Neighbourhood verification at MCH for precipitation and brightness temperature

COSMO GM – WG5 Session
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Investigation of the daily cycle of convection in Summer 2014

Goal: insight of the diurnal convection in high spatial and temporal resolution over the Alps with neighbourhood verification

- **Observations (measurements):** interpolated onto the different COSMO-1/ -2 /-7 grids
  - **CombiPrecip**: **hourly precipitation** estimated over Switzerland from the radar composit of the 4 swiss radars and 75 automatic raingauges by spatio-temporal co-kriging
    pixel resolution: 1km
  - **METEOSAT-8 data:** infrared 10.8µm channel of MSG SEVIRI
    -> **brightness temperature** (BT): detection of clouds in contrast to warm emission by the earth surface
    pixel resolution: 5 km

Investigation of the daily cycle of convection in Summer 2014

Goal: insight of the diurnal convection in high spatial and temporal resolution over the Alps with neighbourhood verification

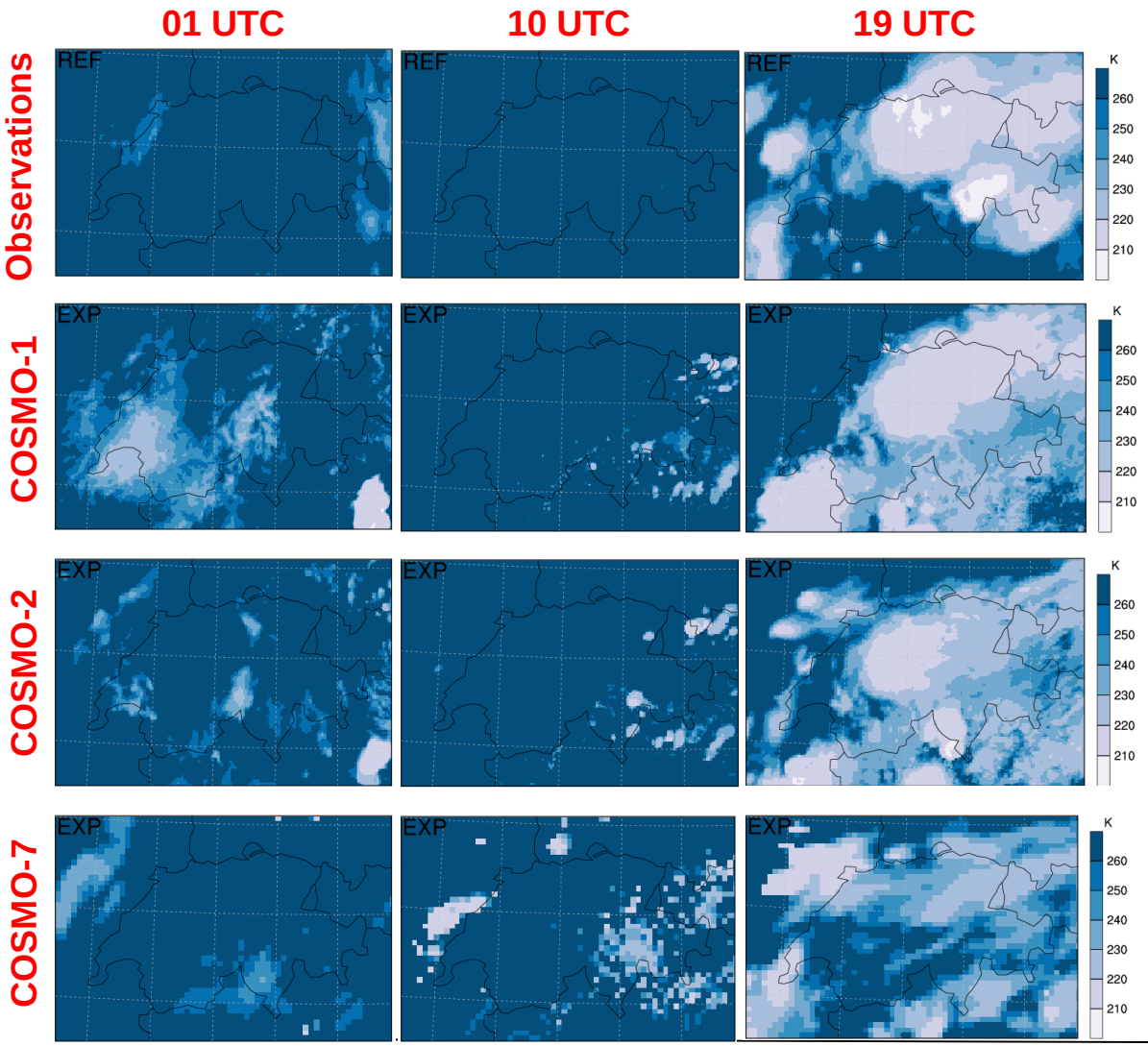
- **Models (COSMO-1/ -2, /-7): 00 UTC forecasts up to +24h**
  - **Hourly precipitation sums**
  - **Brightness temperature**: **LMSynSat product** that produces synthetic satellite images (from NWP-SAF; RTTOV version 7)

Investigation of the daily cycle of convection in Summer 2014

Goal: insight of the diurnal convection in high spatial and temporal resolution over the Alps with neighbourhood verification

- **Period:**
  - June 2014 and first a case study of a typical day with strong convective activity (12 June 2014)
- **Domain:**
  - Switzerland
- **Neighbourhood methods:**
  - Upscaling (UP with ETS) and Fractions Skill Score (FSS)
- **Other investigations**:
  - spatial distributions, frequency-intensity distributions, averaged diurnal cycles

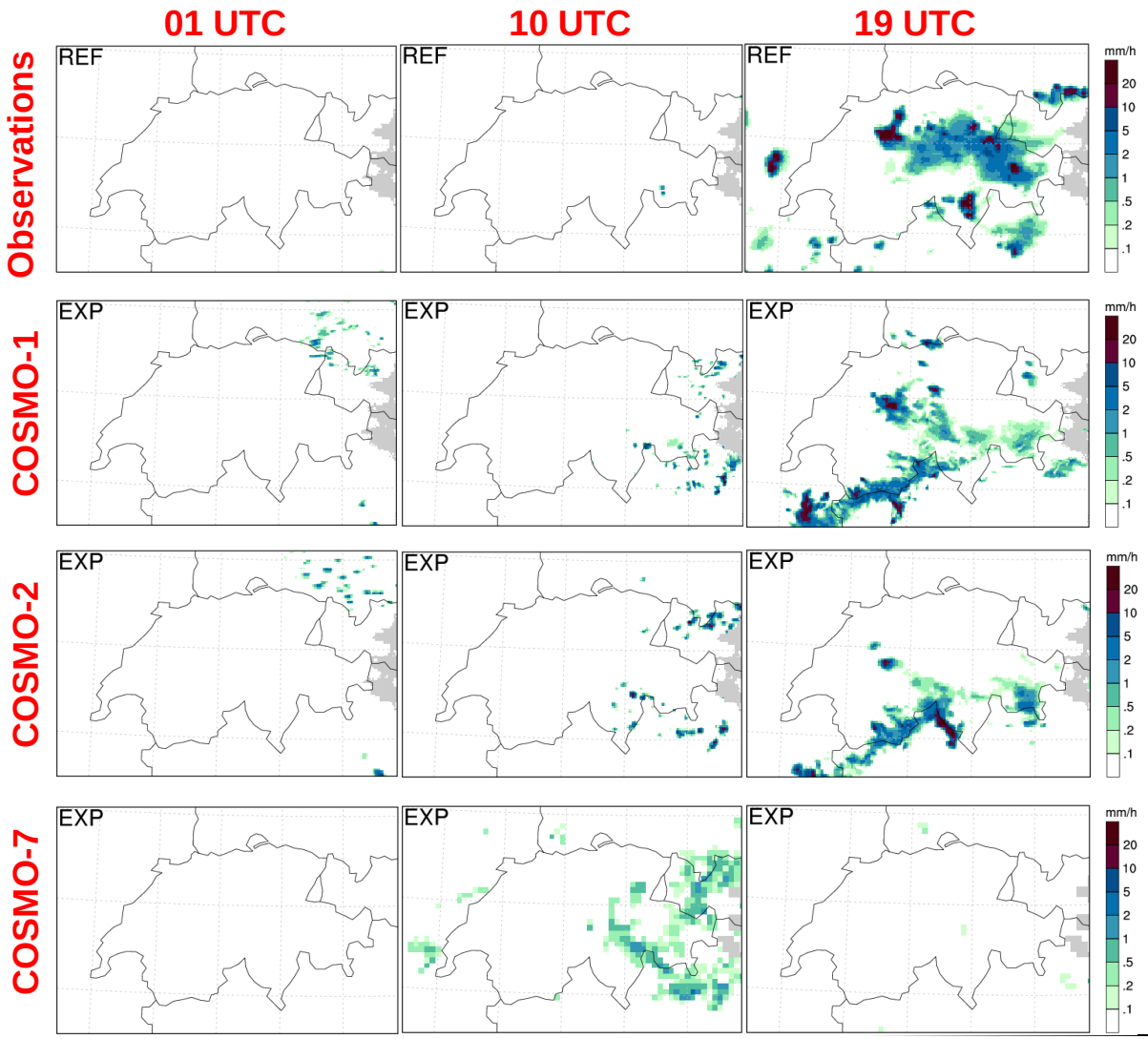
Case study: Brightness temperature



12 June 2014

strong convective activity in the evening

Case study: Precipitation (hourly sums)

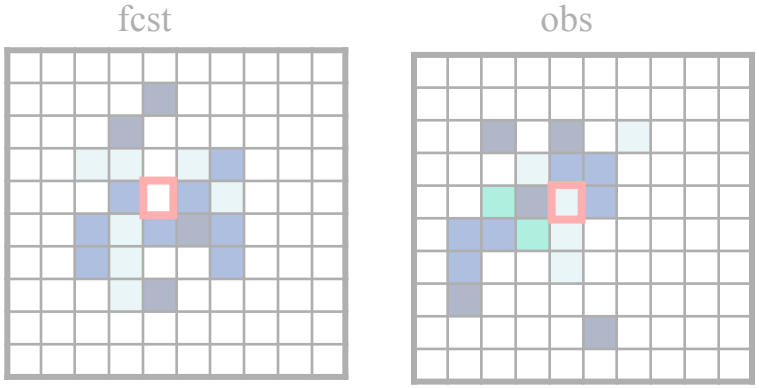


12 June 2014

strong convective activity in the evening

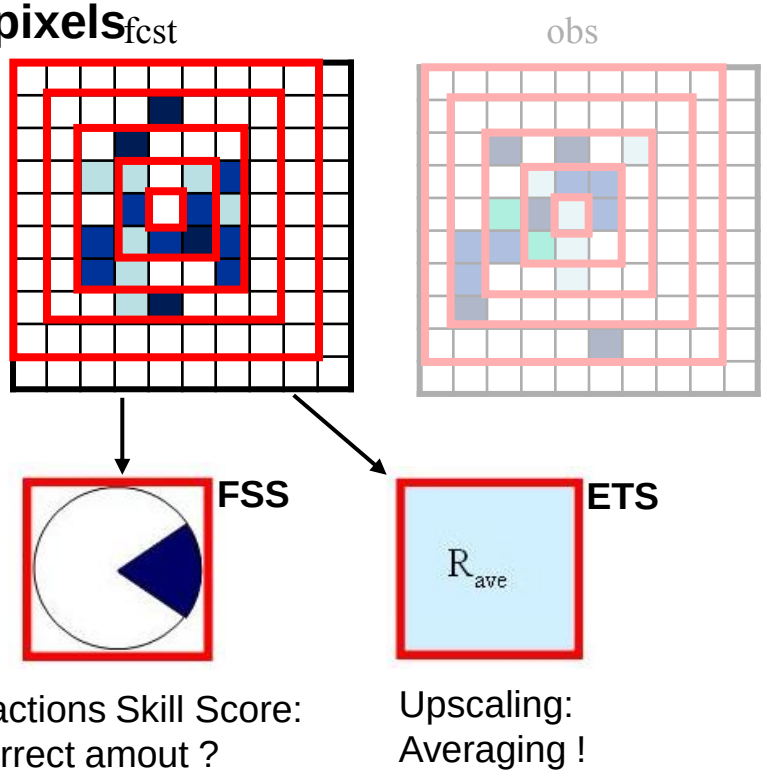
Standard vs neighbourhood verification

Standard-Verification (SYNOP) → point-wise comparison



- precipitation shows great variability in space and time
- Forecast can be useful, even if the location is partly missed

Neigbourhood verification: gridded data → consider neighboring pixels



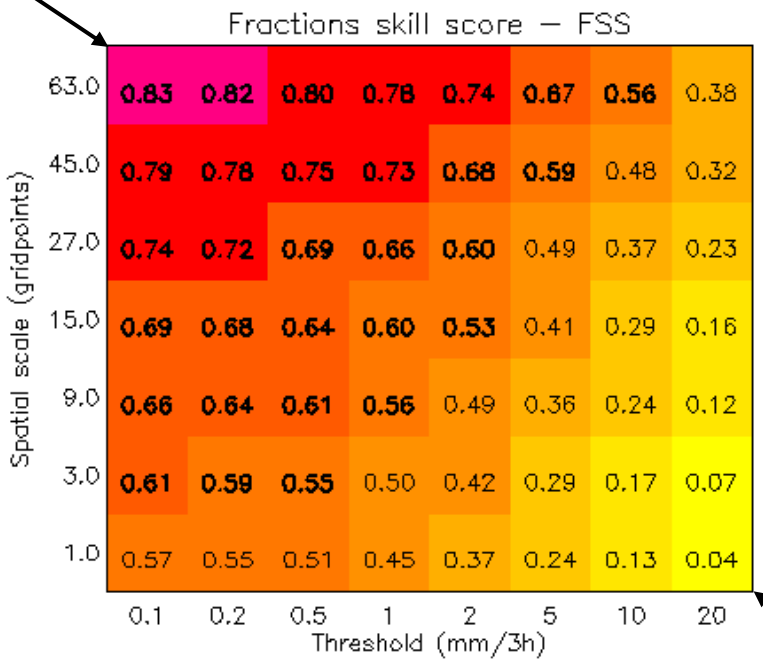
Fractions Skill Score: Correct amout ?

Upscaling: Averaging !

FSS: What are the spatial scales at which the forecast resembles the observations?
ETS: How well did the forecast "yes" events correspond to the observed "yes" events (accounting for hits due to chance)?

How to read neighbourhood graphics?

best skill for slight precipitation on large scales



Increasing window size

Increasing threshold

little skill for strong precipitation on small scales

Scores / Colours

→ Value of the score, here: FSS

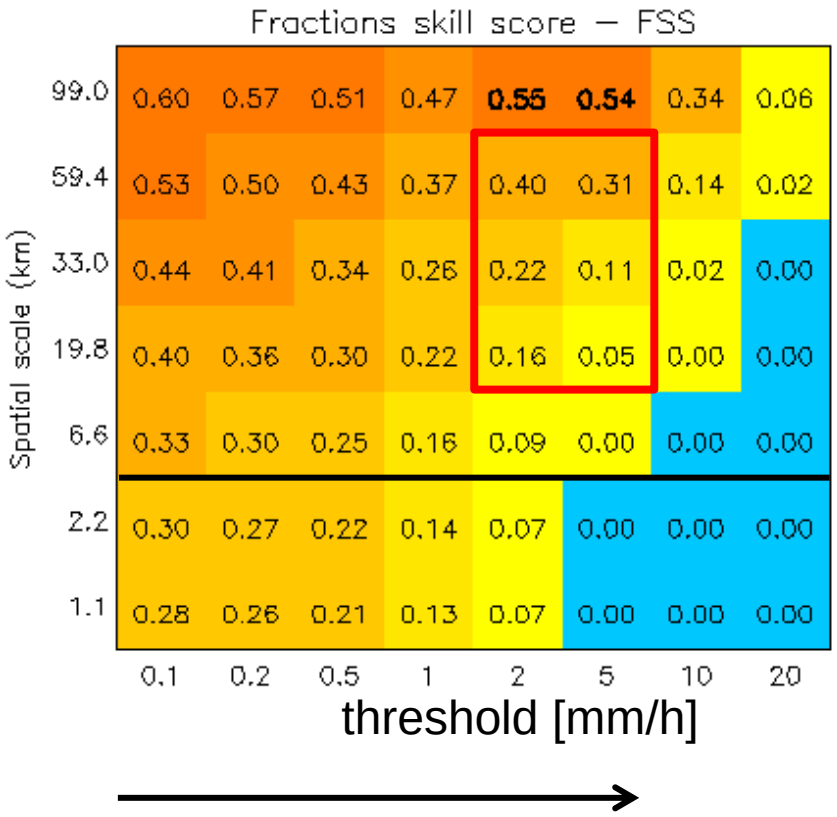
bad — good

Values in bold

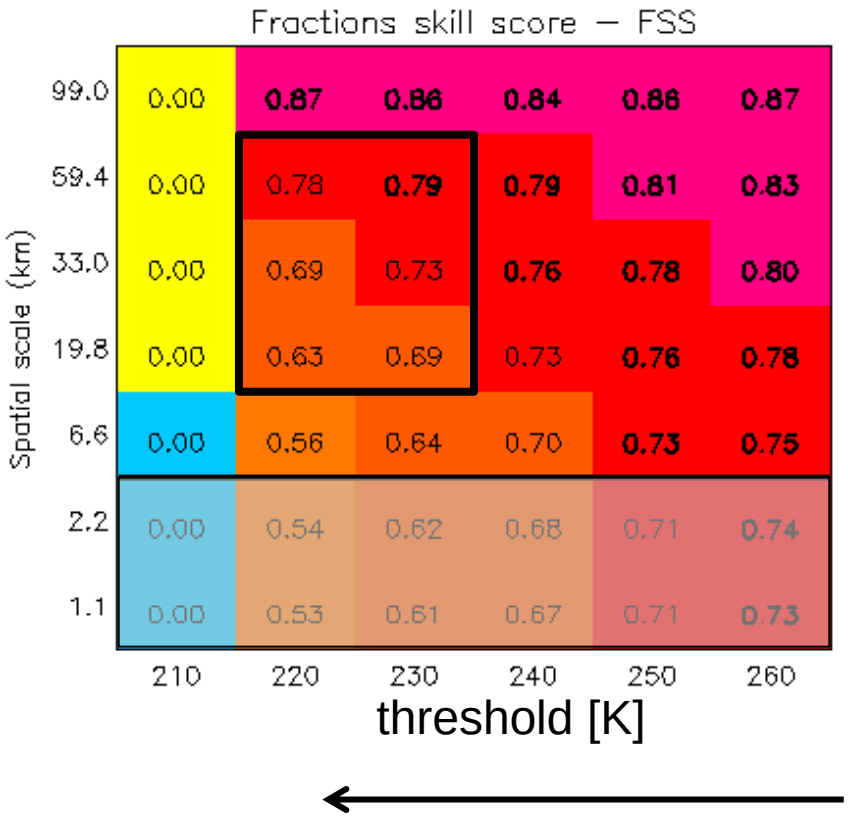
→ „useful scales“ (for FSS, Roberts and Lean, 2008)

FSS 12 June 2014 19 UTC COSMO-1

precipitation

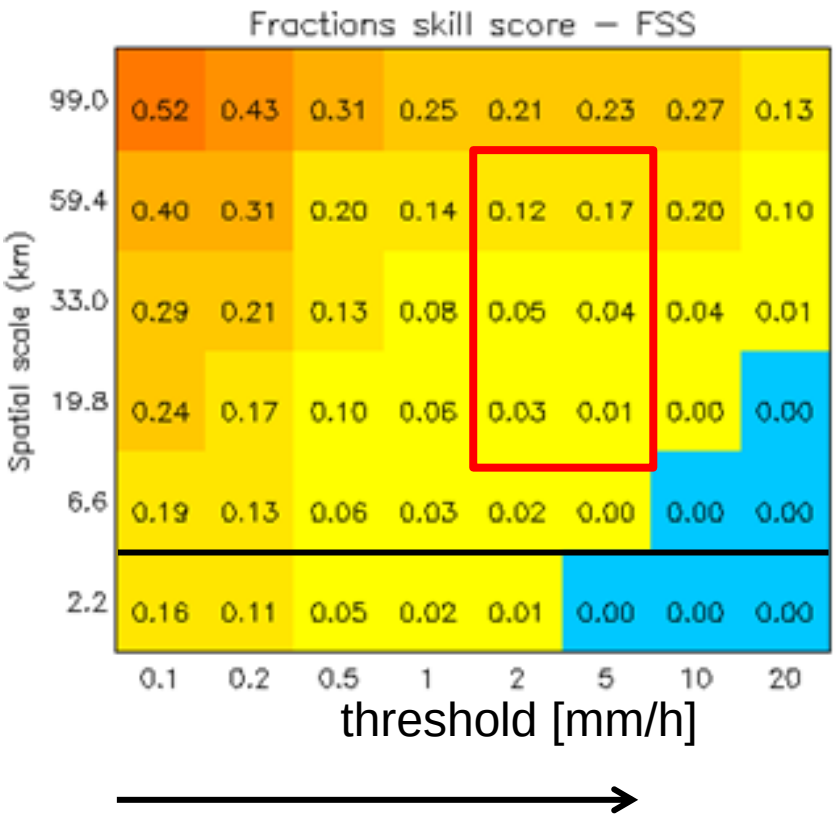


brightness temperature

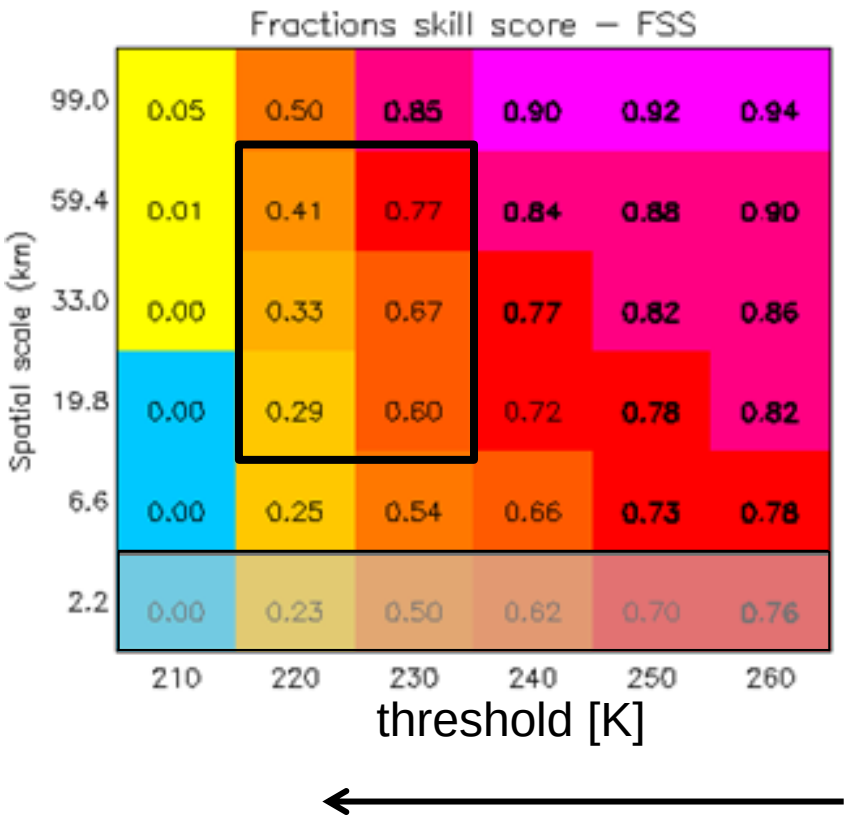


FSS 12 June 2014 19 UTC COSMO-2

precipitation

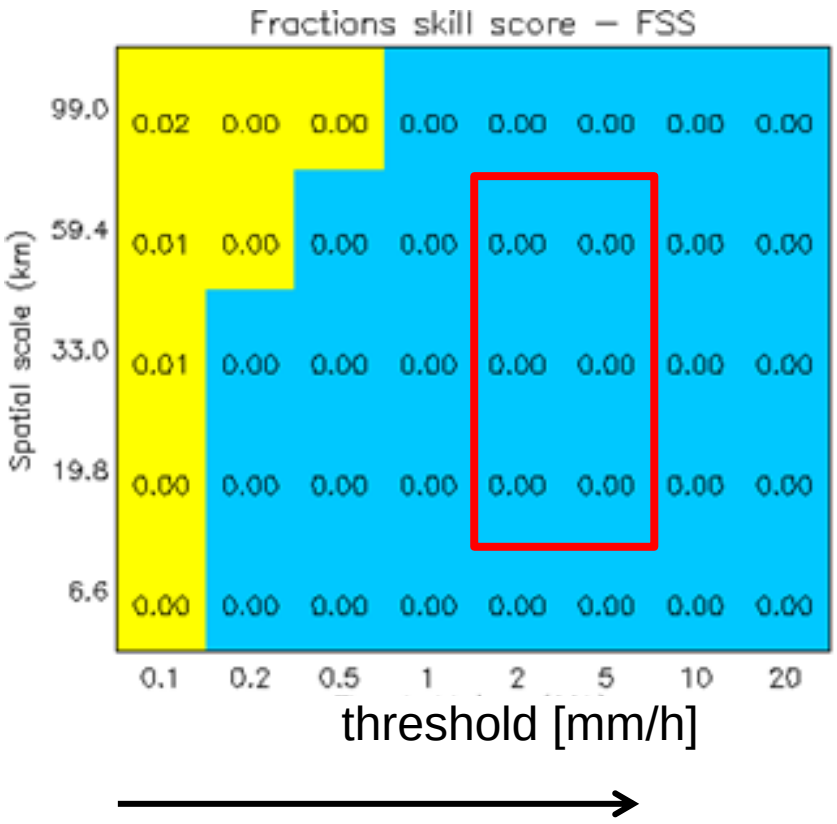


brightness temperature

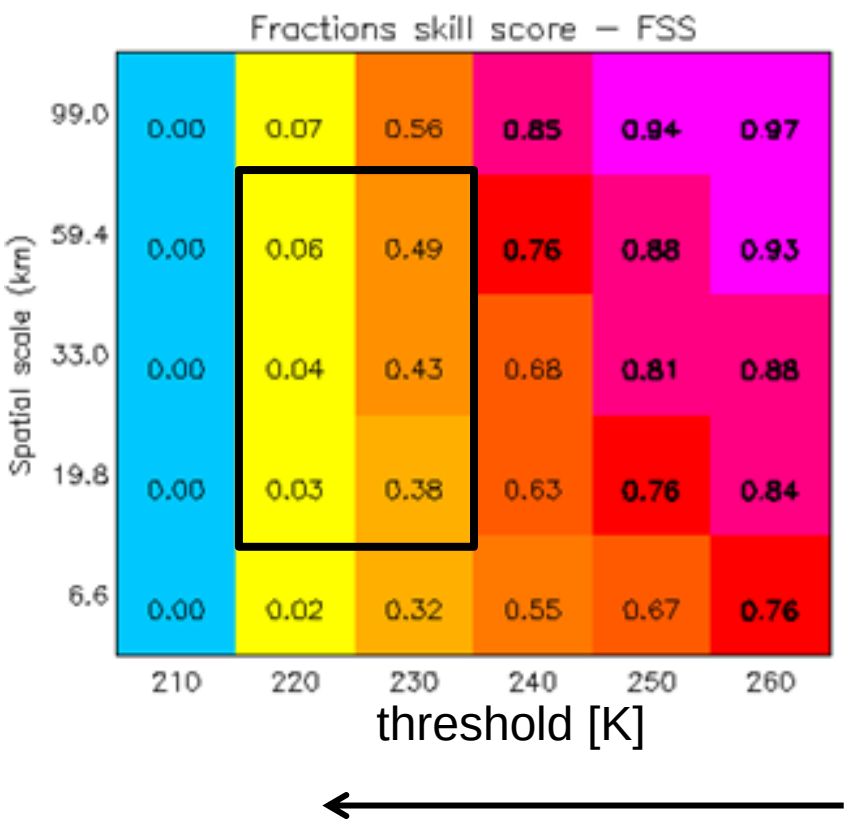


FSS 12 June 2014 19 UTC COSMO-7

precipitation

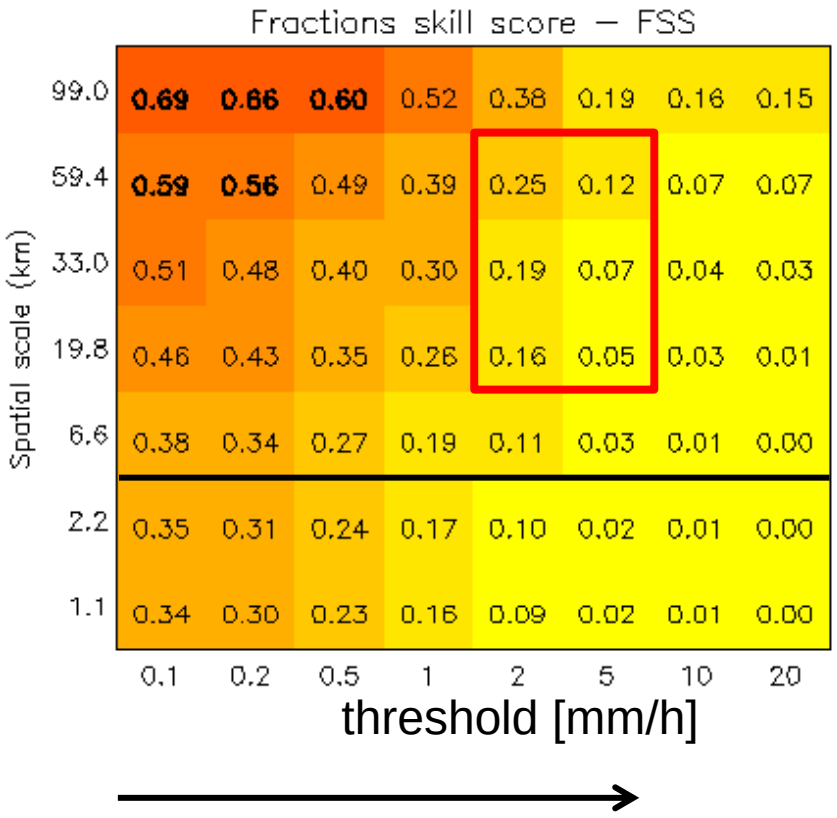


brightness temperature

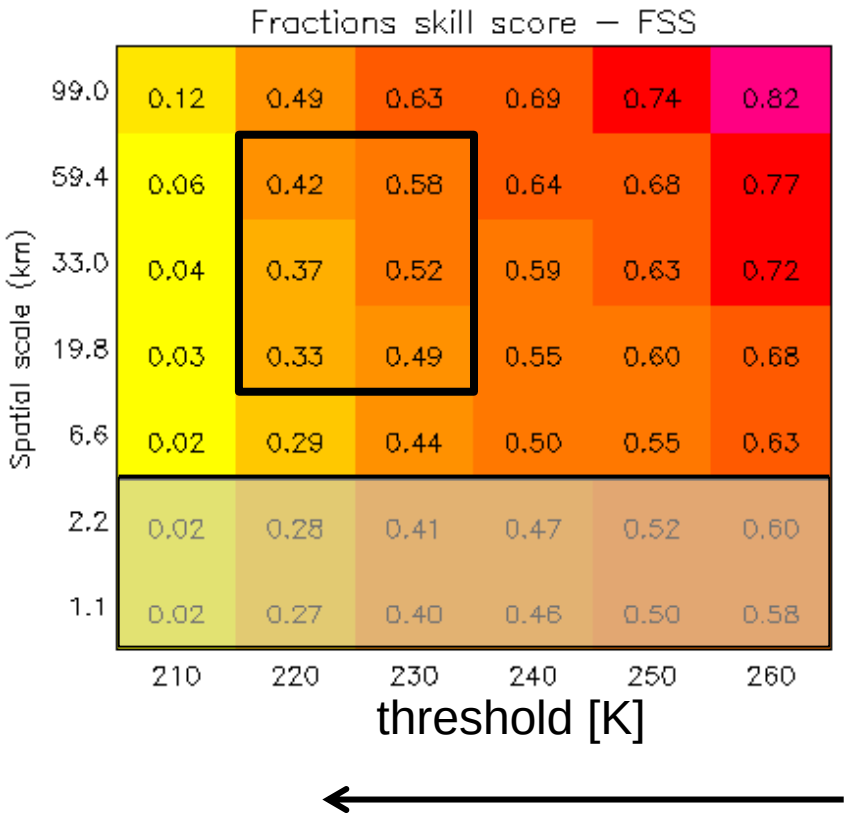


FSS June 2014 mean over all 24h COSMO-1

precipitation

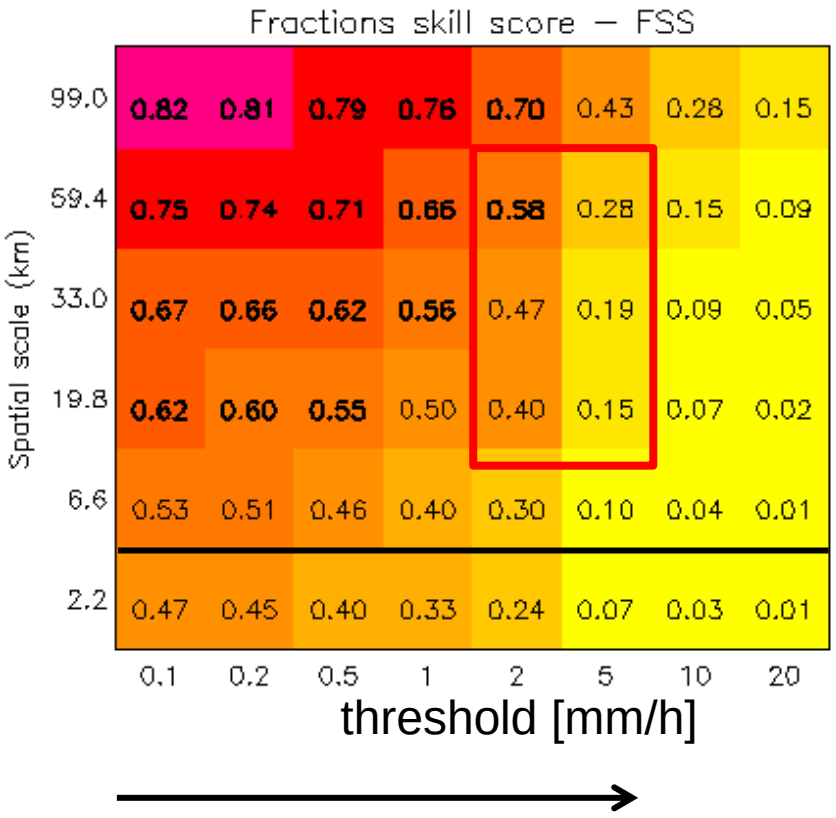


brightness temperature

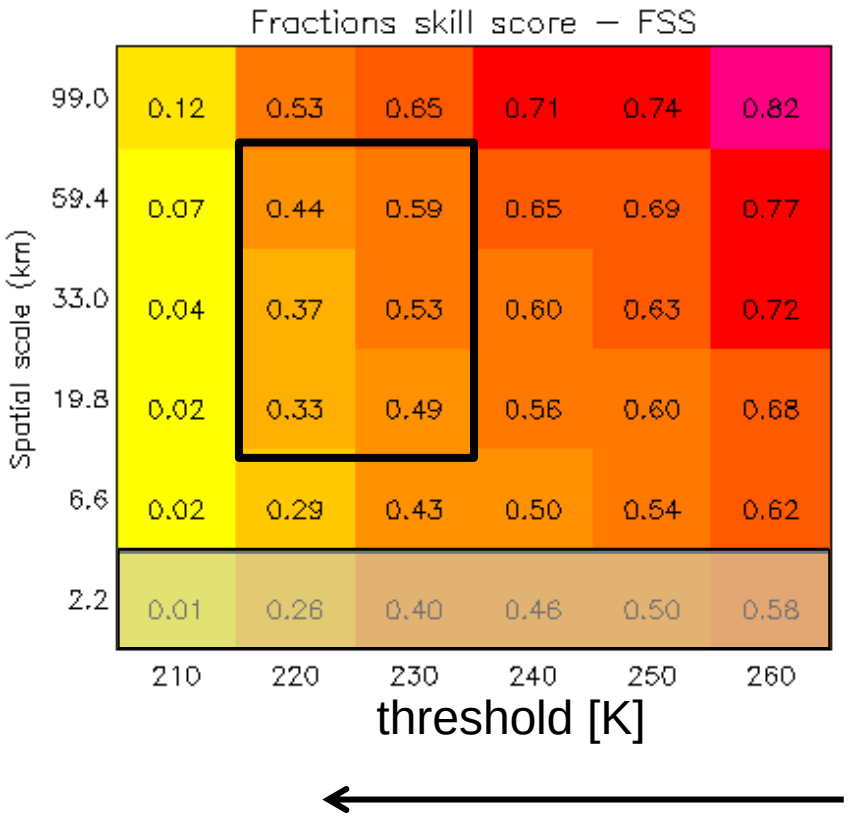


FSS June 2014 mean over all 24h COSMO-2

precipitation

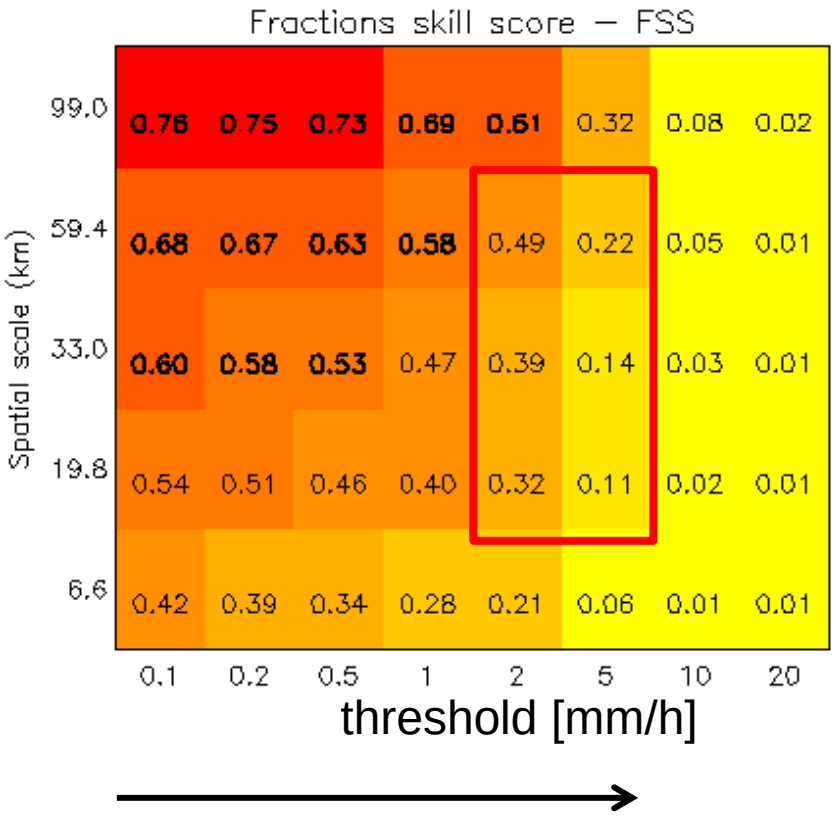


brightness temperature

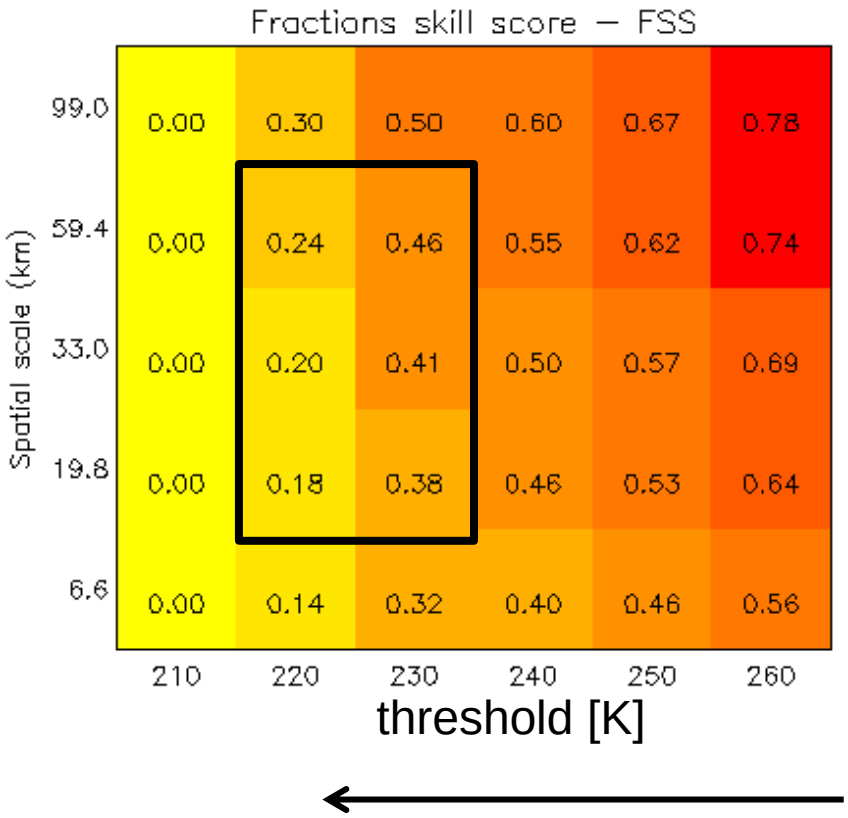


FSS June 2014 mean over all 24h COSMO-7

precipitation

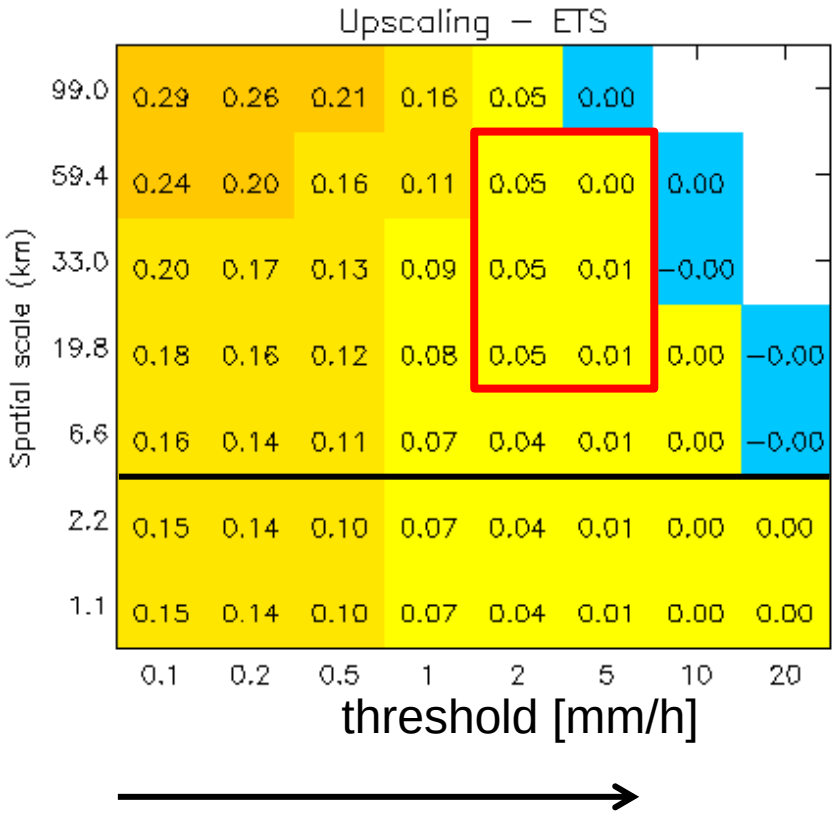


brightness temperature

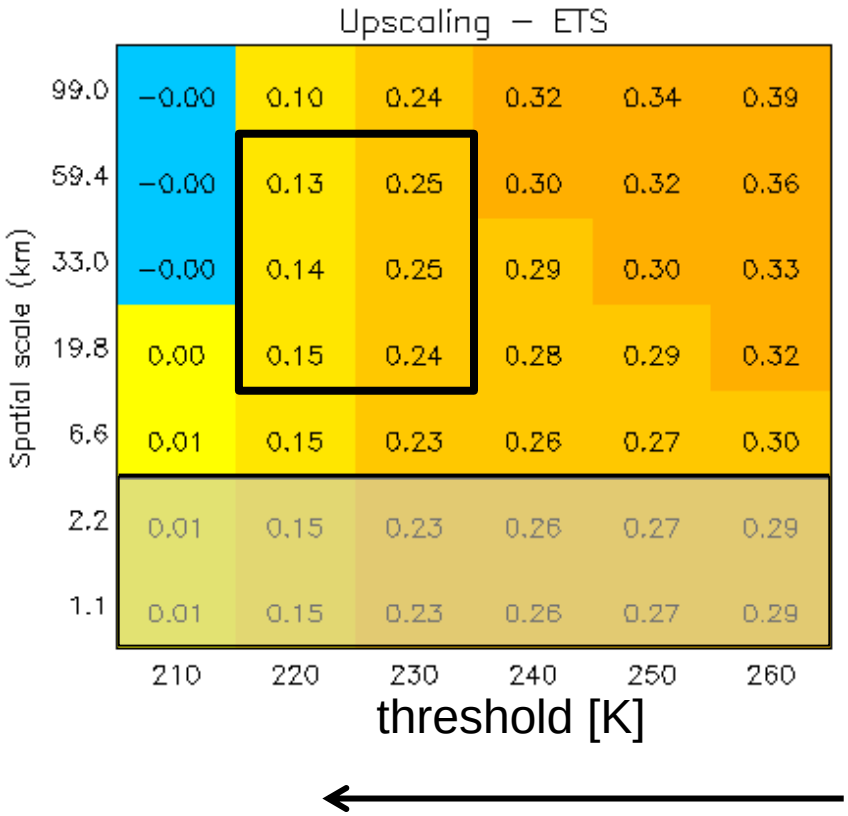


Upscaling: ETS June 2014 mean over all 24h COSMO-1

precipitation

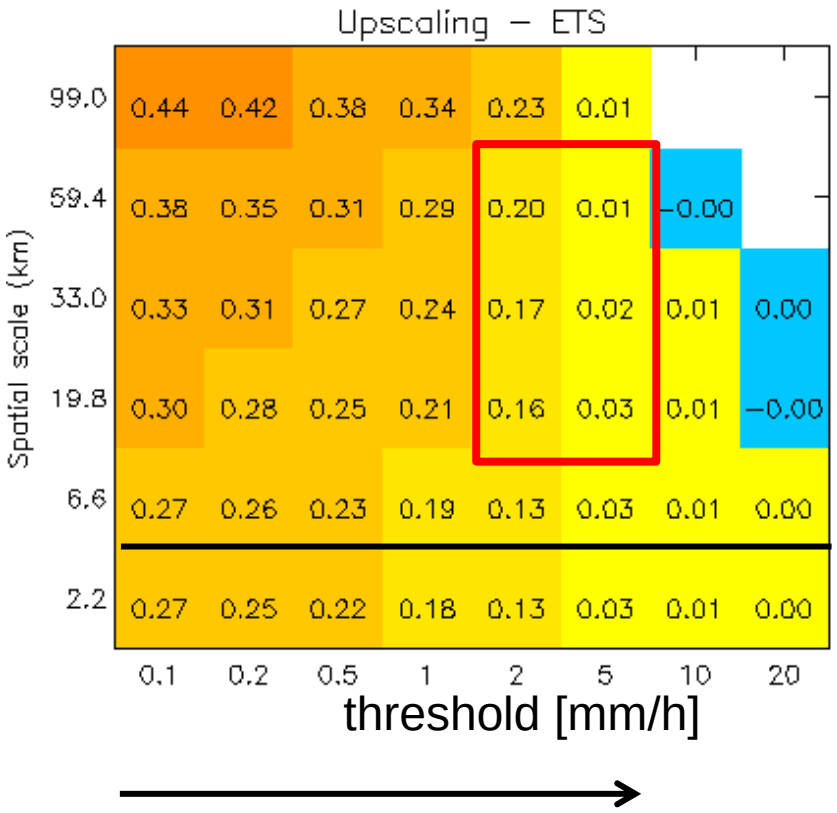


brightness temperature

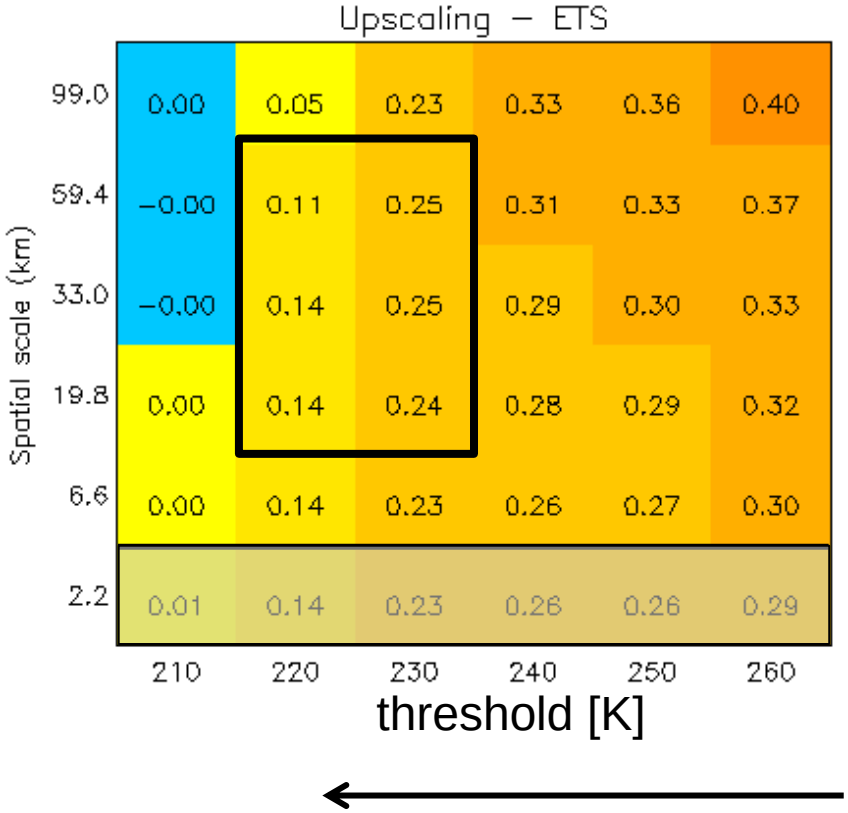


Upscaling: ETS June 2014 mean over all 24h COSMO-2

precipitation

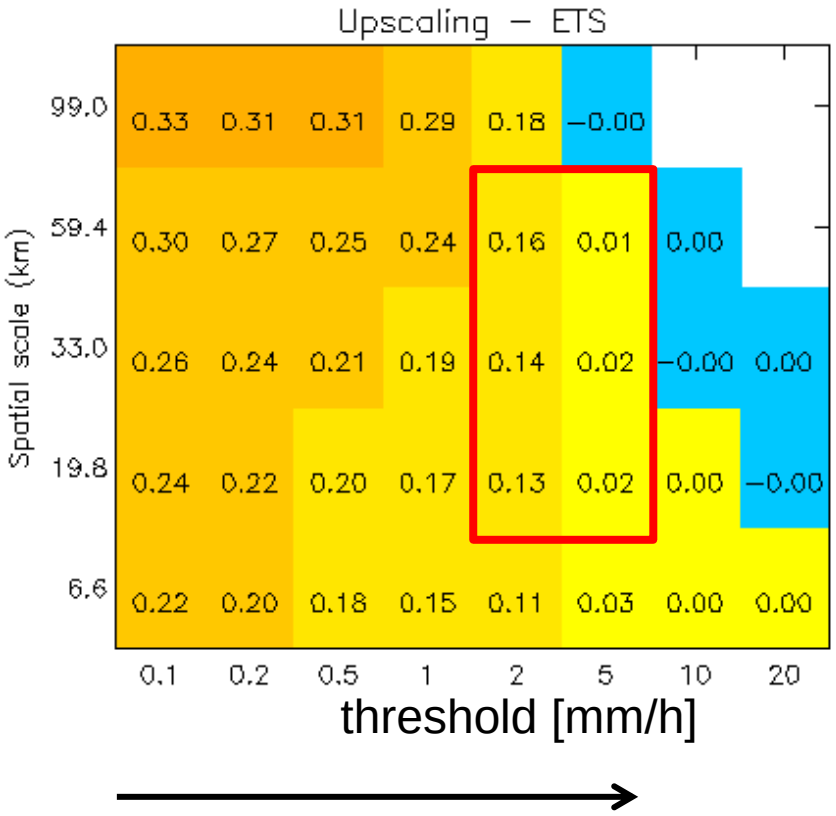


brightness temperature

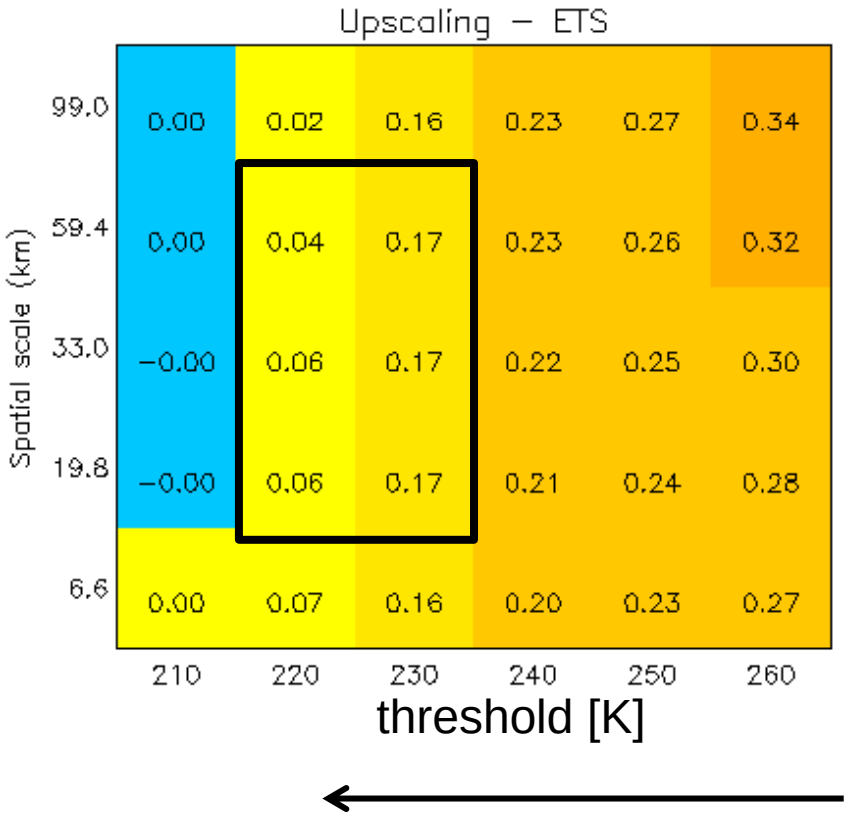


Upscaling: ETS June 2014 mean over all 24h COSMO-7

precipitation

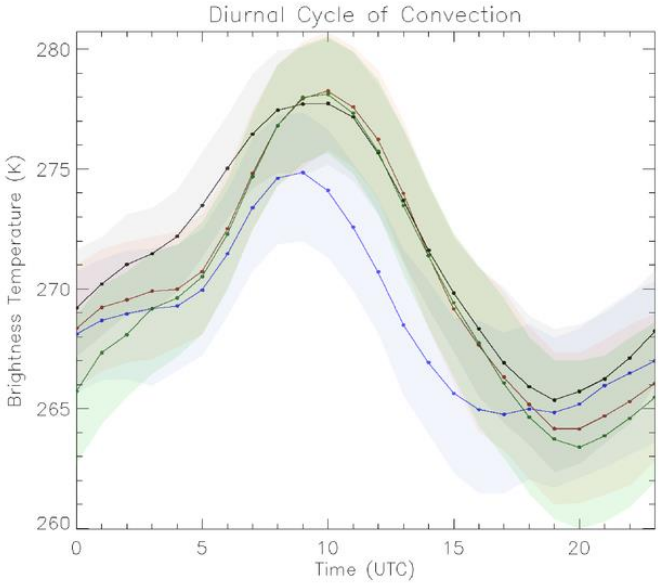


brightness temperature

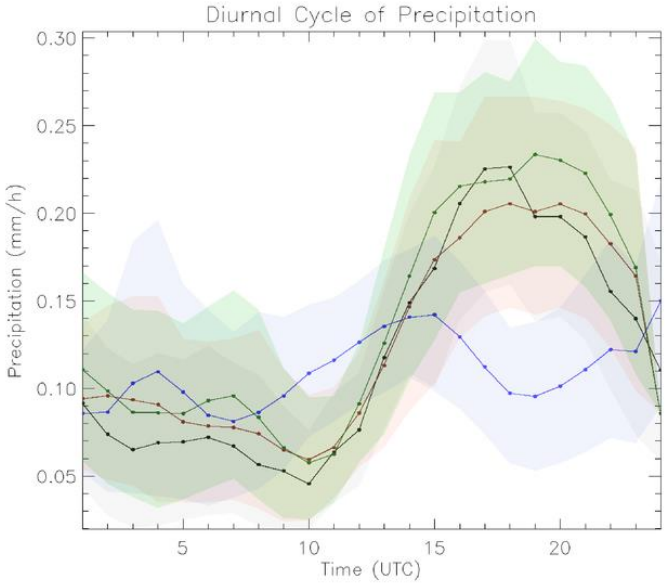


Mean daily cycle in June 2014

Brightness temperature



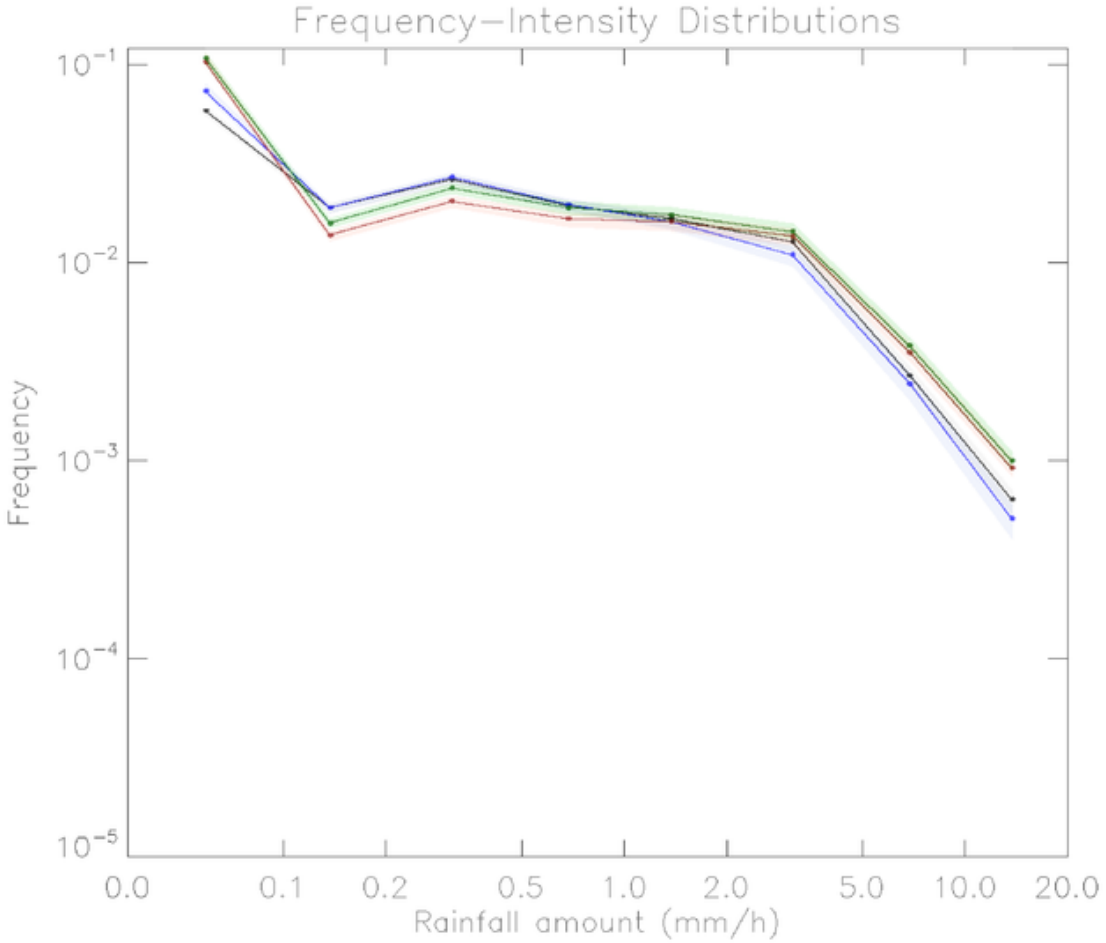
precipitation



OBS **COSMO-1** **COSMO-2** **COSMO-7**

shaded area represents the range between the 10th and 90th percentile

Frequency-intensity distributions: precipitation (mm/h) June 2014



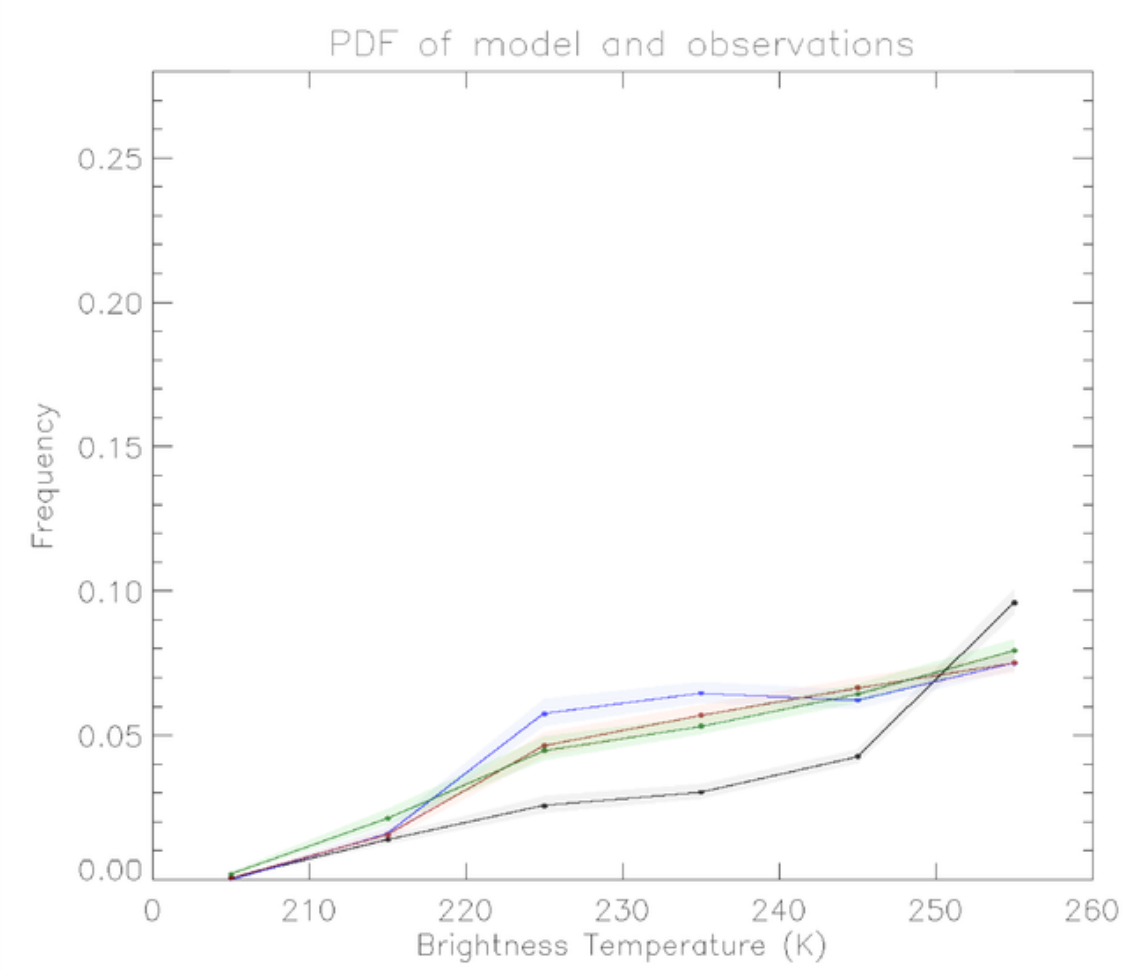
OBS

COSMO-1

COSMO-2

COSMO-7

Frequency-intensity distributions: brightness temperature June 2014



OBS

COSMO-1

COSMO-2

COSMO-7

Summary

- **for a single convective day (12 June 2014) at 19 UTC (maximum in convective activity):**
  - highest FSS in COSMO-1 for both, precipitation (all scales, all thresholds) and brightness temperature (all scales, and thresholds < 250K, i.e. deep convective clouds)
  - lowest values in FSS and UP/ETS for COSMO-7
- **for the whole month of June 2014 (averaged over all forecast hours up to +24h):**
  - best scores in COSMO-2
  - mean daily cycles of COSMO-1 and COSMO-2 much better than COSMO-7, however overestimation of night-time and morning clouds and precipitation
  - all 3 models overestimate brightness temperature < 250K

Summary and Outlook

- **Brightness temperature of:**
  - SEVIRI IR 10.8μm channel of METEOSAT and
  - COSMO simulated with LMSynSat

  can well serve as proxy for convective clouds, and has the potential to complement precipitation for the spatial verification of convective processes

- **Outlook**
  - extend the evaluation to season(s)
  - look also at 3h-sums of precipitation (0..3, 3..6, .., 18..24h)
  - extend the neighbourhood concept to «fuzzy in time»