ALARO-0 and Harmonie in climate simulations

David Lindstedt, Petter Lind

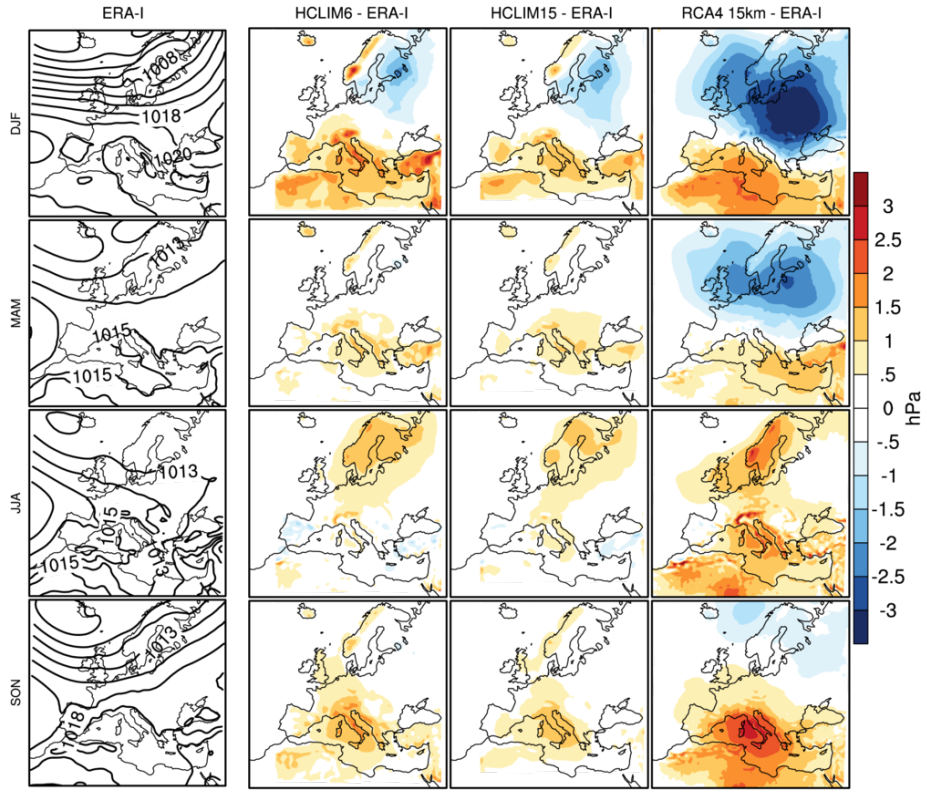
Overview

1. A new regional climate model operating at the meso-gamma scale; performance over Europe (Lindstedt et al., Tellus A, 2014, submitted)
2. Summer precipitation in the Alpine region
3. Future simulations and development

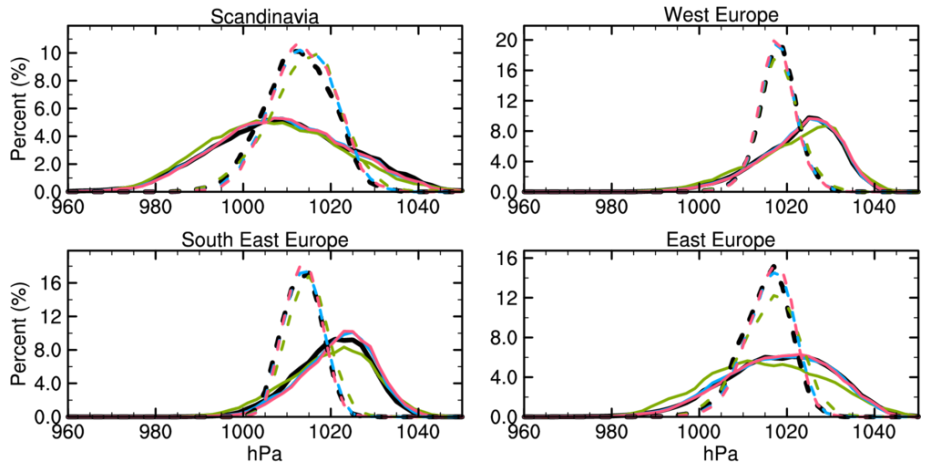
Part I

A new regional climate model operating at the meso-gamma scale; performance over Europe

Large scale circulation - seasonal mean, variability

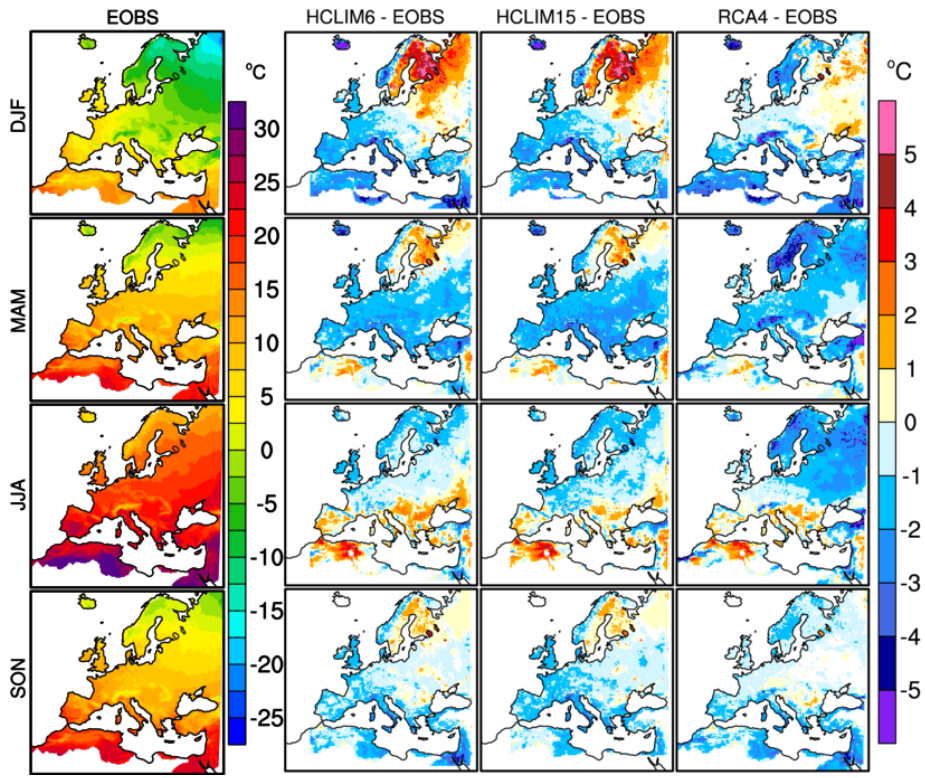


Seasonal mean of sea level pressure. Absolute values for ERA-I to the left and differences to the right.

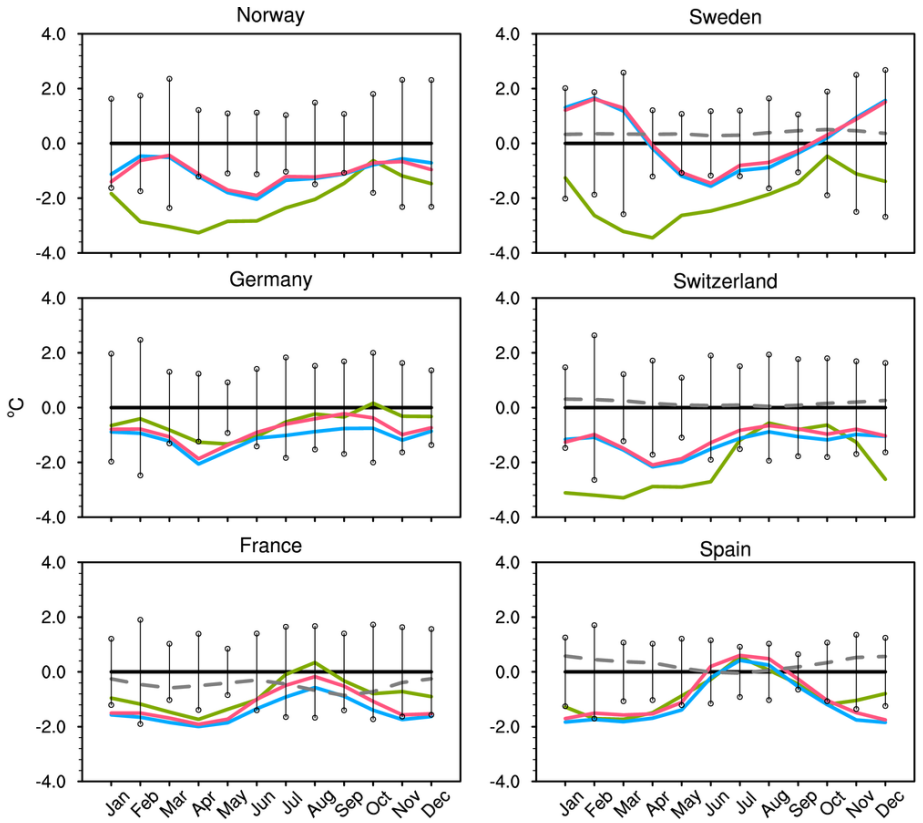


PDFs of daily mean SLP, Winter (solid) and Summer (dotted). HCLIM6 (red), HCLIM15 (blue) and RCA (green)

2m temperature - seasonal mean, annual cycle (bias)

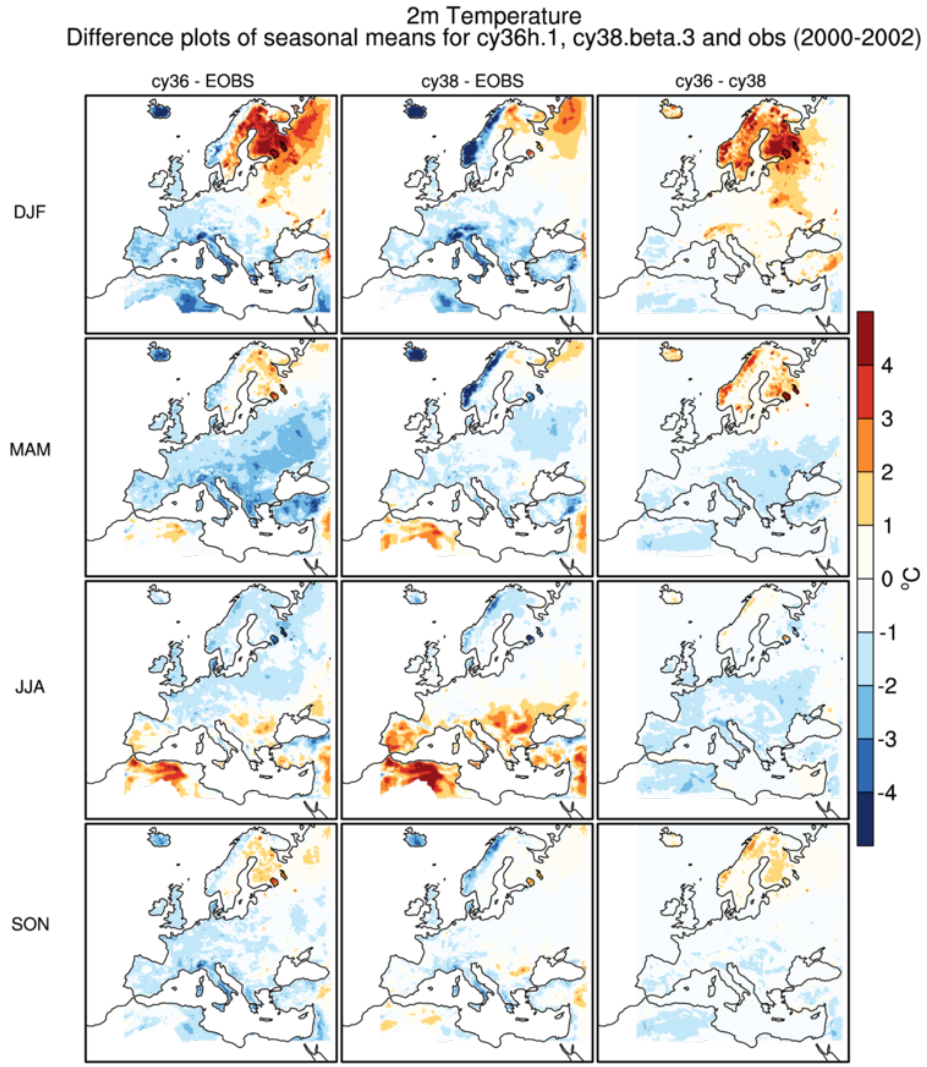


Seasonal mean of 2m temperature.



Annual cycle of 2m temperature with reference to E-OBS. HCLIM6 (red), HCLIM15 (blue), RCA (green). Vertical bars represent plus/minus one standard deviation based on 10 years of monthly values from E-OBS. Grey dashed lines are high-res observations.

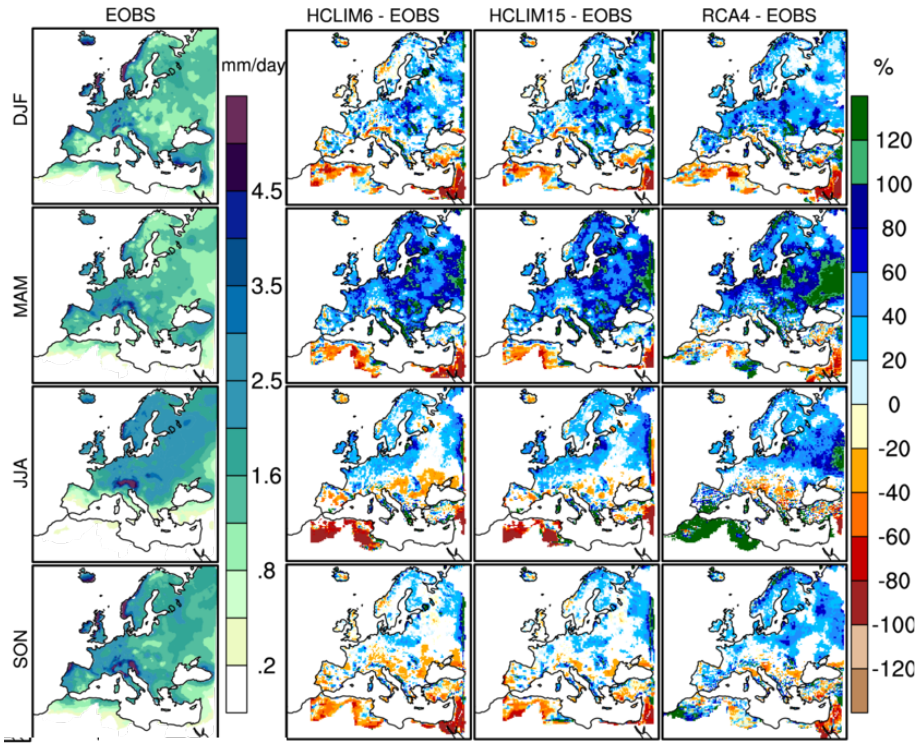
2m temperature in cycle 38



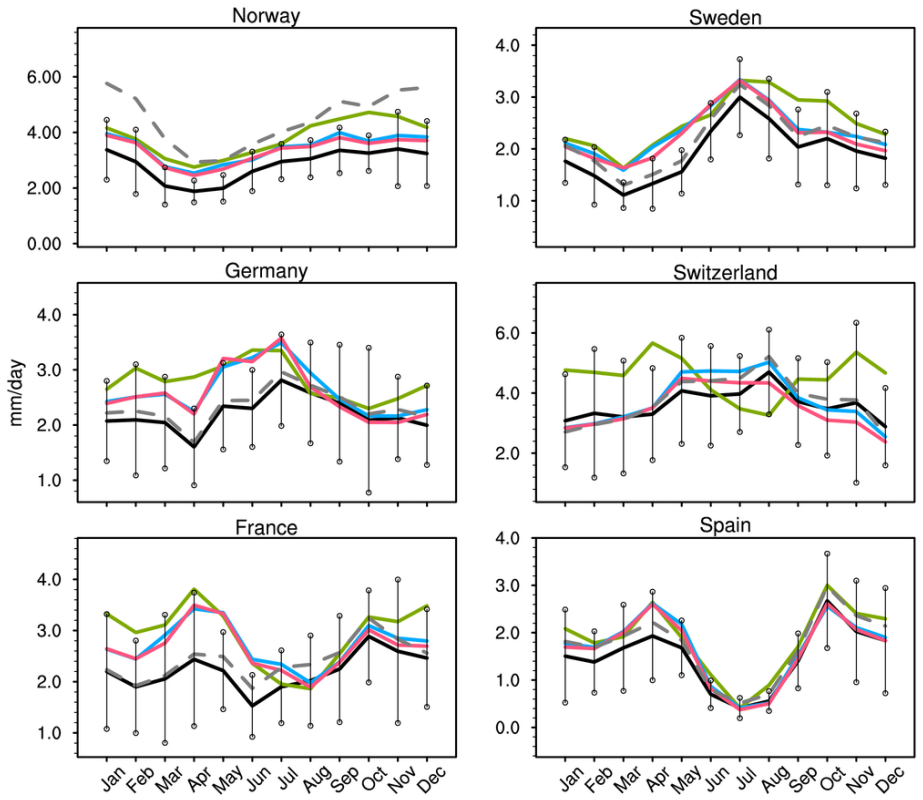
cycle 38 vs 36
(SURFEX 7.3 vs 5.1)

- Lake model (deep soil temp)
- Diffusion soil (force restore)
- 14 soil layers (5)
- Atmosphere physics

Precipitation - seasonal mean, annual cycle

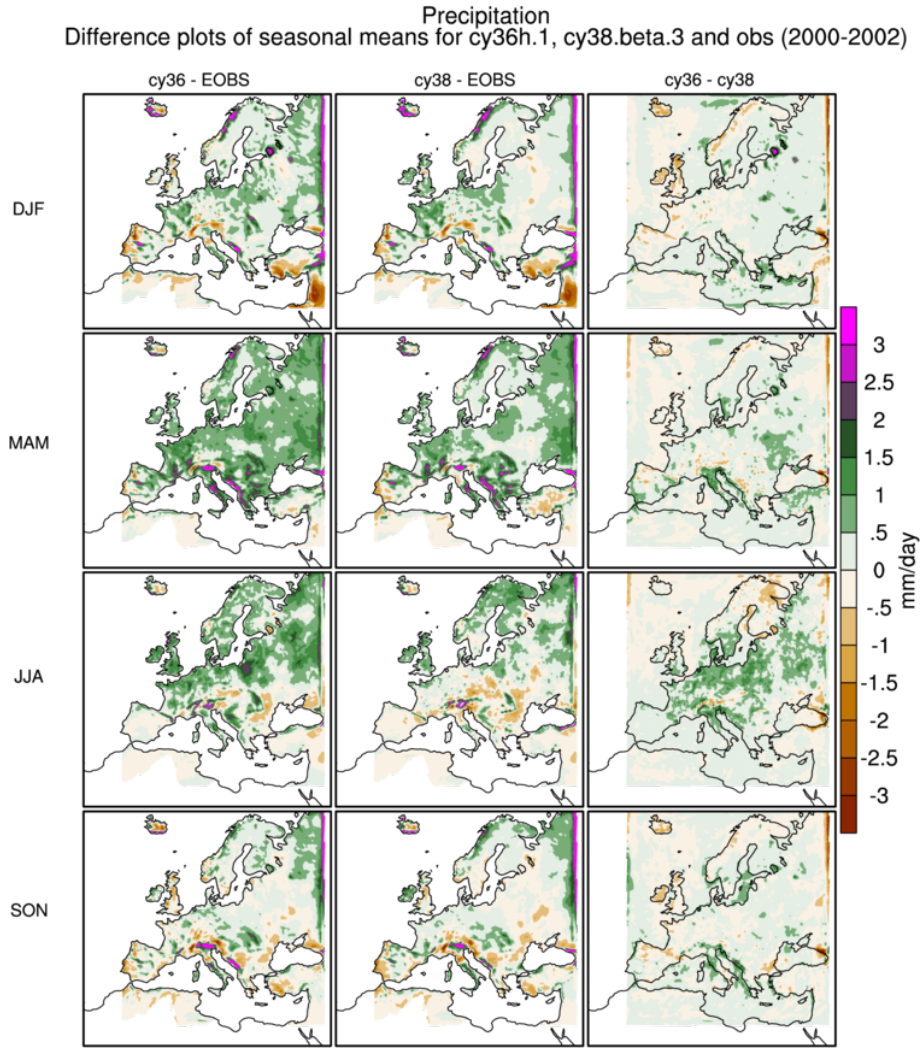


Seasonal mean of total precipitation



Annual cycle of precipitation with reference to E-OBS. HCLIM6 (red), HCLIM15 (blue), RCA (green). Vertical bars represent plus/minus one standard deviation based on 10 years of monthly values from E-OBS. Grey dashed lines are high-res observations.

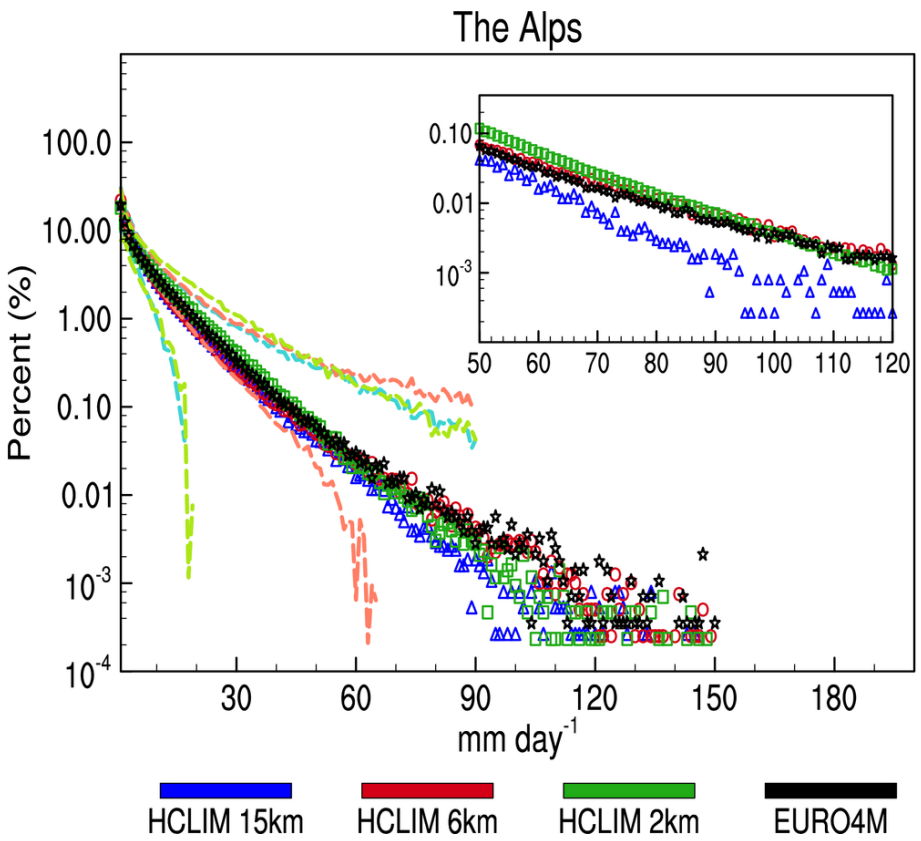
Precipitation in cycle 38



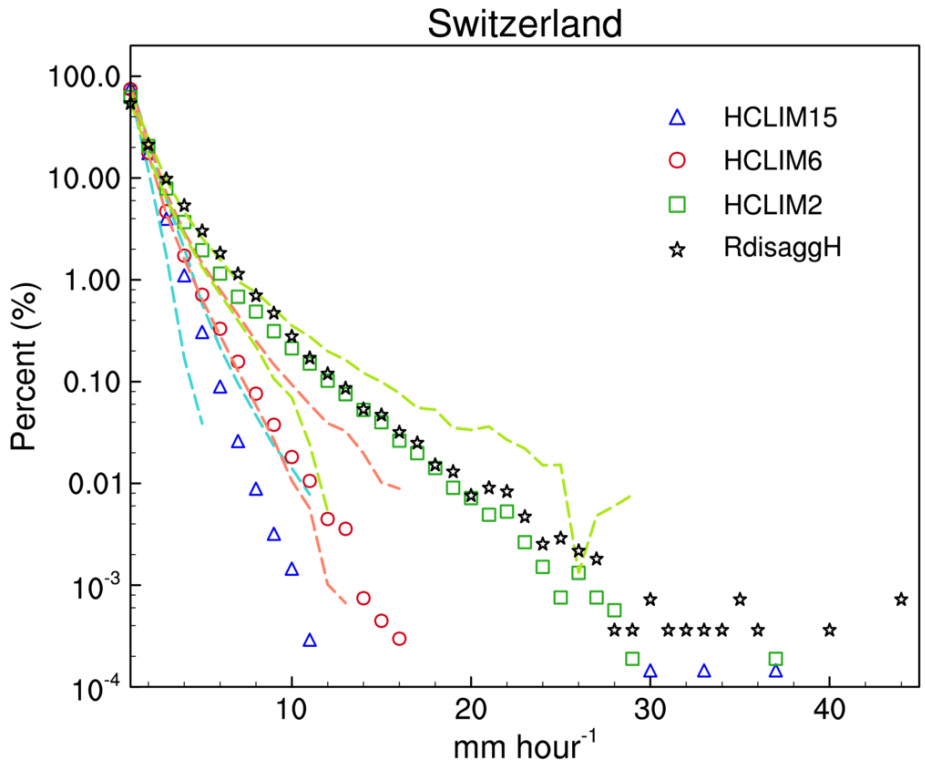
Part II

Summer precipitation in the Alpine region

Daily/Hourly precipitation

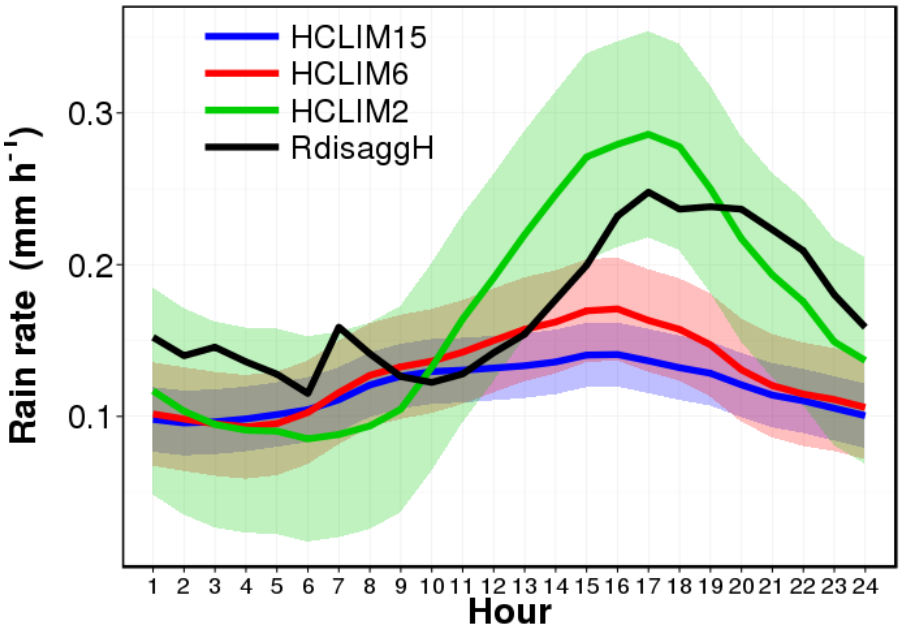


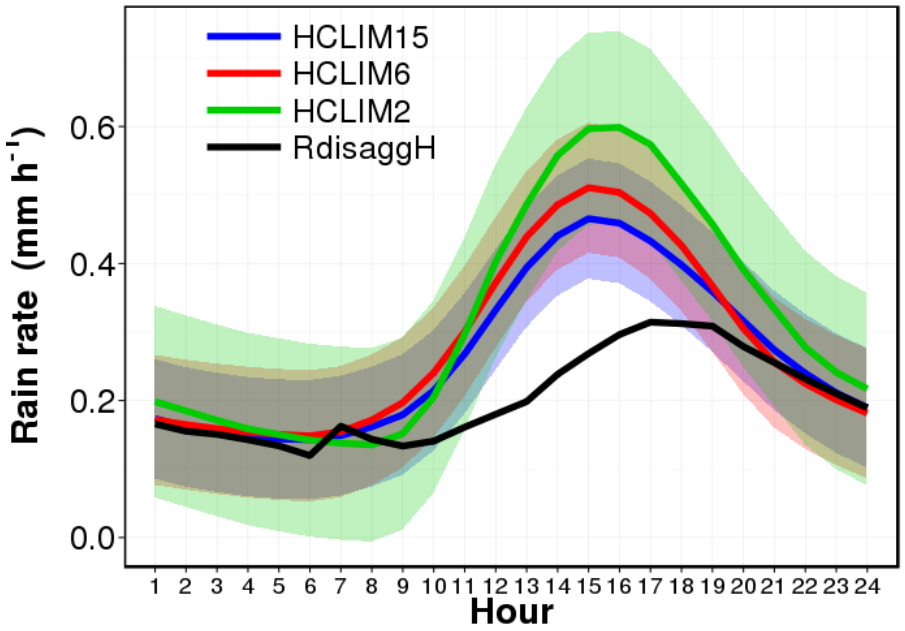
PDFs over the Alps based on daily values (green is AROME)



PDFs for Switzerland based on hourly values (green is AROME)

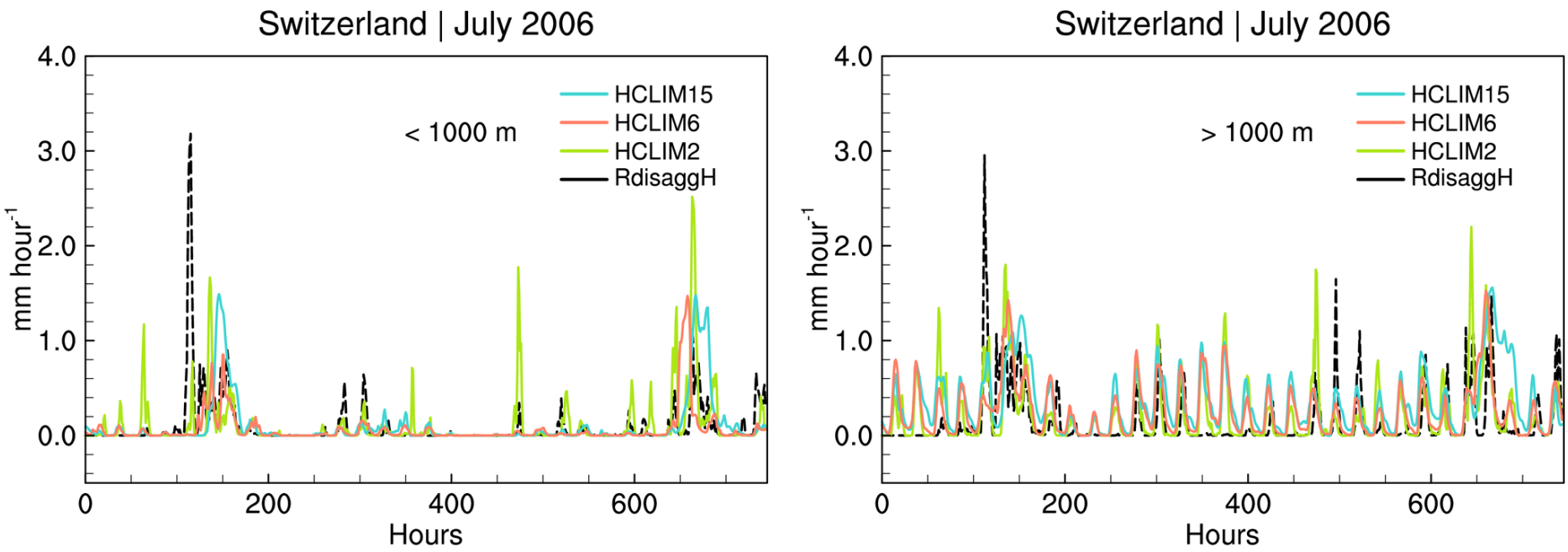
Diurnal cycle





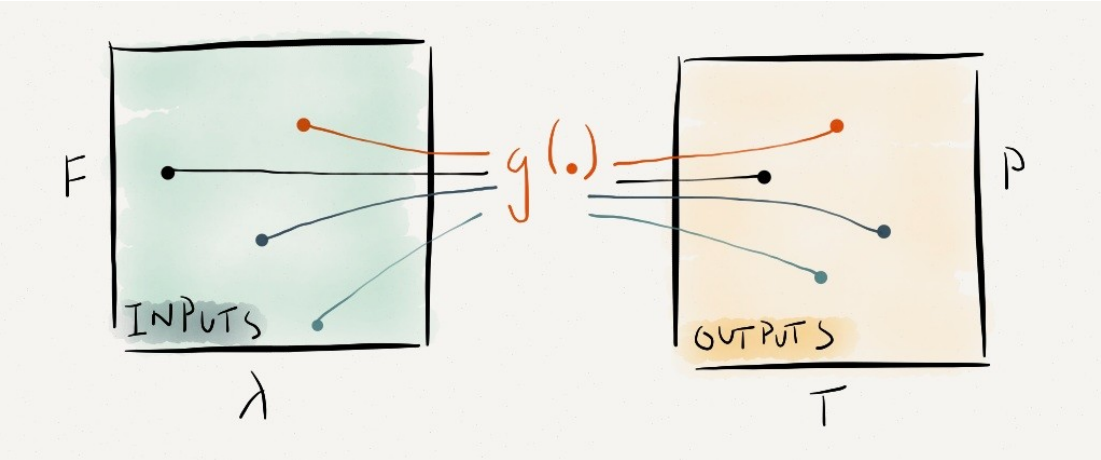
Diurnal cycle of precipitation in Switzerland at $< 1000m$ (left panel) and $> 1000m$ (right panel)

Precipitation Swizerland - July 2006



Precipitation in Switzerland at $< 1000m$ (left panel) and $> 1000m$ (right panel)

Future simulations and development



- HELIX: 5km EUR 30y, (Historical + 2 RCPs) x 2 GCMs
- NCHM-2: 3km Alps, 5y
- ALARO2ALARO
- SURFEX input/output in NetCDF
- Prognostic sea-ice temperatures
- Variable GHG

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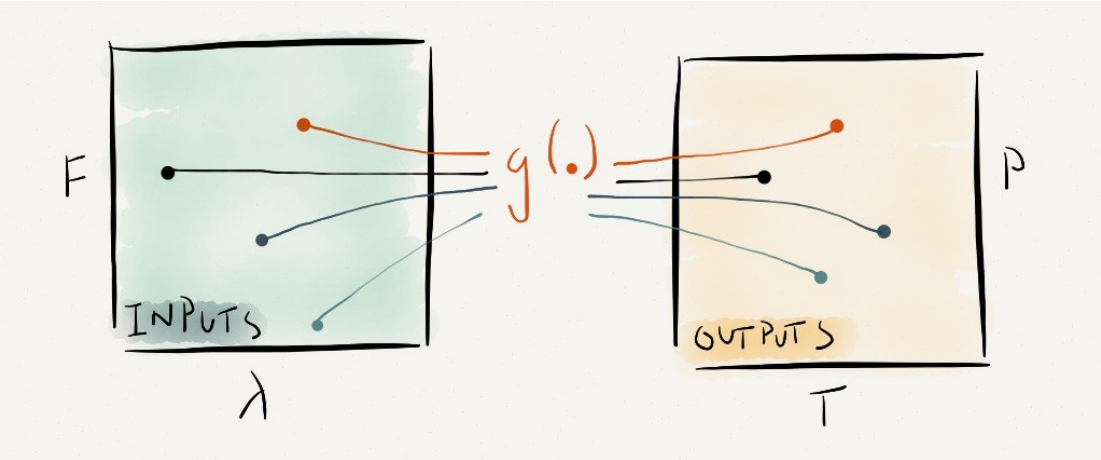

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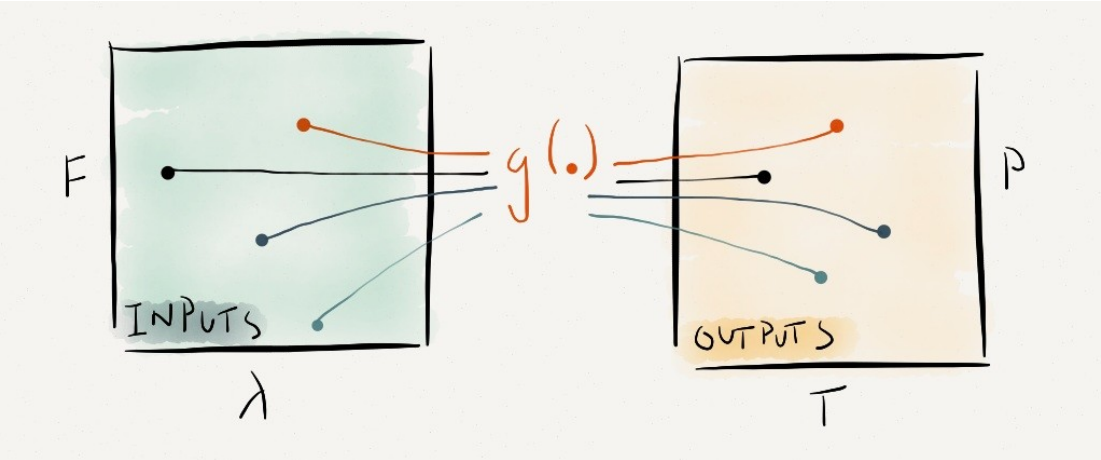

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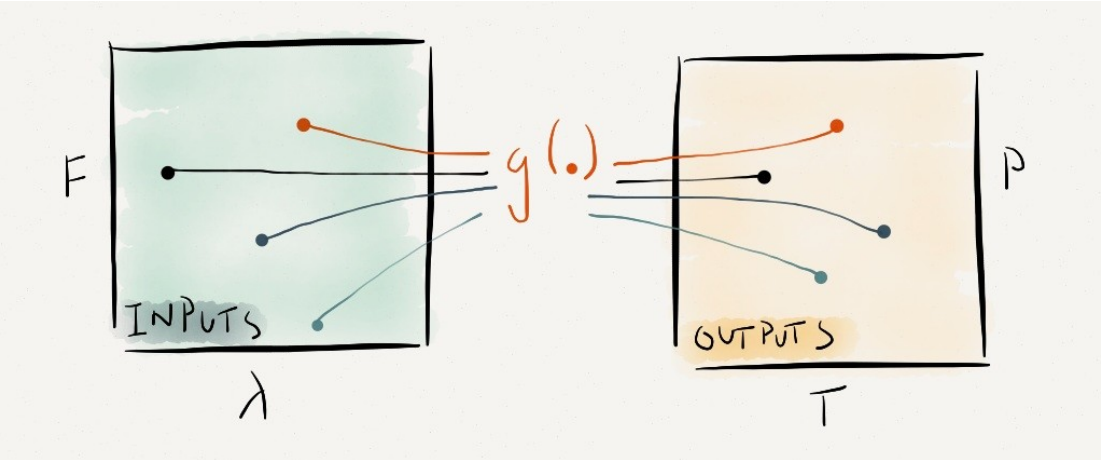

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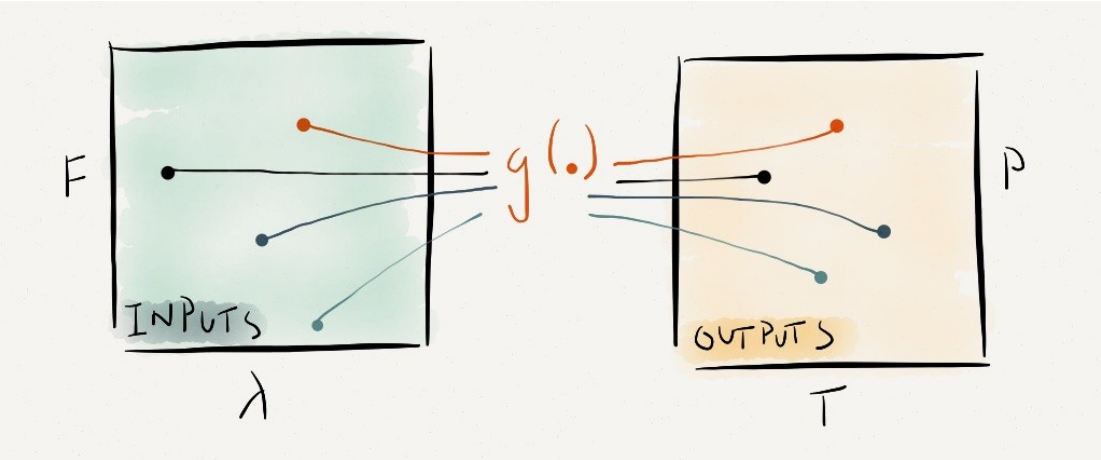

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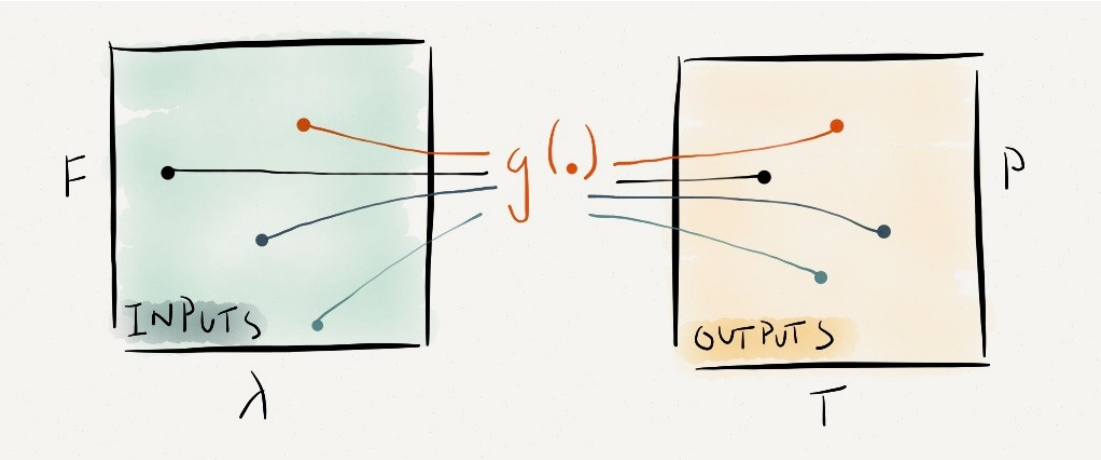

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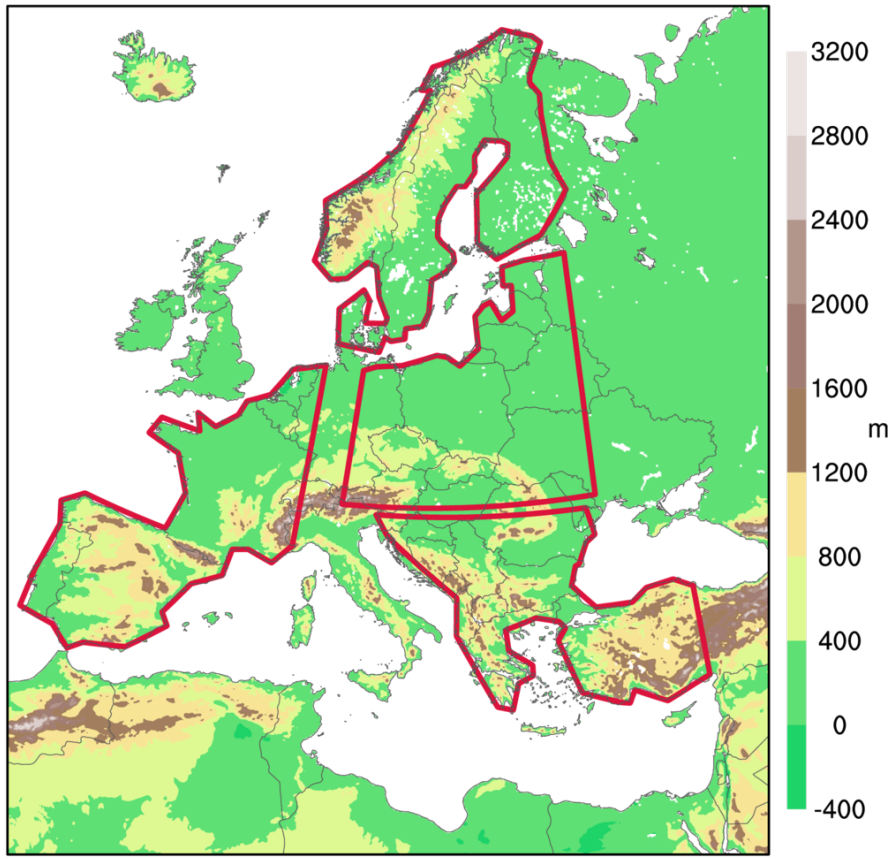
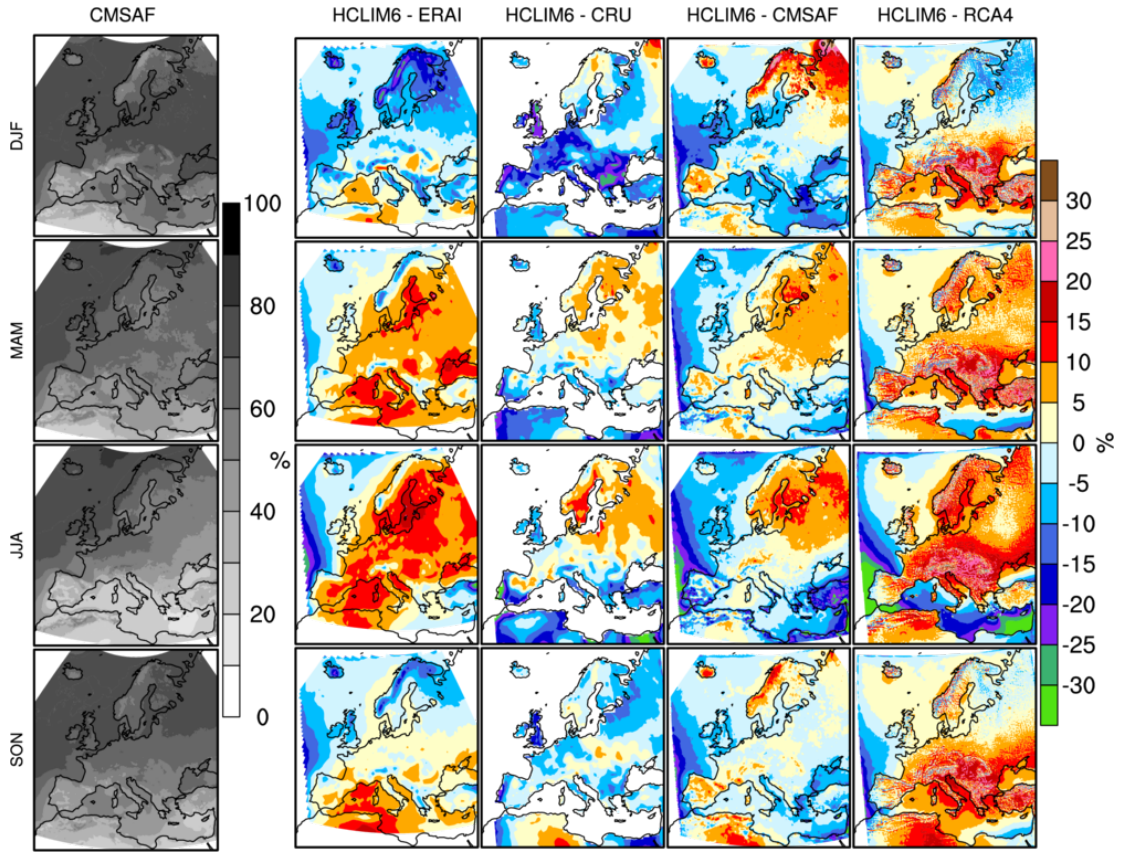
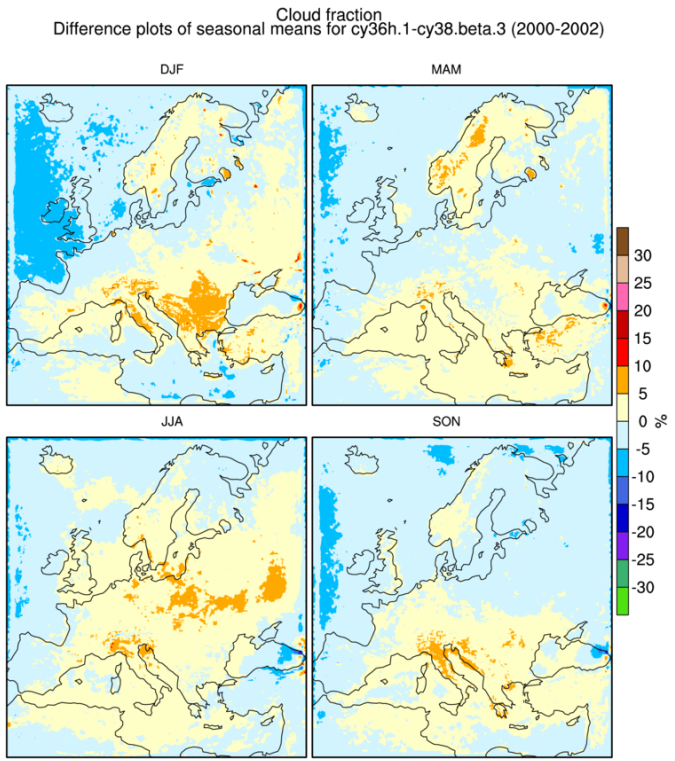
Thank you!

Regions

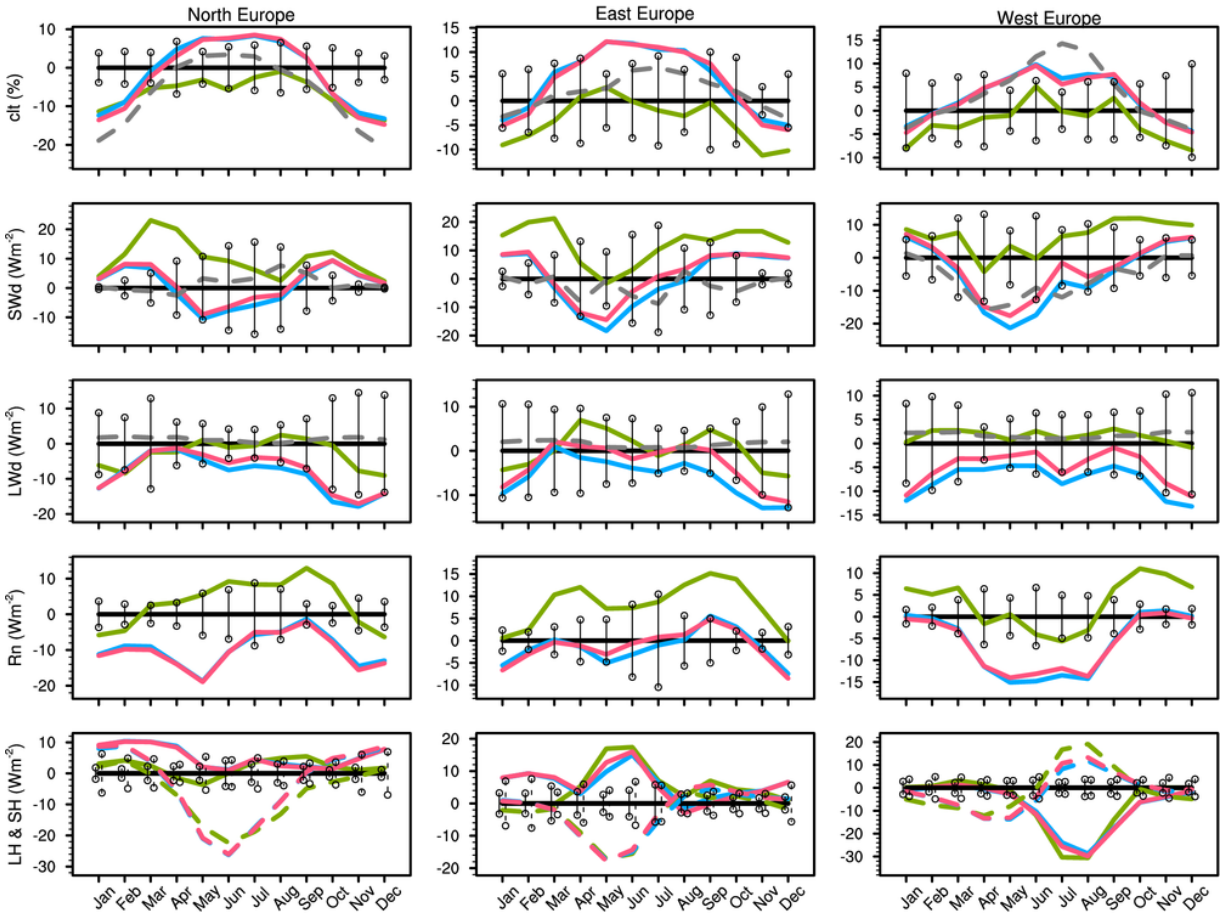


Cloud fraction - seasonal mean



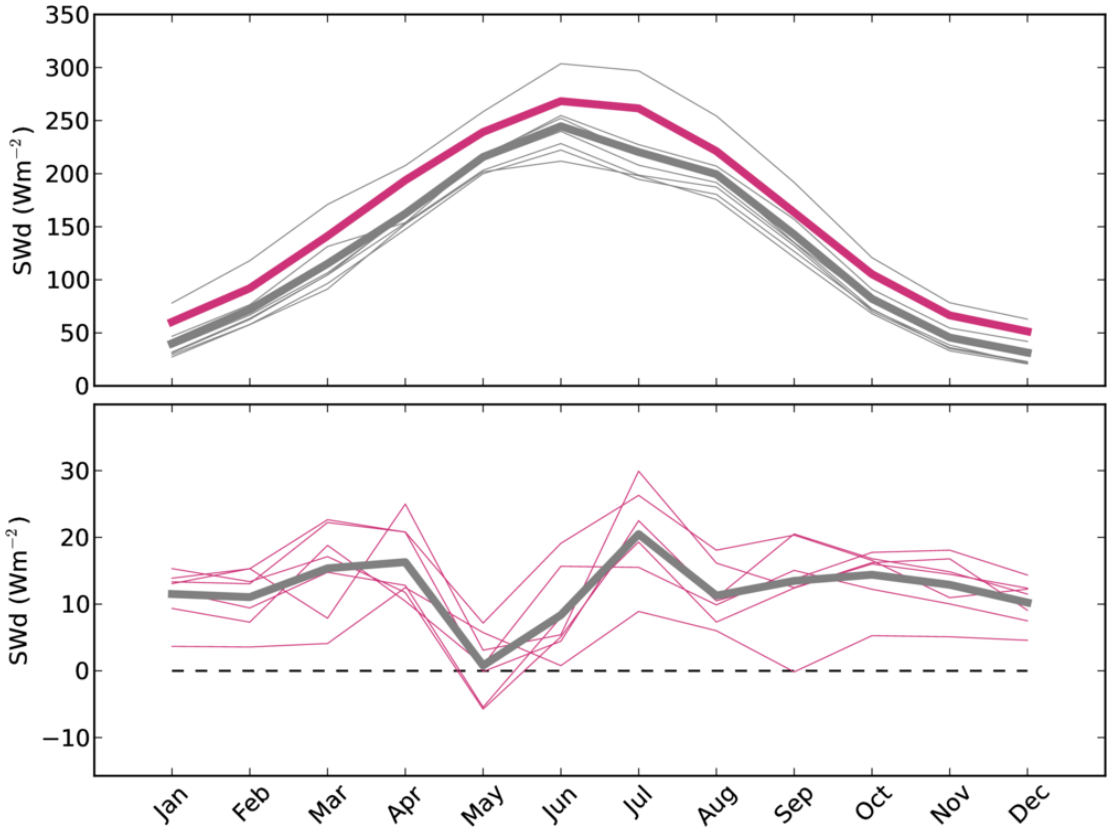


Radiation



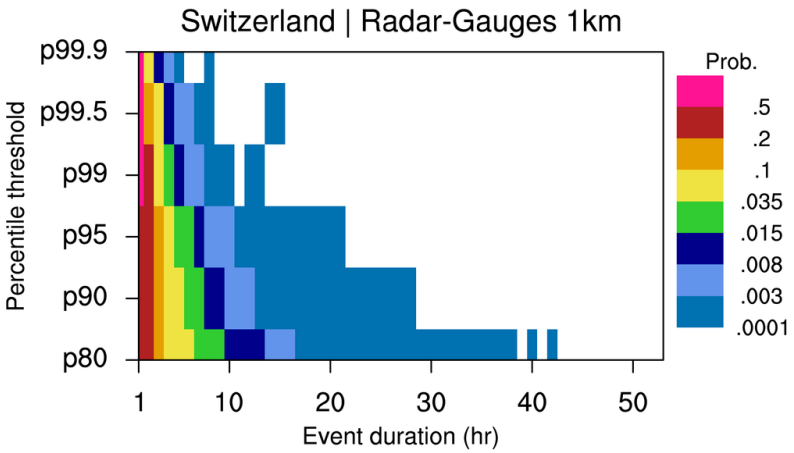
Annual cycle with reference to ERA-I (black) of (top to bottom); cloud fraction (clt), downwelling solar radiation (SWd), downwelling thermal radiation (LWd), surface net radiation budget (R_n) and latent (solid) and sensible (dashed) surface heat fluxes. HCLIM6 (red), HCLIM15 (blue), RCA4 (green). The grey dashed line is the satellite product CM-SAF.

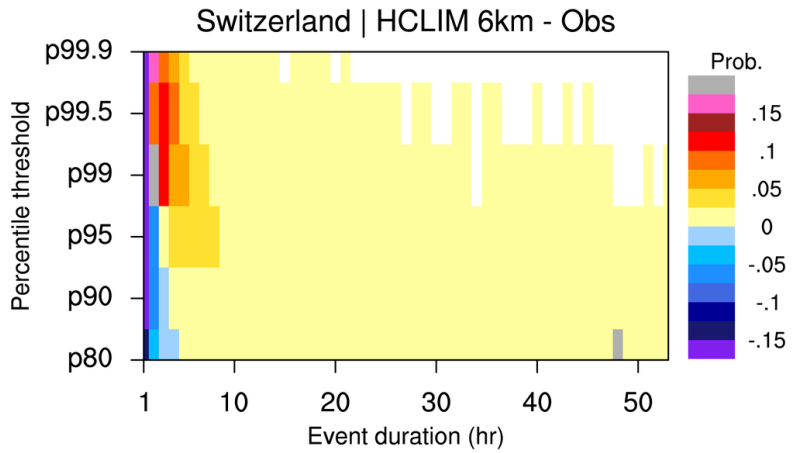
Downwelling solar radiation

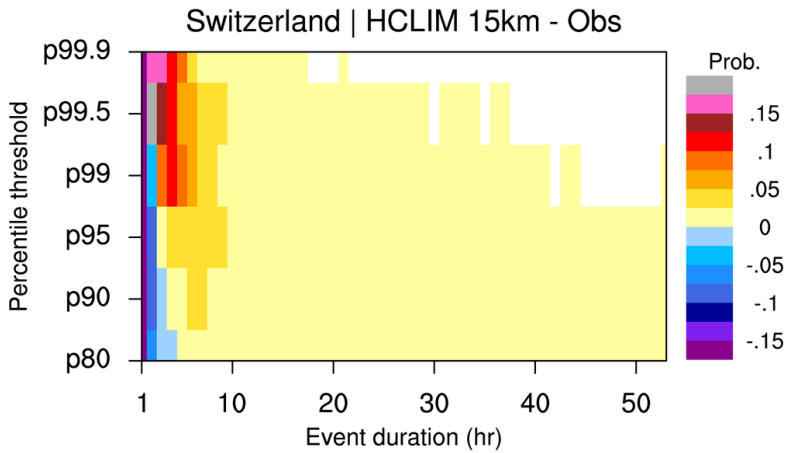


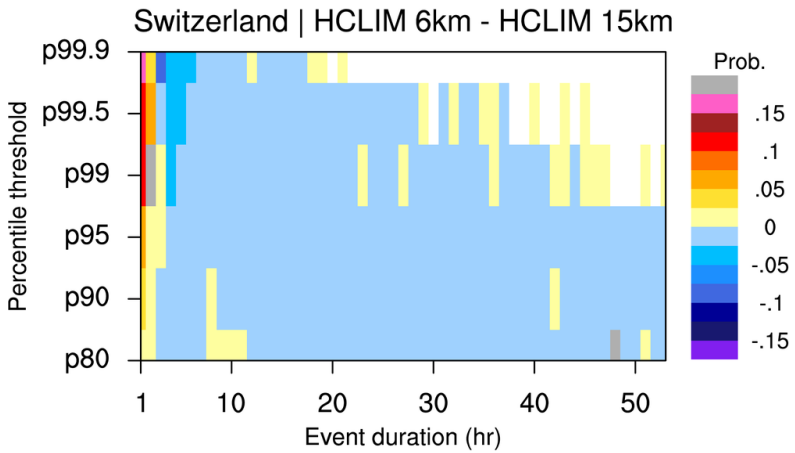
Anuual cycle of downwelling solar radiation from seven measuring towers from the BSRN dataset. Top figure shows absolute values from BSRN and HCLIM6. Bottom figure shows HCLIM6 anomalies (red lines) with reference to corresponding BSRN station and the mean bias (grey line)

Time-duration analysis 1/2



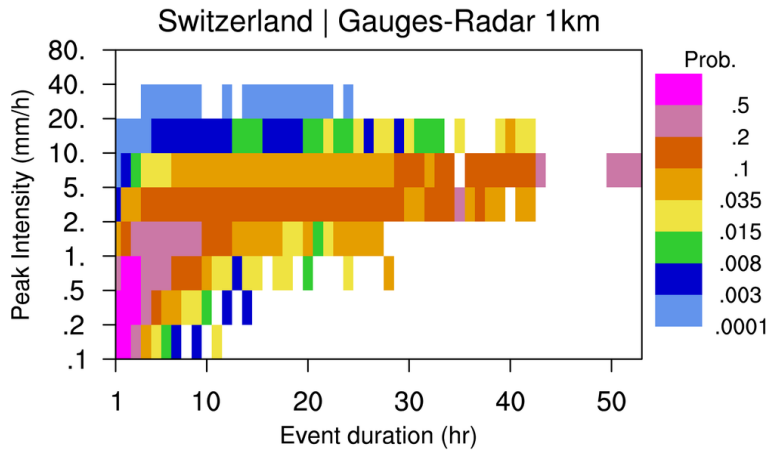


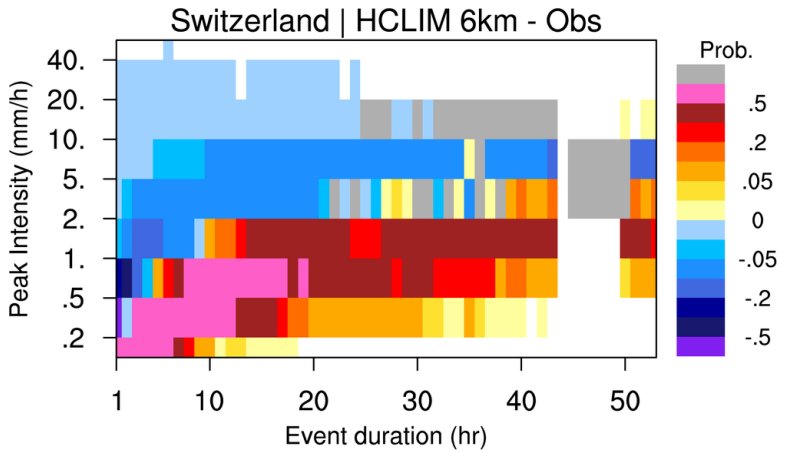


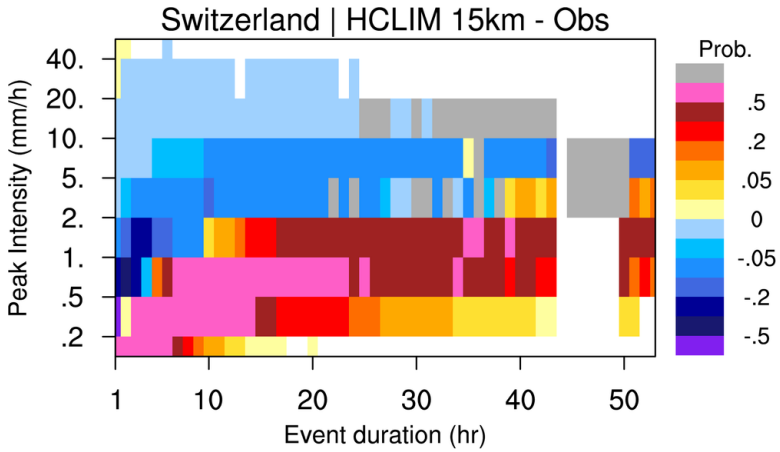


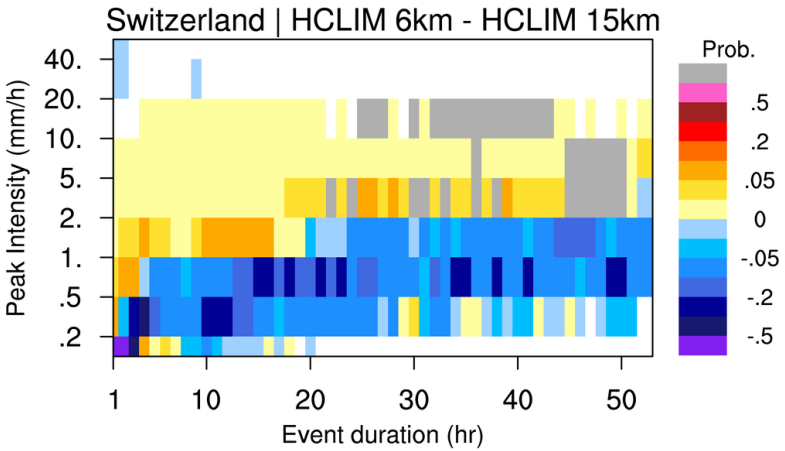
Observed probabilities at different durations (top left) and the other panels shows model differences.

Time-duration analysis 2/2



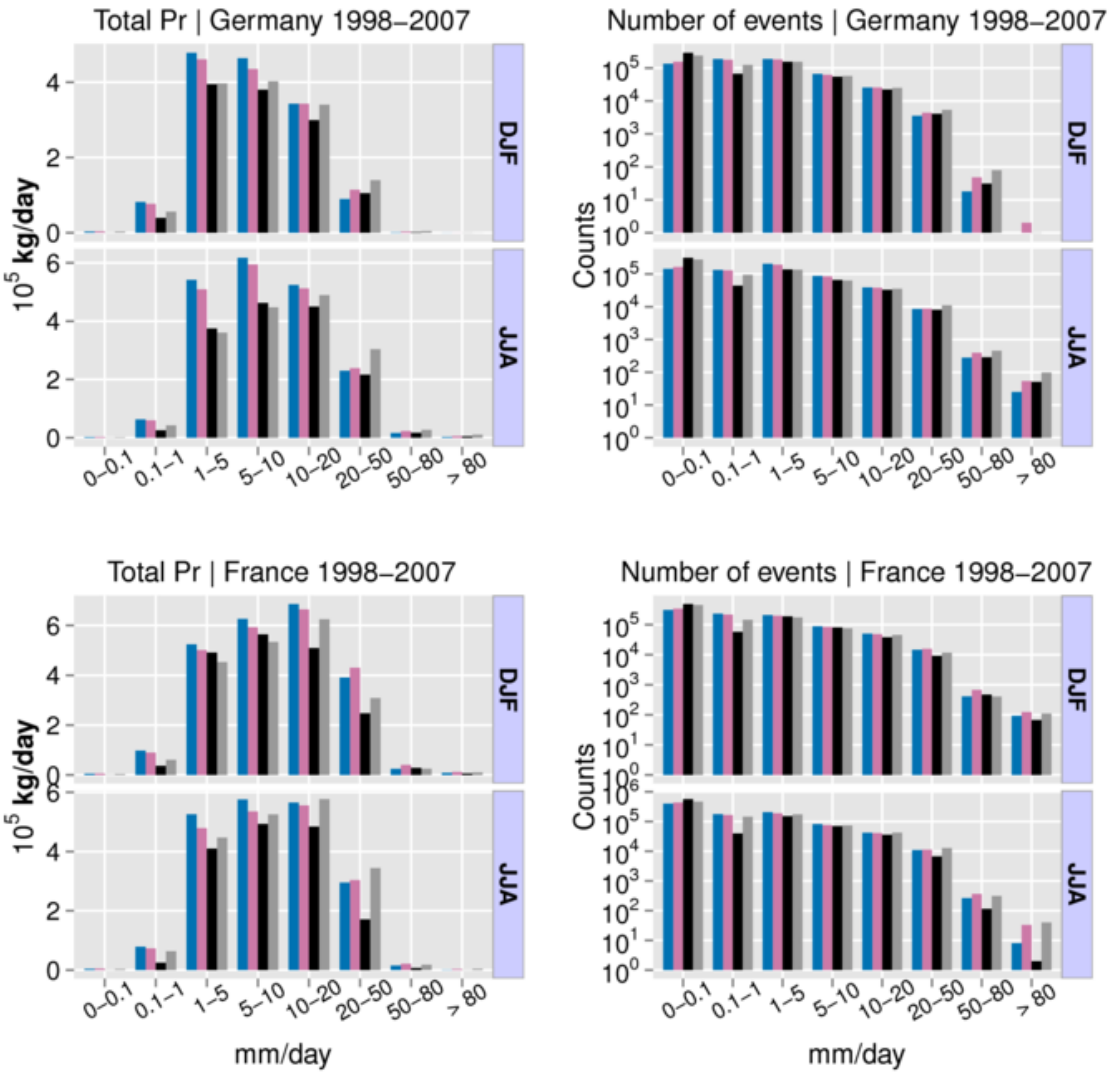






Rain spell peak intensities for various durations, observed probabilities (top left) and the other panels shows model differences.

Precipitation - intensity,frequency



HCLIM15(blue), HCLIM6(red), E-OBS(black) and high-resolution observations (grey; SAFRAN, REGNIE)