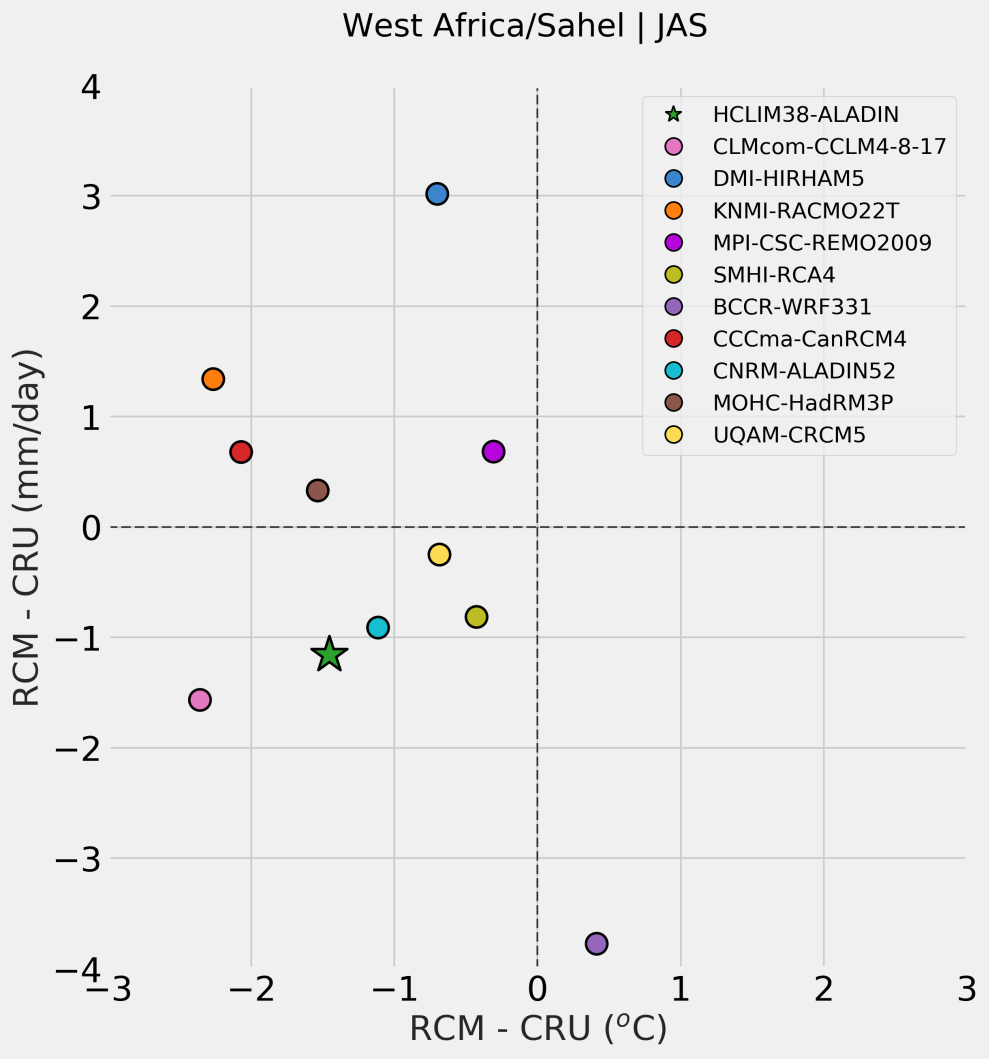
HCLIM38 paper

HCLIM38-ALADIN performance in Europe



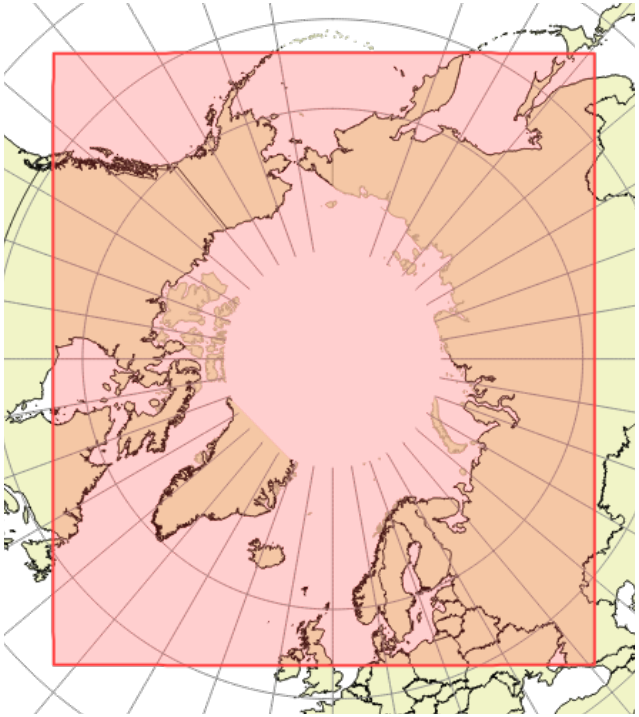
HCLIM38 paper

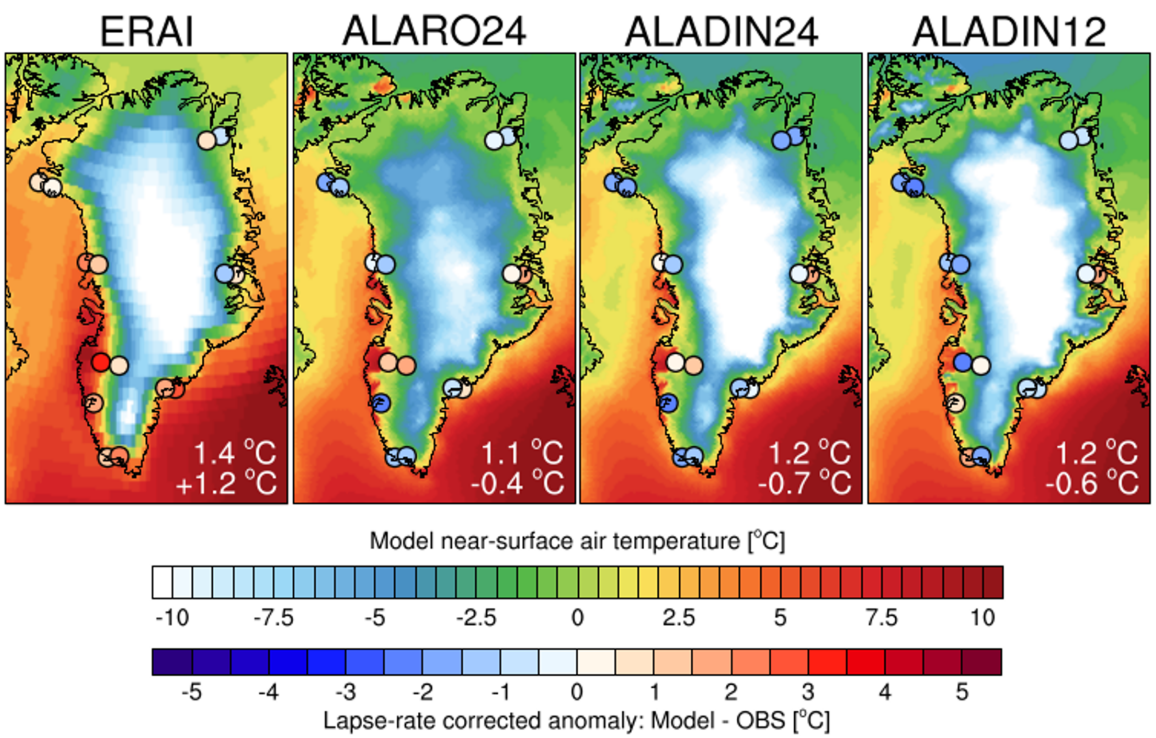
HCLIM38-ALADIN performance in Africa



HCLIM38 paper

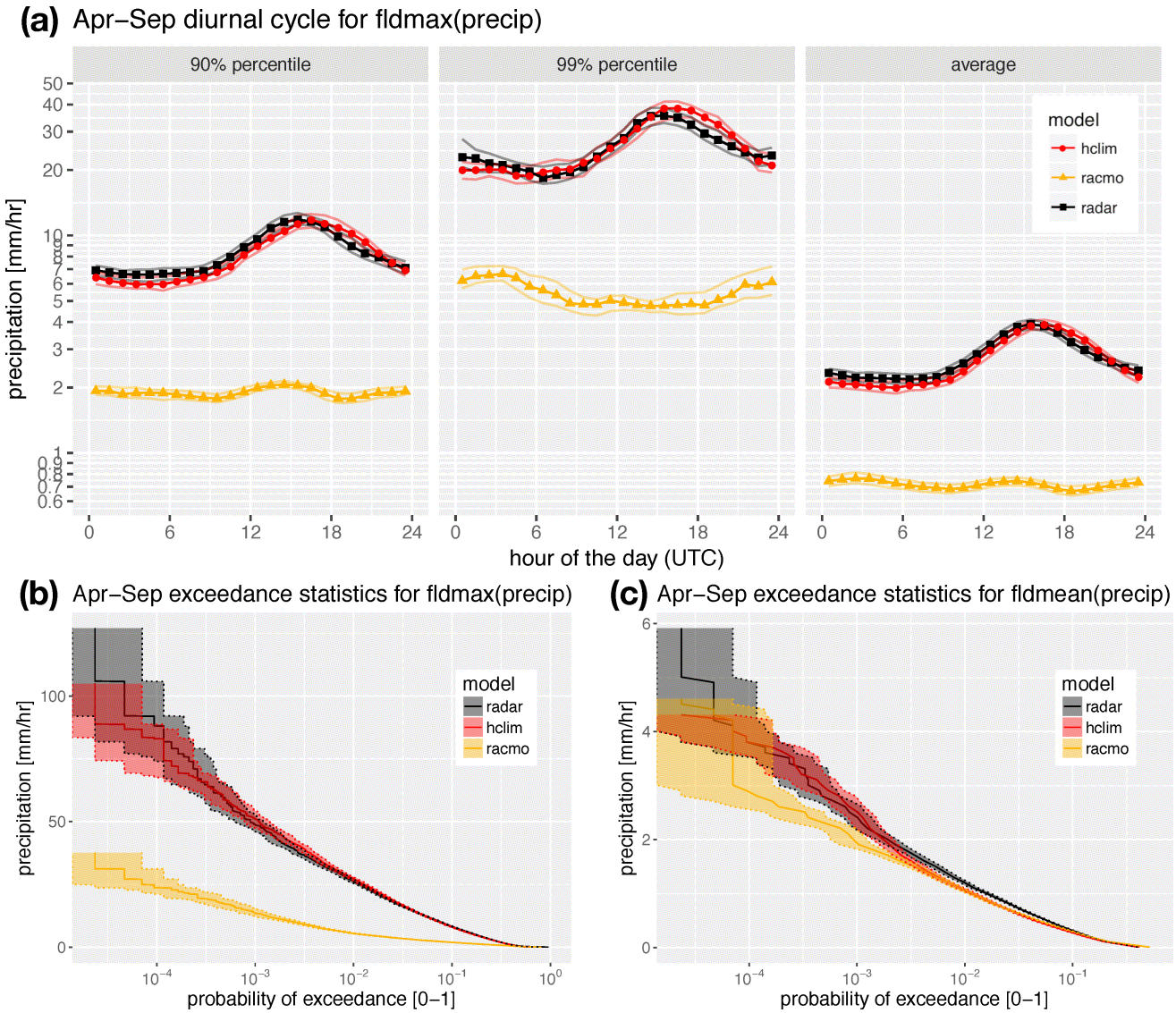
HCLIM38 performance in Greenland





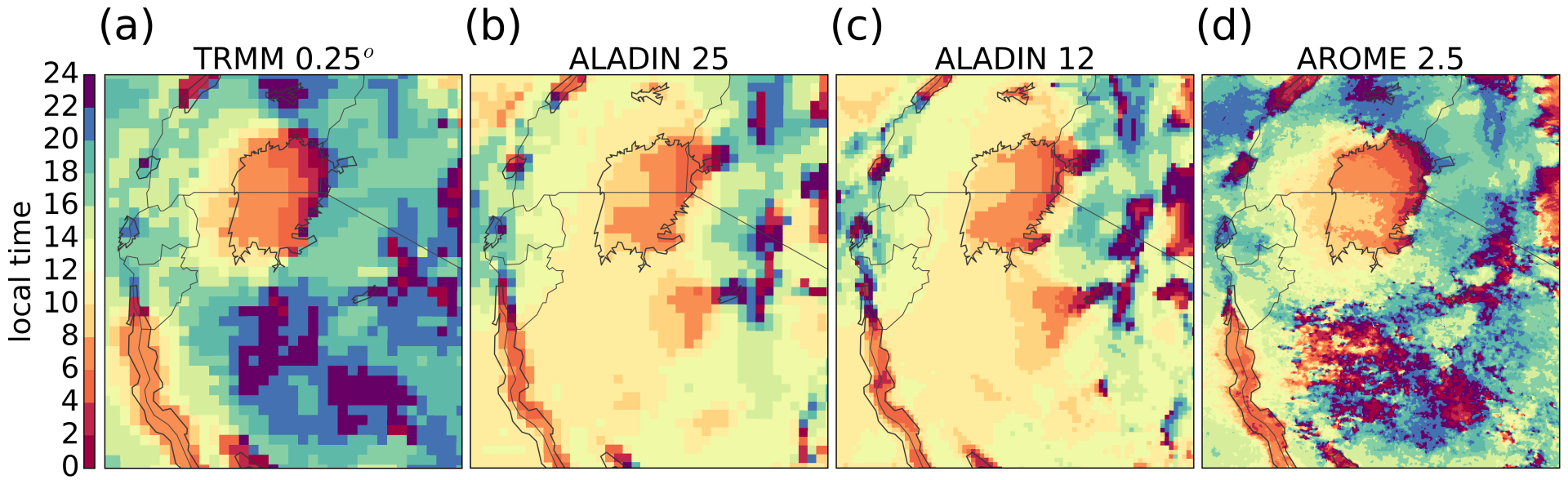
HCLIM38 paper

HCLIM38-AROME performance, the Netherlands



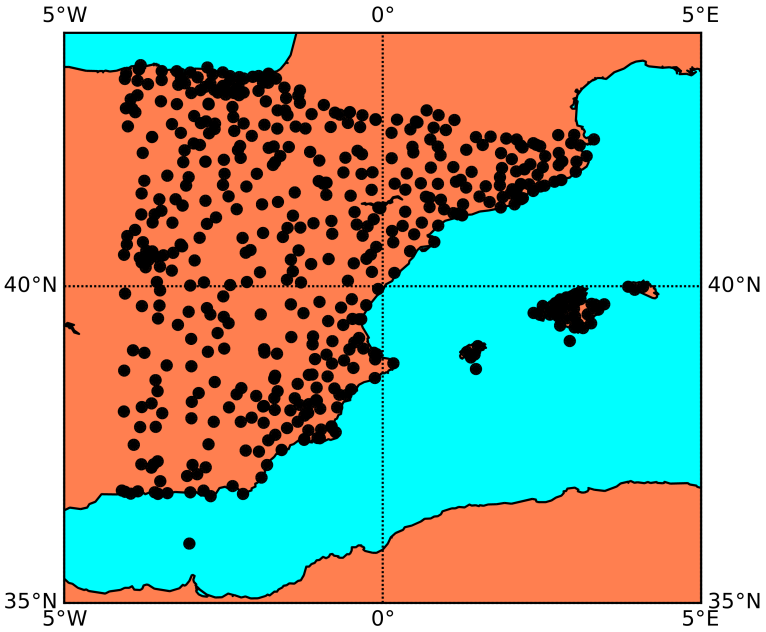
HCLIM38 paper

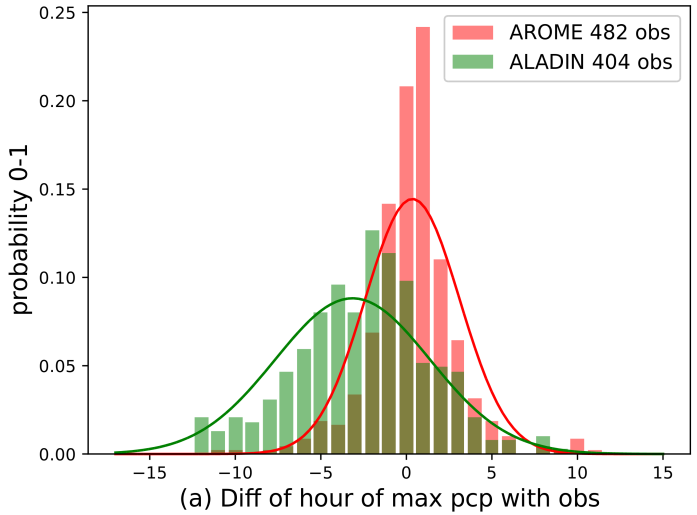
HCLIM38-AROME performance, Lake Victoria, Africa

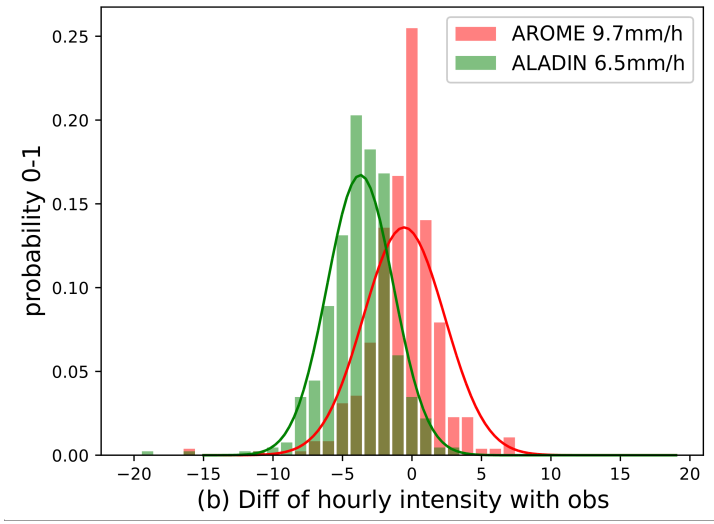


HCLIM38 paper

HCLIM38-AROME performance, Spain

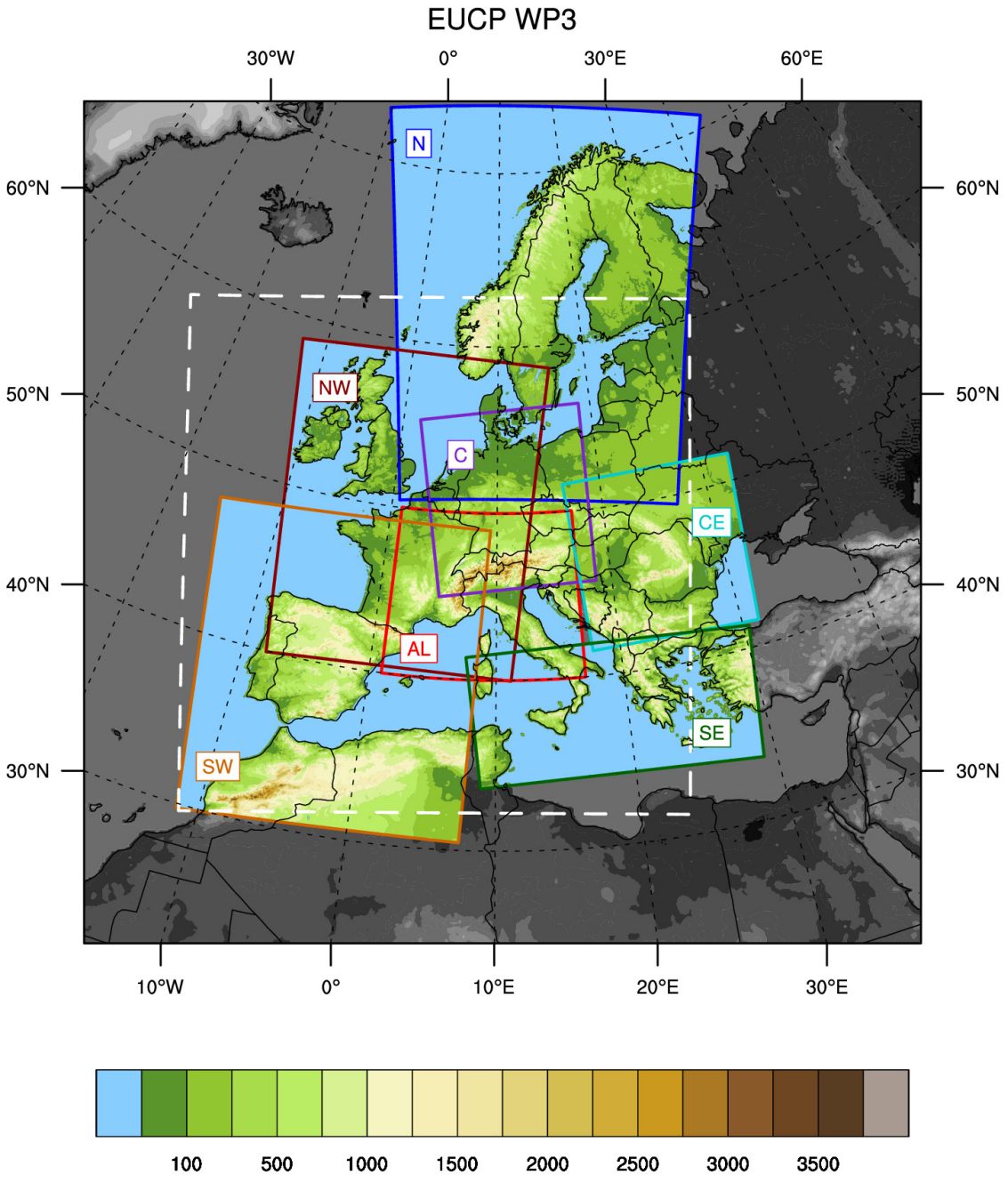






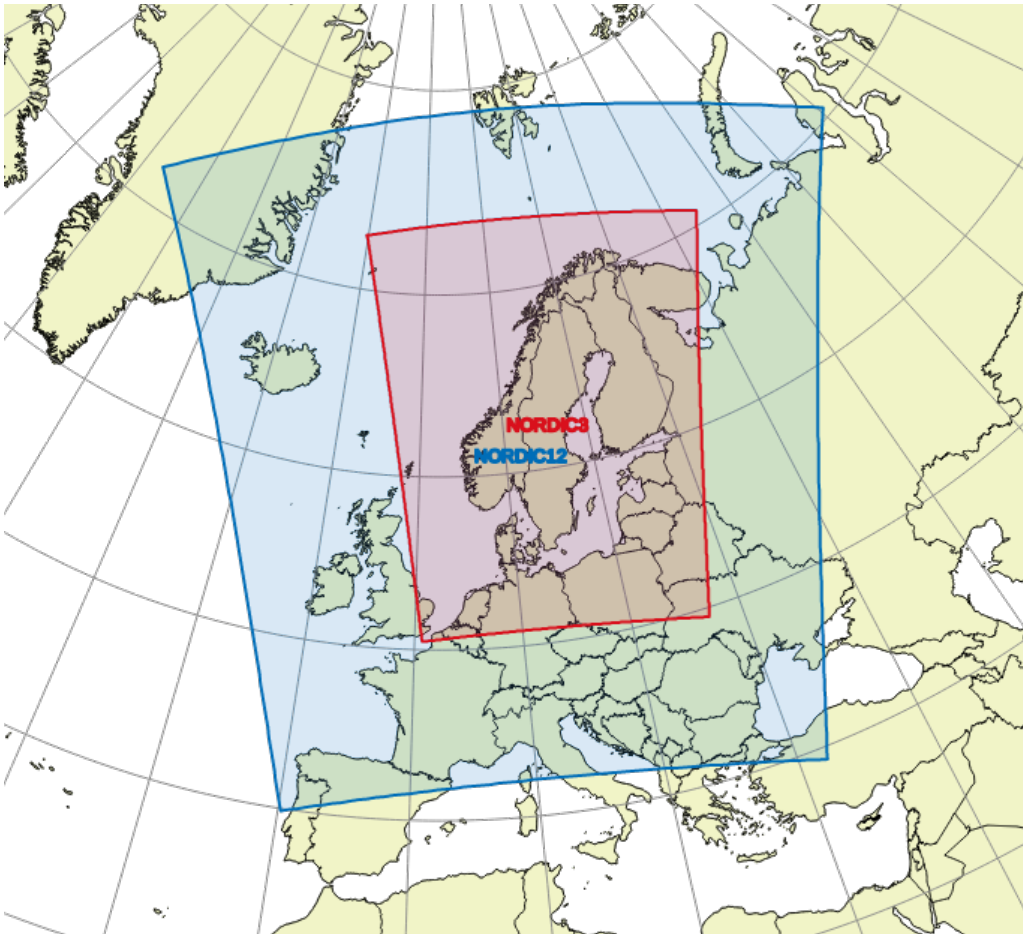
HCLIM in EUCP

- EUCP European domains.
- HCLIM:
  - North (N) → NorCP
  - Pan-Alpine (AL)
  - Central East (CE)
  - North West (NW)

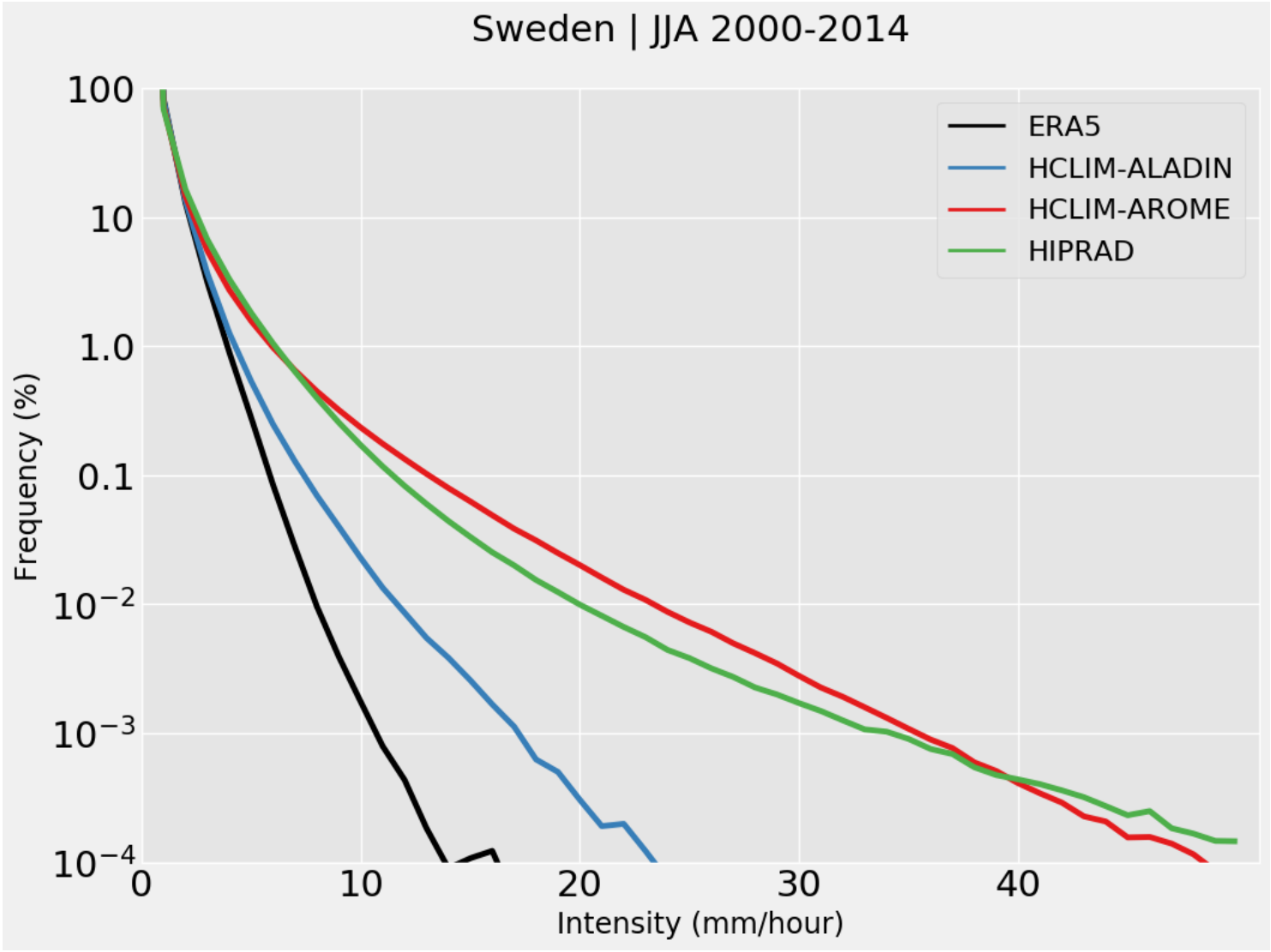


NorCP

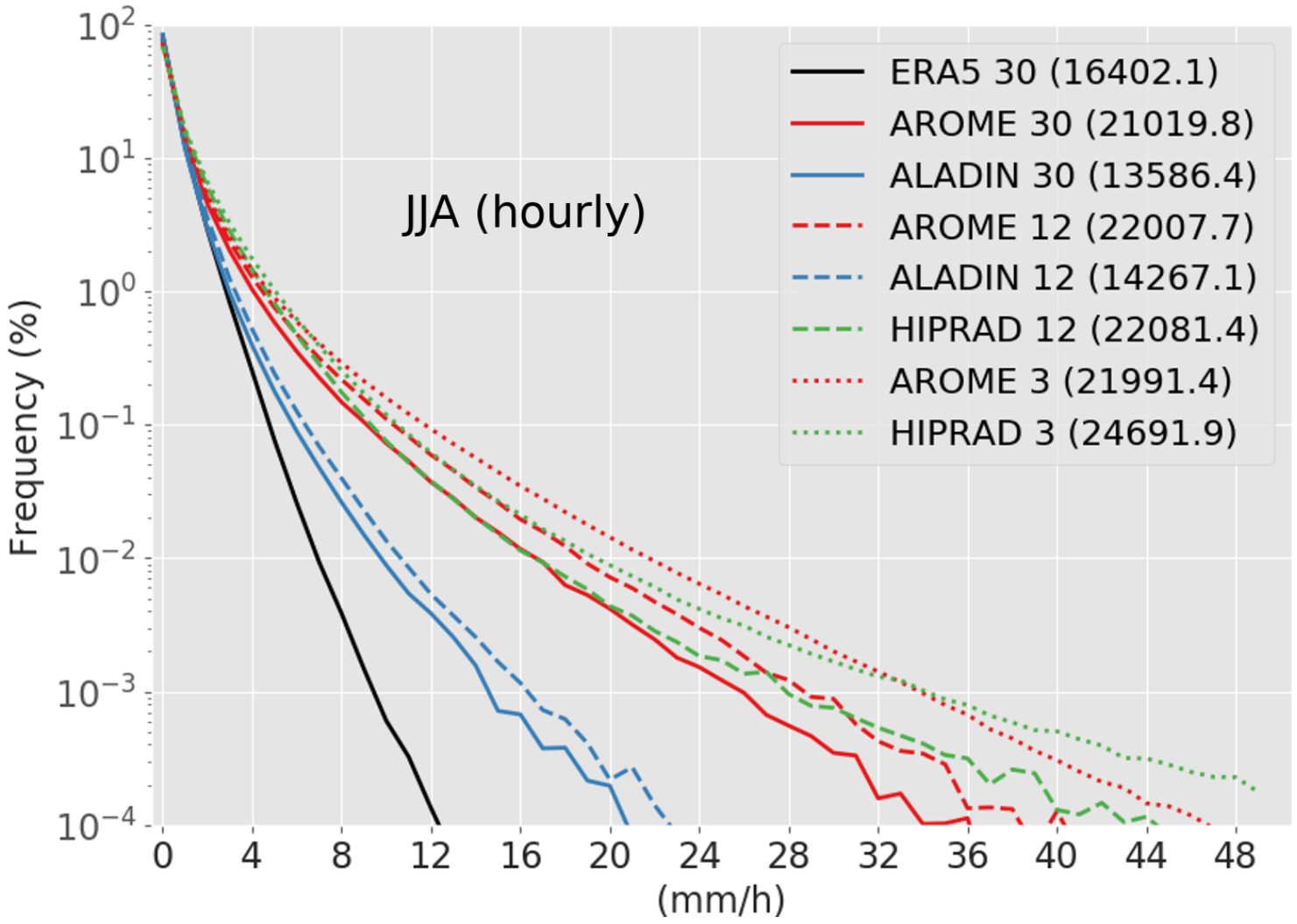
- Periods (20 years):
  - ERA-Interim: 1997 – 2017
  - Historical GCMs: 1985 – 2005
  - Mid-century GCMs: 2040 – 2060
  - End of century GCMs: 2080 – 2100
- GCMs:
  - EC-Earth
  - GFDL
- RCPs: 8.5 & 4.5



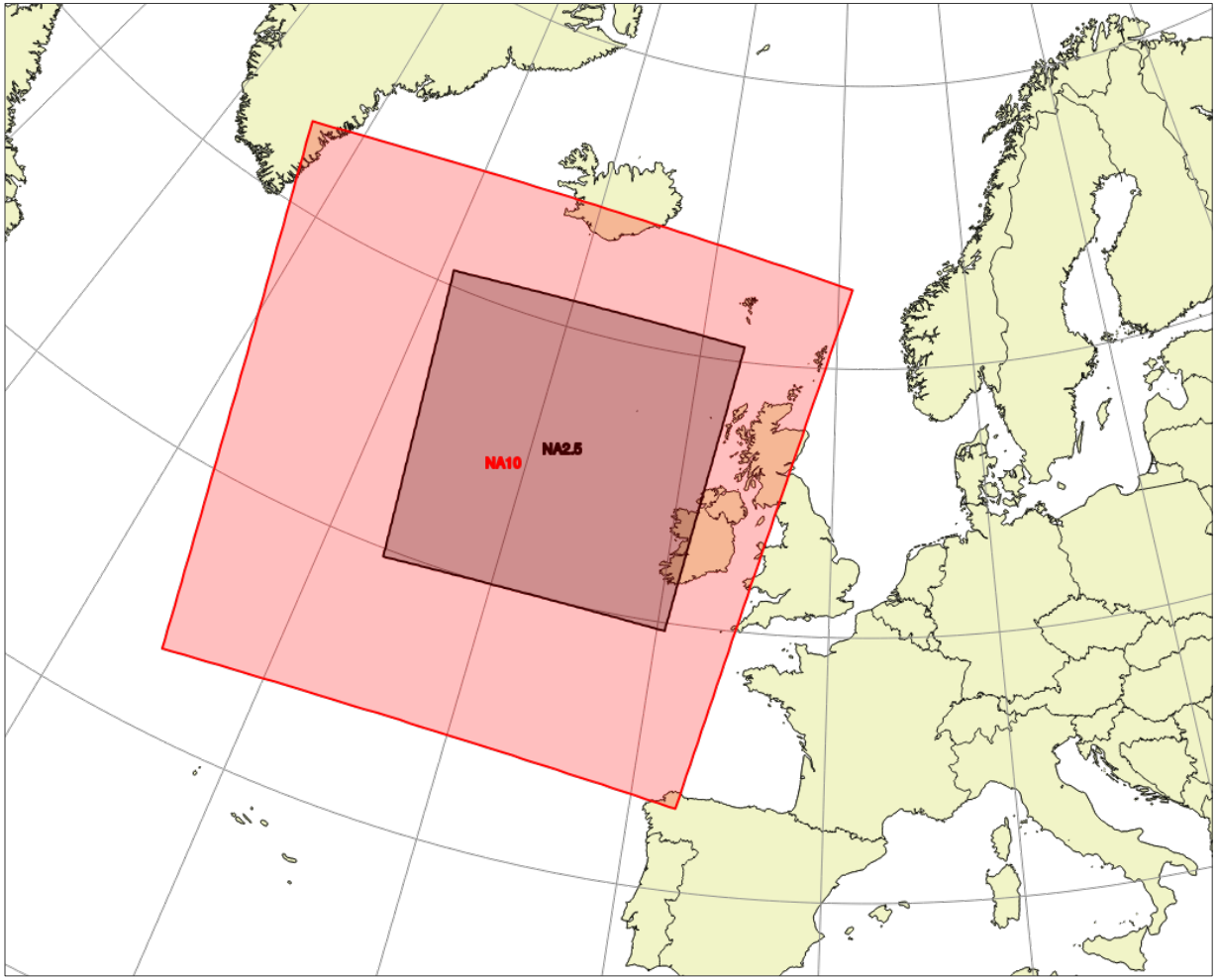
Summer precipitation - hourly



Summer precipitation - hourly

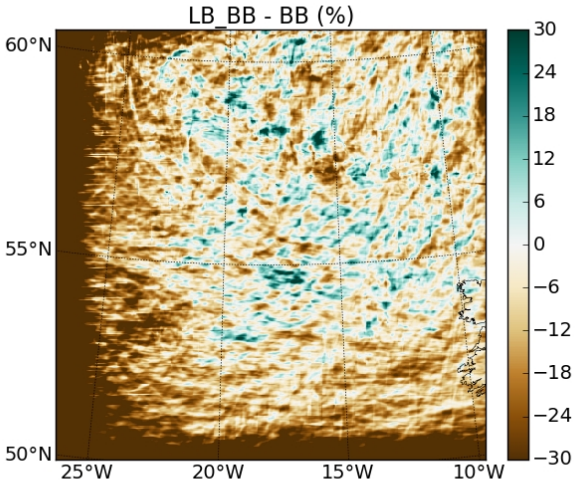


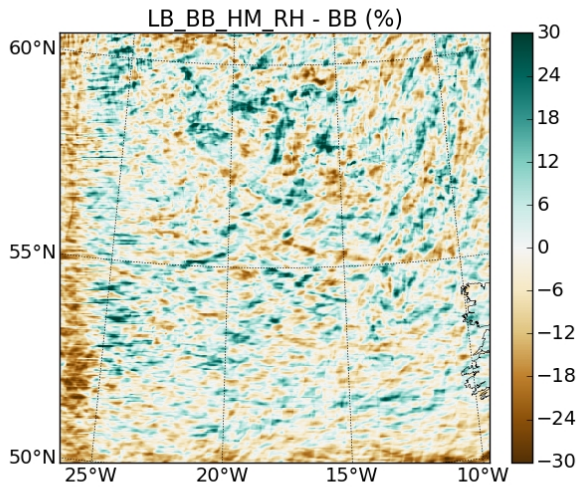
Rain LBC issue



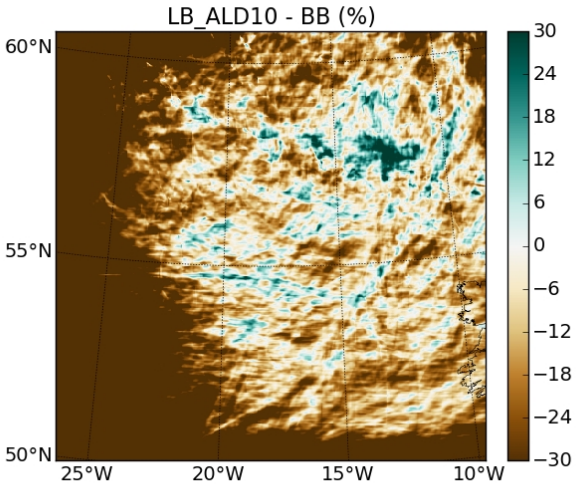
Rain LBC issue

Accumulated precipitation Jan 1995

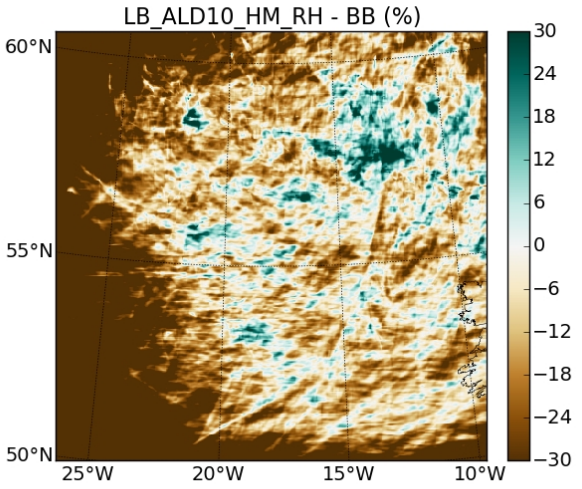




AROME2.5 → AROME2.5 (not very useful)



No HM LBC coupling



HM LBC coupling

ALADIN10 → AROME2.5 (not good)

Climate Models Permit Convection at Much Coarser Resolutions Than Previously Considered

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LINDA SCHLEMMER

Deutscher Wetterdienst, Offenbach, and Hans Ertel Centre for Weather Research, Goethe University Frankfurt, Frankfurt, Germany

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(Manuscript received 18 April 2019, in final form 15 November 2019)

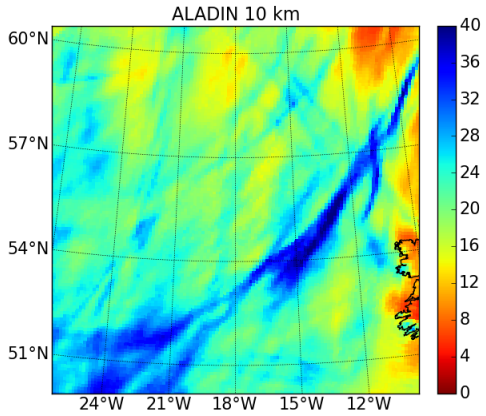
ABSTRACT

The "gray zone" of convection is defined as the range of horizontal grid-space resolutions at which convective processes are partially but not fully resolved explicitly by the model dynamics (typically estimated from a few kilometers to a few hundred meters). The representation of convection at these scales is challenging, as both parameterizing convective processes or relying on the model dynamics to resolve them might cause systematic model biases. Here, a regional climate model over a large European domain is used to study model biases when either using parameterizations of deep and shallow convection or representing convection explicitly. For this purpose, year-long simulations at horizontal resolutions between 50- and 2.2-km grid spacing are performed and evaluated with datasets of precipitation, surface temperature, and top of the atmosphere radiation over Europe. While simulations with parameterized convection seem more favorable than using explicit convection at around 50-km resolution, at higher resolutions (grid spacing $\leq$ 25 km) models tend to perform similarly or even better for certain model skills when deep convection is turned off. At these finer scales, the representation of deep convection has a larger effect in model performance than changes in resolution when looking at hourly precipitation statistics and the representation of the diurnal cycle, especially over nonorographic regions. The shortwave net radiative balance at the top of the atmosphere is the variable most strongly affected by resolution changes, due to the better representation of cloud dynamical processes at higher resolutions. These results suggest that an explicit representation of convection may be beneficial in representing some aspects of climate over Europe at much coarser resolutions than previously thought, thereby reducing some of the uncertainties derived from parameterizing deep convection.

Rain LBC issue

Accummulated rain 1-4 Jan 1995 (mm)

Parent

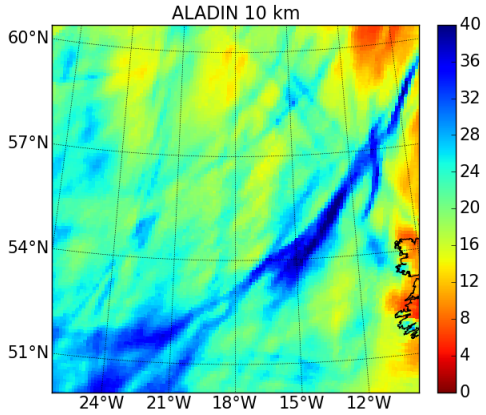


Child

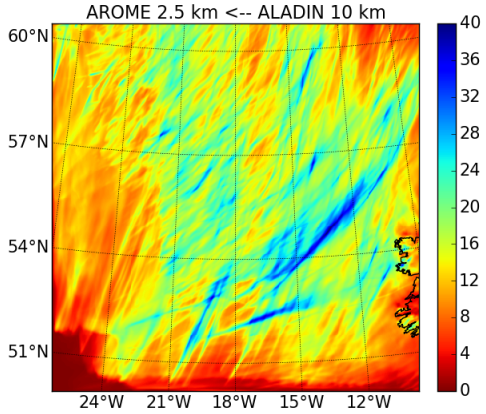
Rain LBC issue

Accummulated rain 1-4 Jan 1995 (mm)

Parent



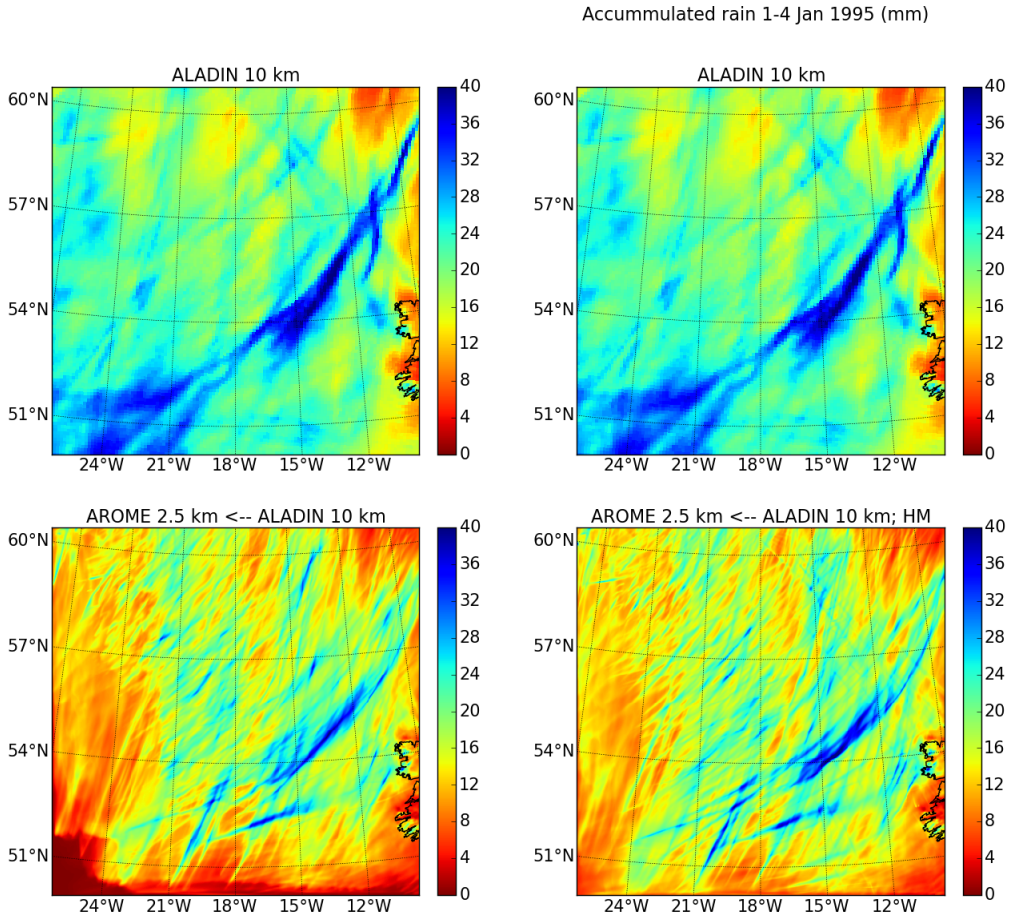
Child



Rain LBC issue

Parent

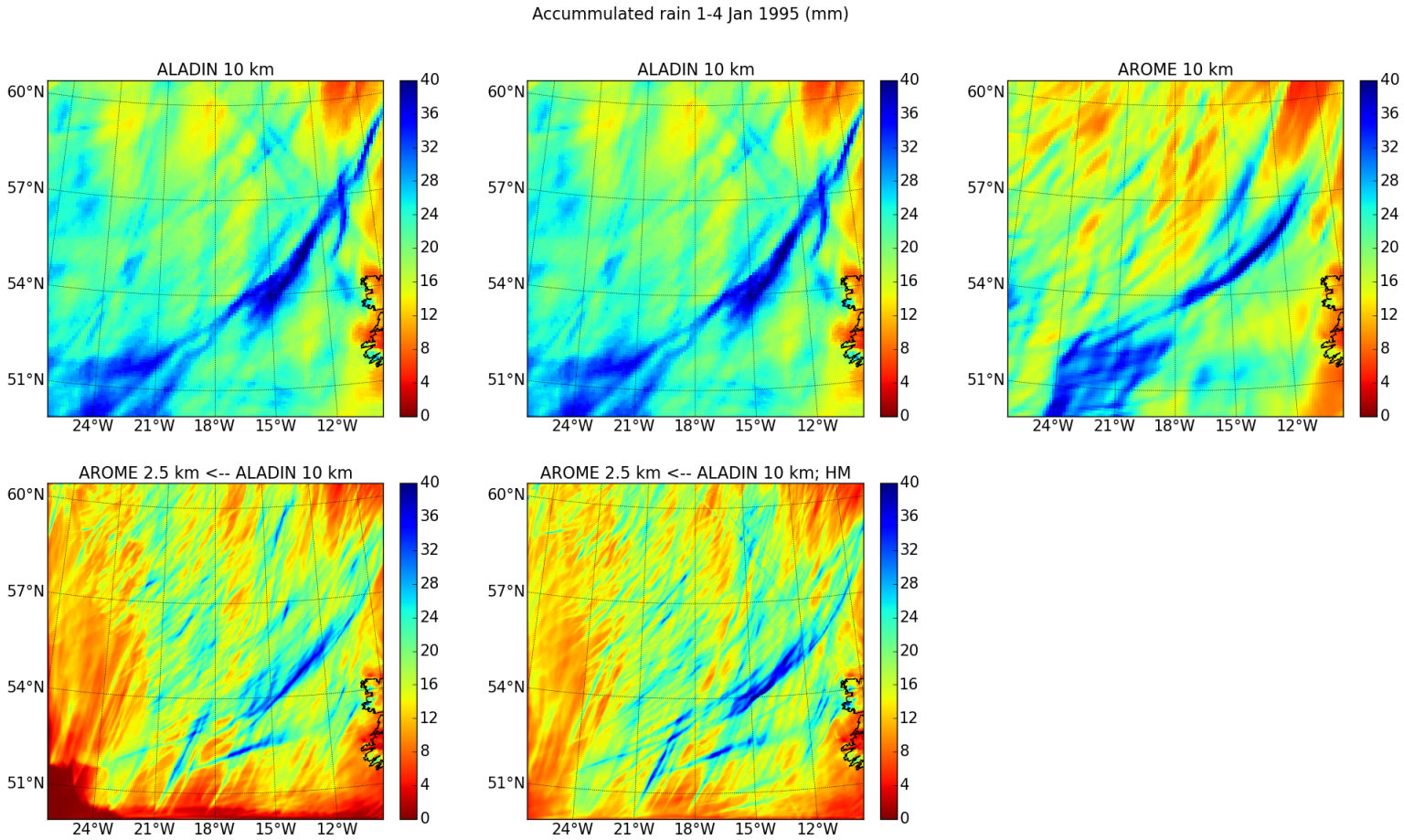
Child



Rain LBC issue

Parent

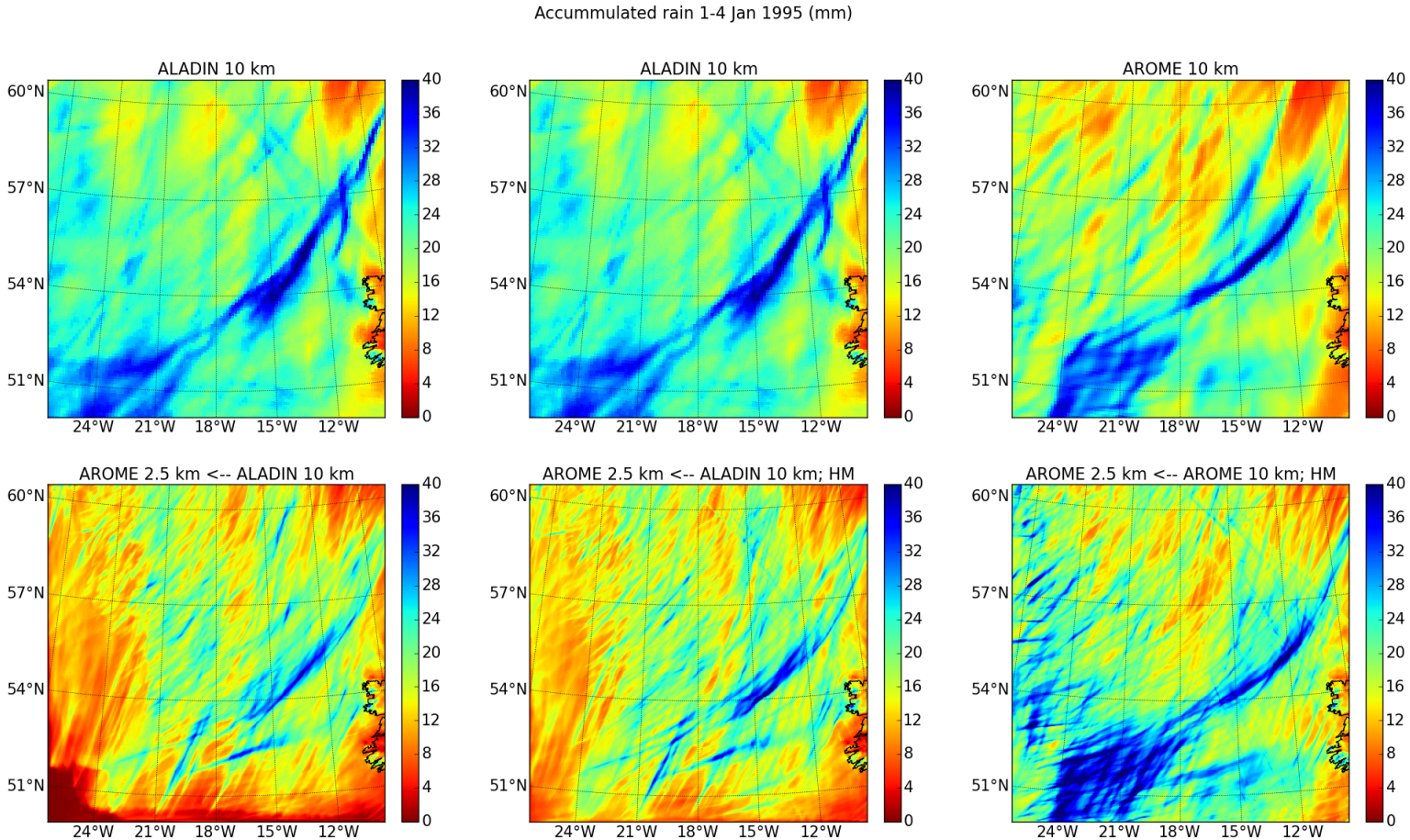
Child



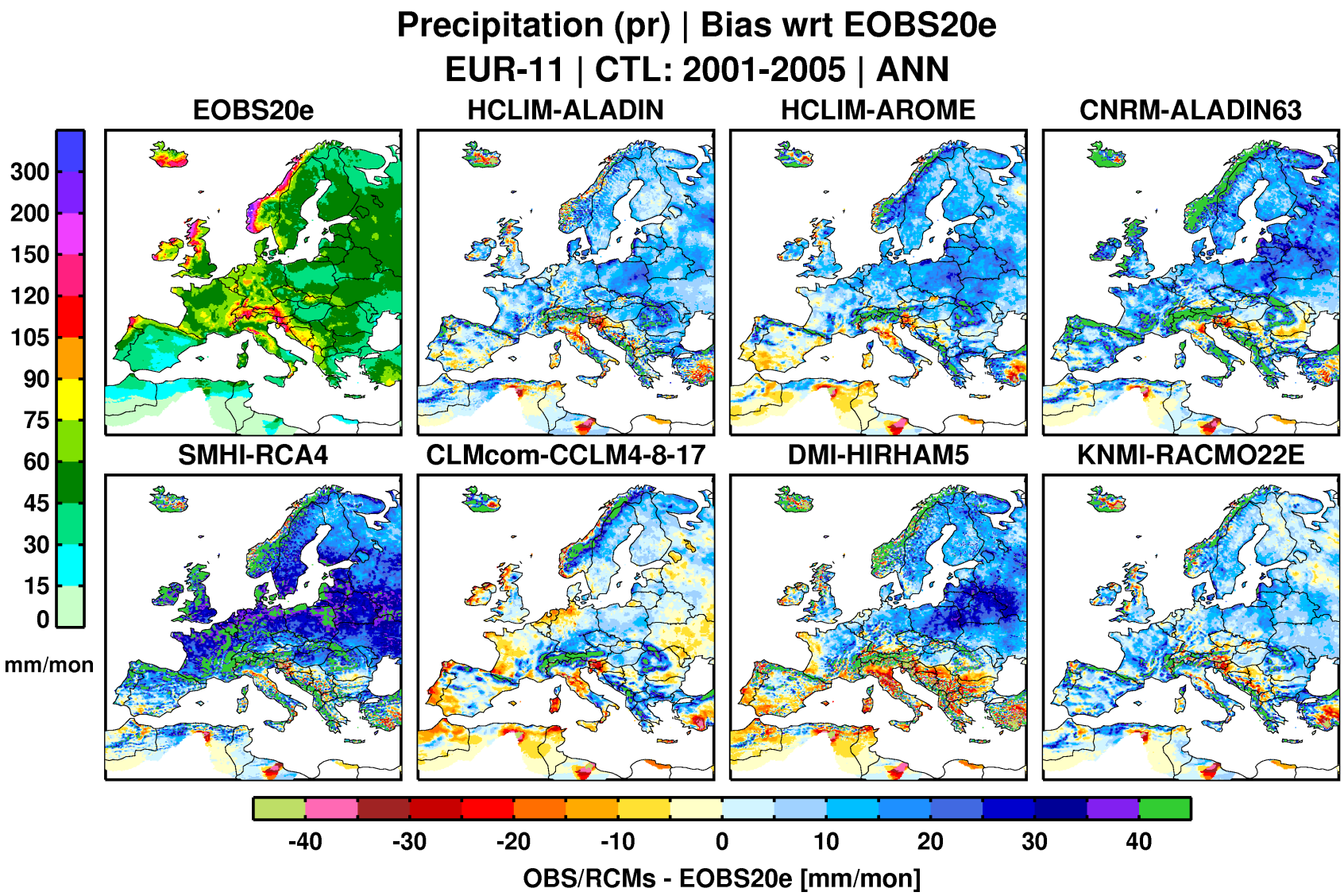
Rain LBC issue

Parent

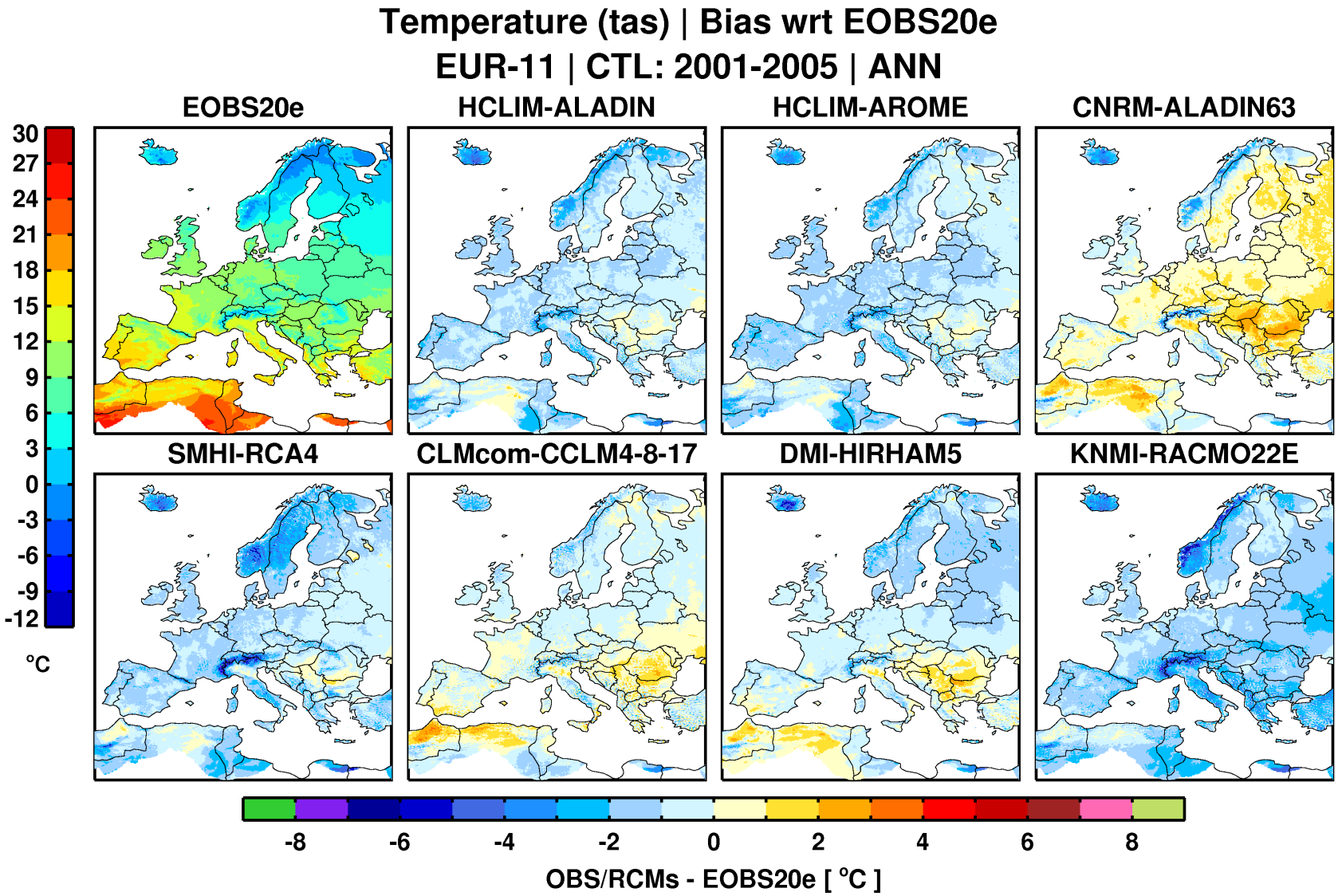
Child



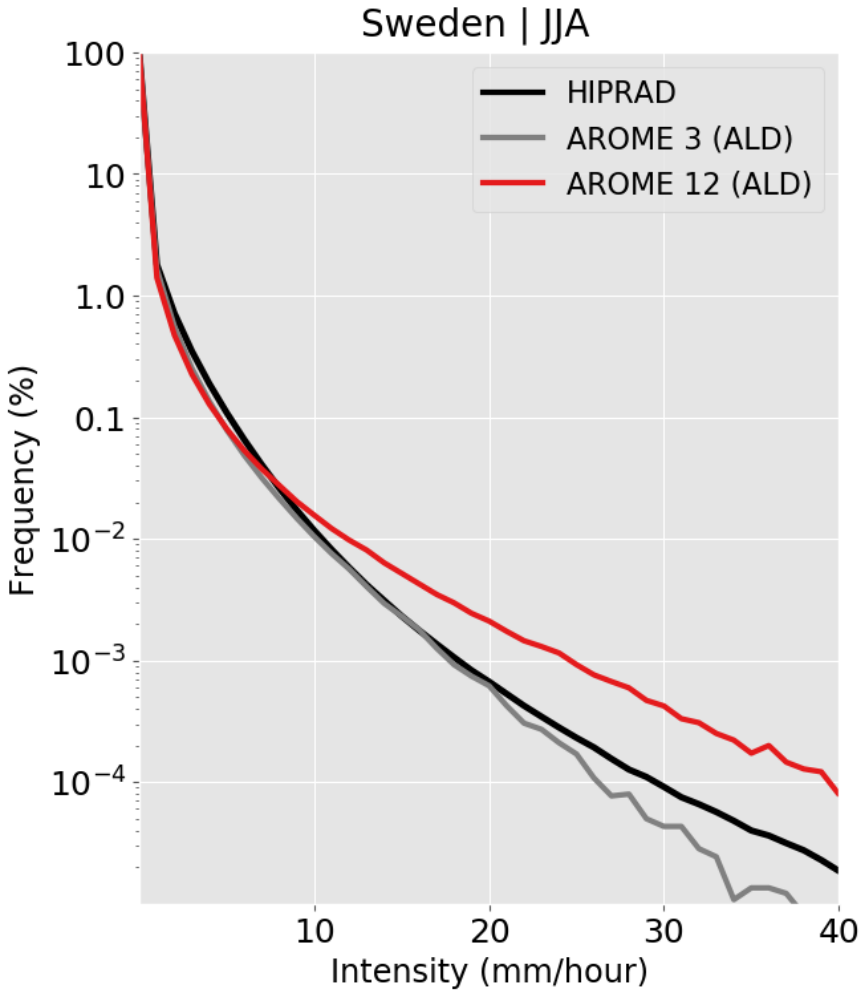
AROME @ 12 km

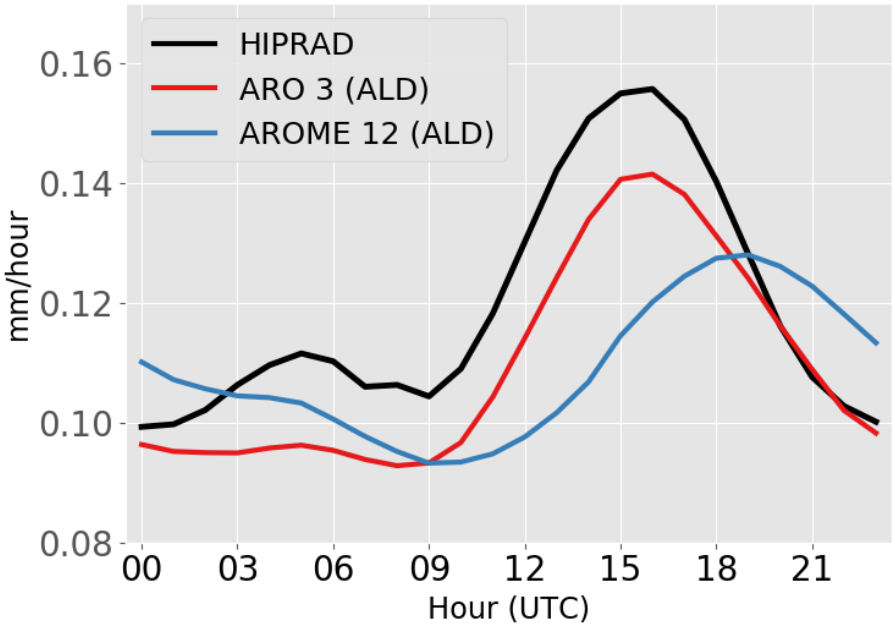

Precipitation (pr) | Bias wrt EOBS20e
EUR-11 | CTL: 2001-2005 | ANN
EOBS20e
HCLIM-ALADIN
HCLIM-AROME
CNRM-ALADIN63
SMHI-RCA4
CLMcom-CCLM4-8-17
DMI-HIRHAM5
KNMI-RACMO22E
300
200
150
120
105
90
75
60
45
30
15
0
mm/mon
-40
-30
-20
-10
0
10
20
30
40
OBS/RCMs - EOBS20e [mm/mon]

AROME @ 12 km


Temperature (tas) | Bias wrt EOBS20e
EUR-11 | CTL: 2001-2005 | ANN
EOBS20e
HCLIM-ALADIN
HCLIM-AROME
CNRM-ALADIN63
SMHI-RCA4
CLMcom-CCLM4-8-17
DMI-HIRHAM5
KNMI-RACMO22E
30
27
24
21
18
15
12
9
6
3
0
-3
-6
-9
-12
°C
-8
-6
-4
-2
0
2
4
6
8
OBS/RCMs - EOBS20e [°C]

AROME @ 12 km


Sweden | JJA
HIPRAD
AROME 3 (ALD)
AROME 12 (ALD)
Frequency (%)
100
10
1.0
0.1
10^{-2}
10^{-3}
10^{-4}
10
20
30
40
Intensity (mm/hour)


HIPRAD
ARO 3 (ALD)
AROME 12 (ALD)
mm/hour
0.16
0.14
0.12
0.10
0.08
00
03
06
09
12
15
18
21
Hour (UTC)

HCLIM summary

- Organised in a consortium; close collaboration with HIRLAM NWP colleagues
- The modelling system performs well for climate applications in different regions
- Convection-permitting climate simulations show large benefit, especially on sub-daily scales
- Participation in international regional climate model intercomparison projects – very good performance
- Exploring options for LBCs – convection-permitting AROME at 12 km?