Karlsruhe Institute of Technology

Intercomparison of AROME and COSMO simulations for a period of the AMMA campaign

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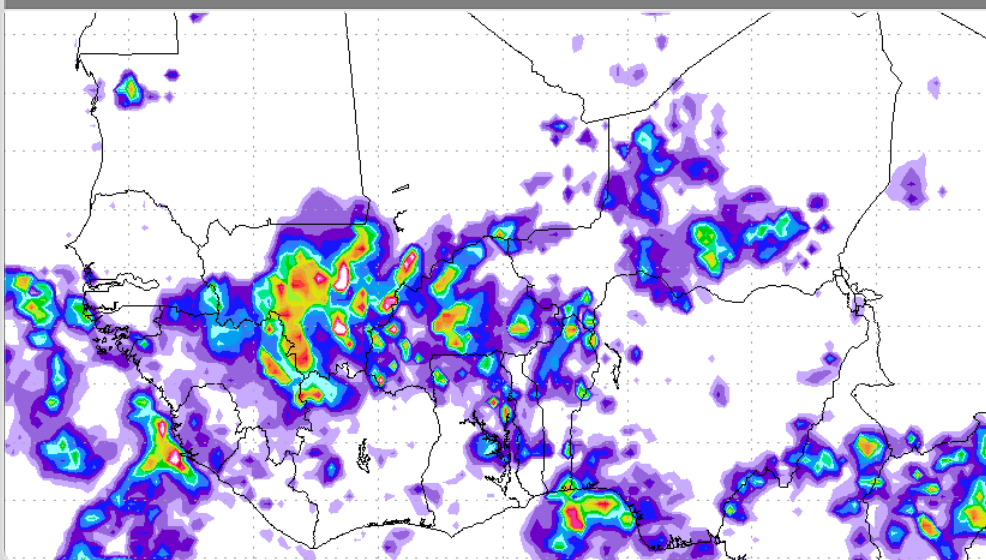
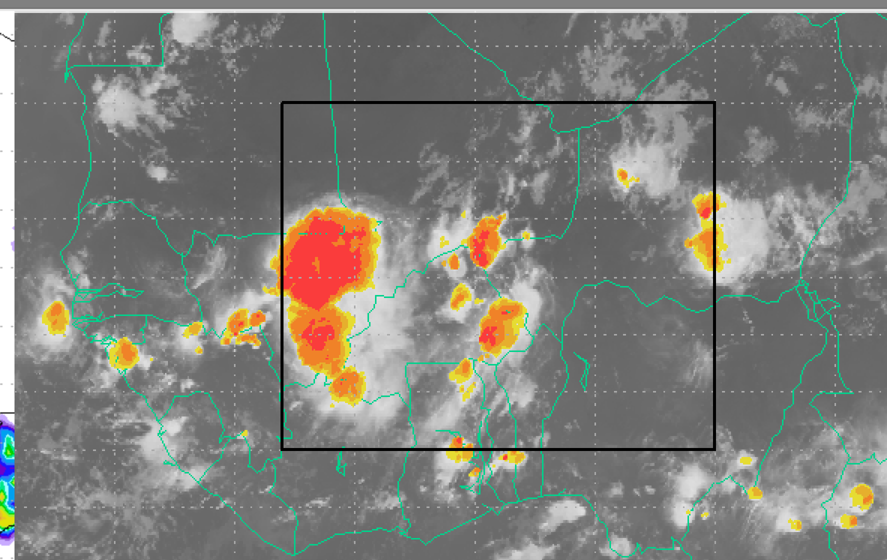




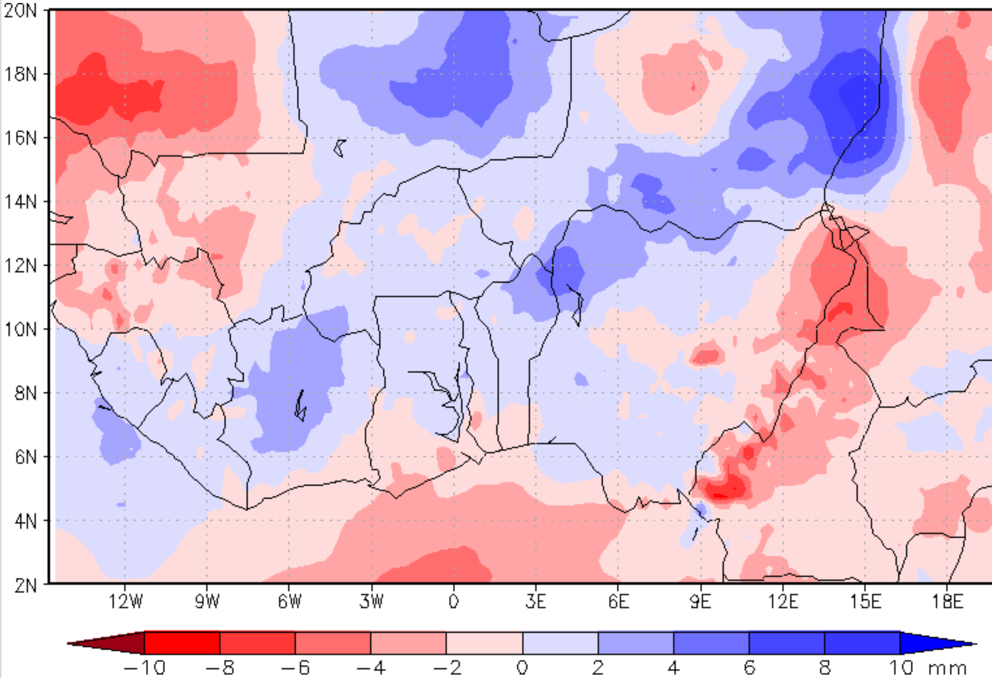
General comparison of model components

	AROME	COSMO
parameterizations		
turbulence scheme	prognostic TKE, comp. of exchange-coeff. (Cuxart et al., 2000)	TKE-based level 2.5 turbulence closure after Mellor and Yamada (1982)
shallow convection	Eddy diffusion / Kain Fritsch (EDKF)	shallow convection from Tiedtke mass-flux scheme
radiation	two-stream approximation (RRTM scheme from IFS)	radiative transfer after Ritter and Geleyn (1992)
microphysics	mixed-phase bulk scheme	cloud-ice bulk scheme including graupel
soil model	ISBA (3 layers)	Terra-ML (8 layers)

General comparison of model components

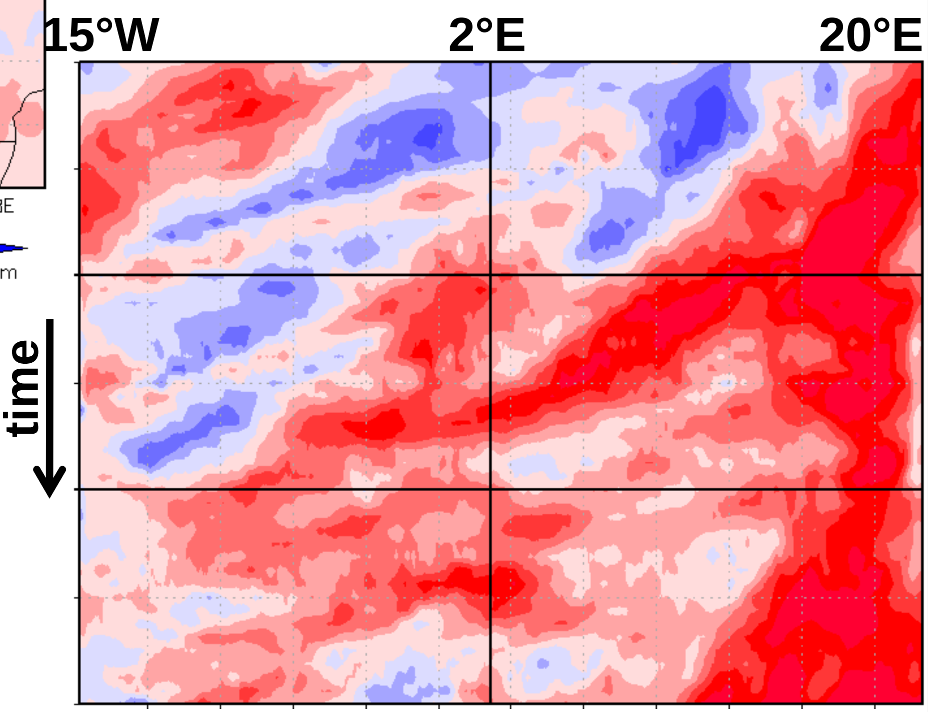
	AROME	COSMO
numerics	spectral limited-area model	rotated geographical lat/lon grid
	semi-implicit, semi-Lagrangian timestep	3rd order two time-level Runge-Kutta split-explicit scheme (Wicker and Skamarock, 2002)
	Arakawa A-grid terrain-following hybrid mass coordinates	Arakawa C-grid terrain-following hybrid height-based coordinate
model setup		model version 4.18
initial and boundary conditions	Arpège analysis using AMSU-B microwave data	ECMWF AMMA re-analysis (6-hourly resolution)
	nominal res. of 0.05°	0.025°

differences of total precipitable water

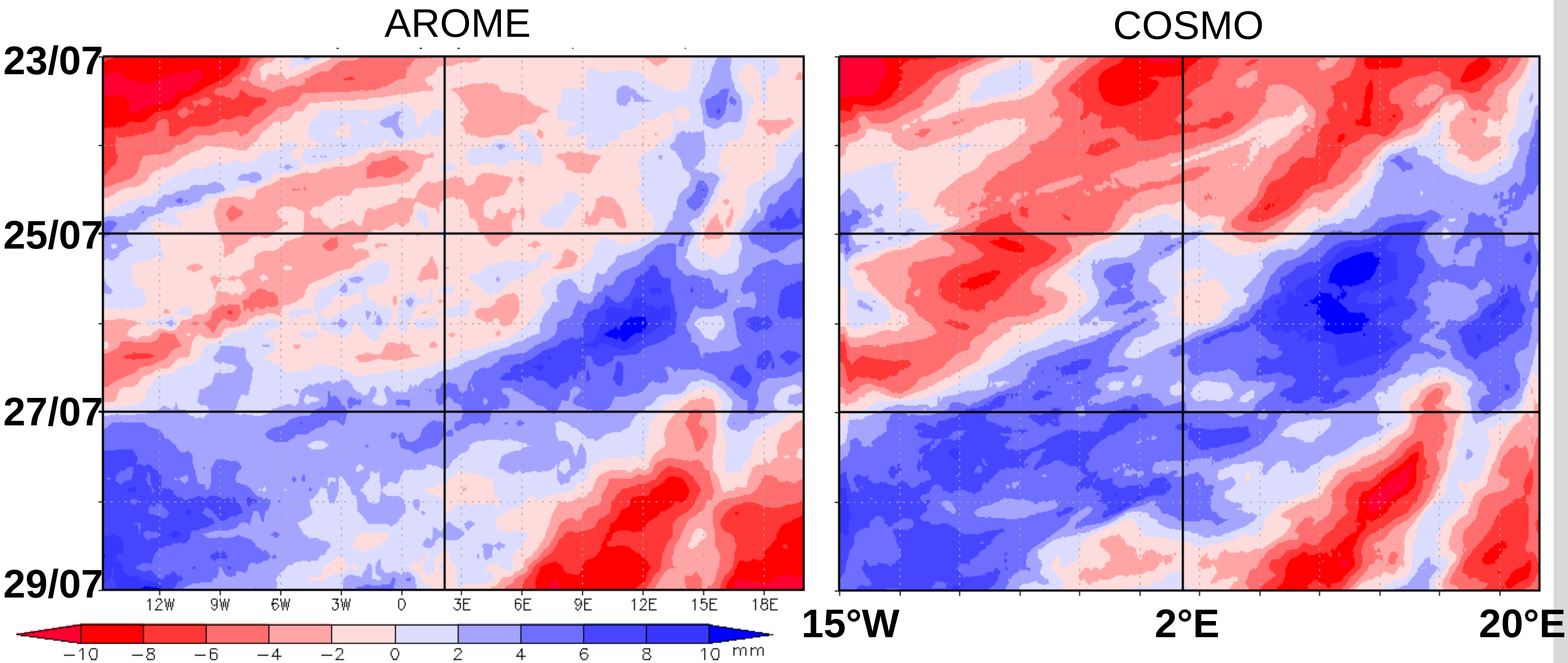


Arpège – ECMWF reanalyes,
6-day mean

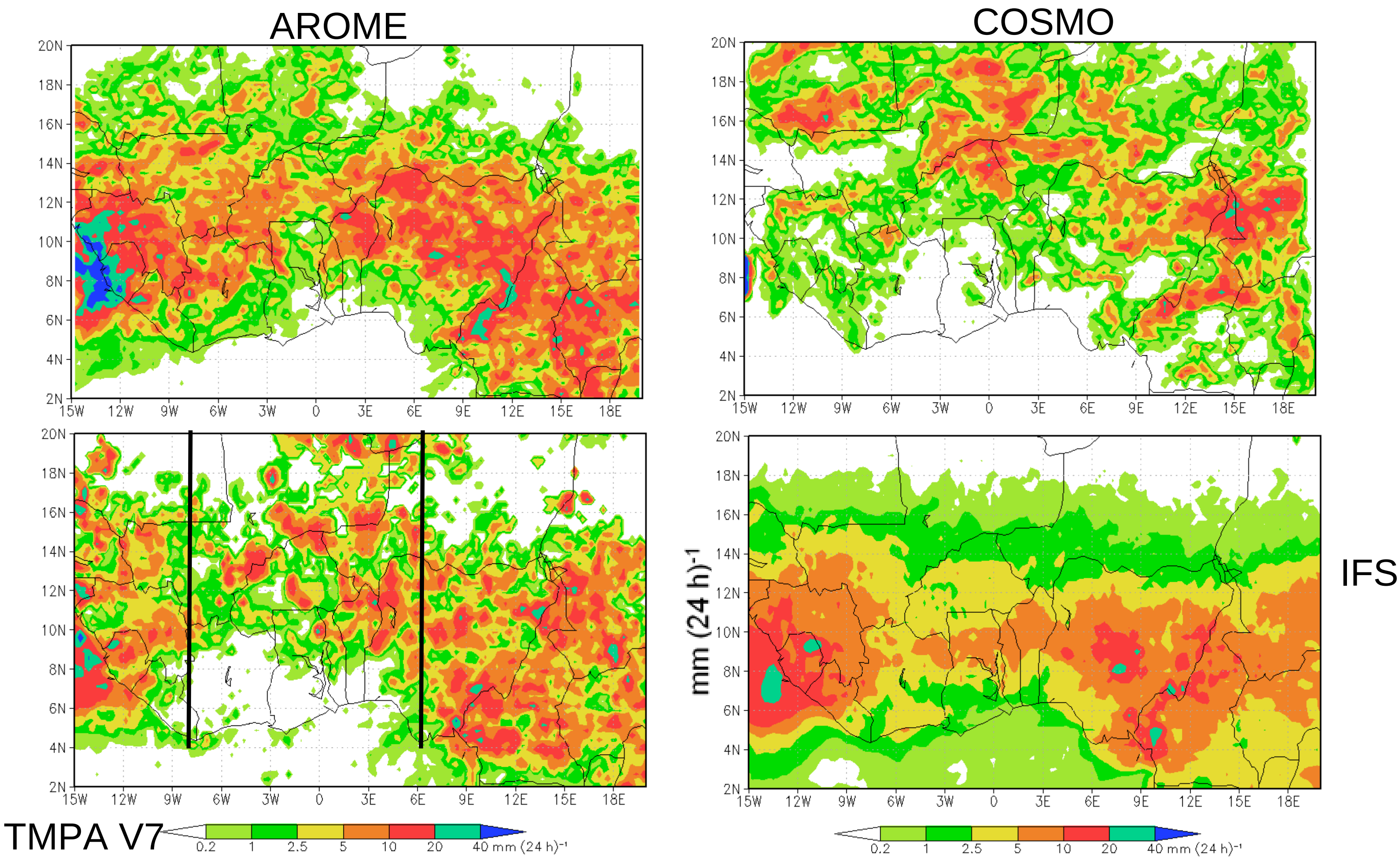
AROME – COSMO simulation,
average over 12-20°N



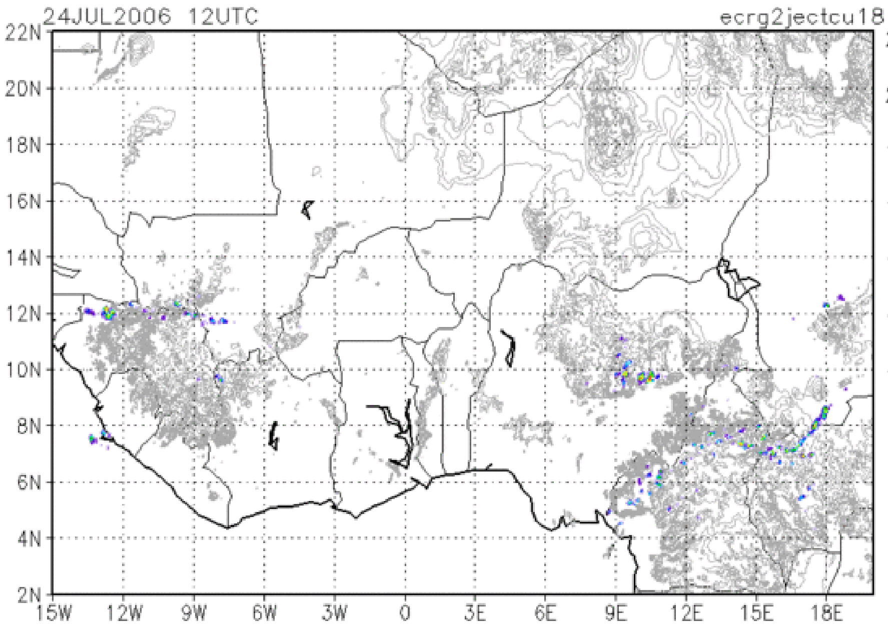
anomaly of precipitable water with respect to 6-day period, averaged over 12-20°N

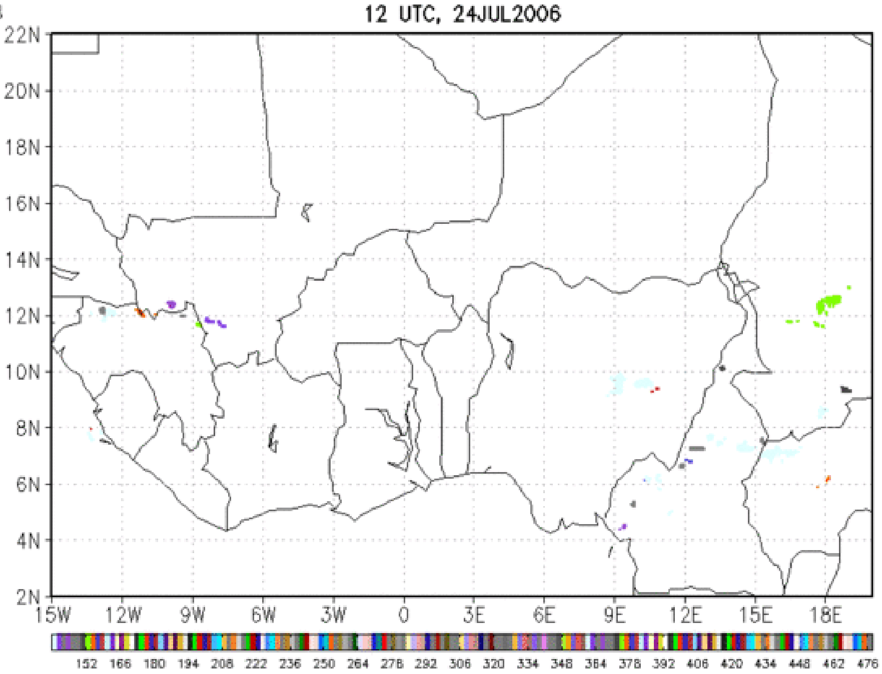


precipitation 5-day mean

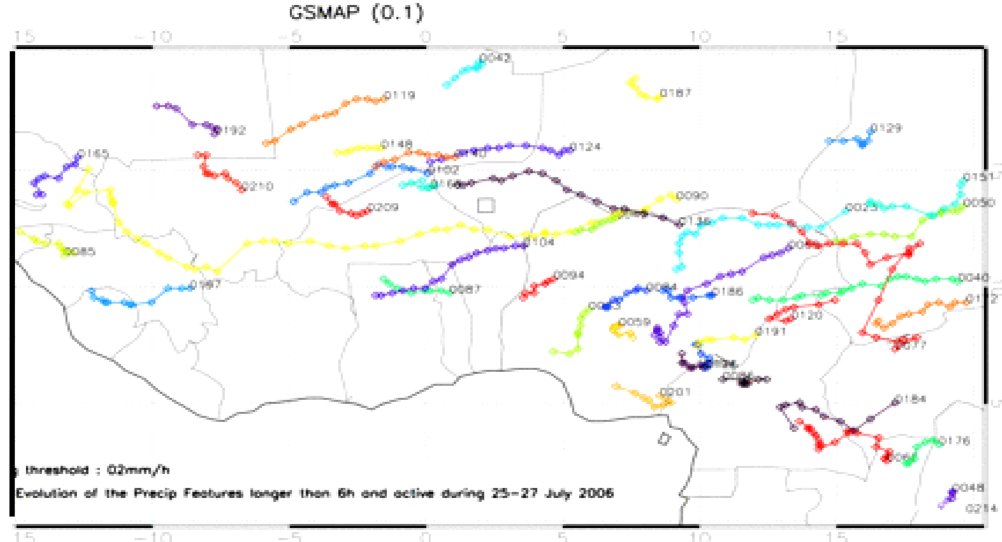


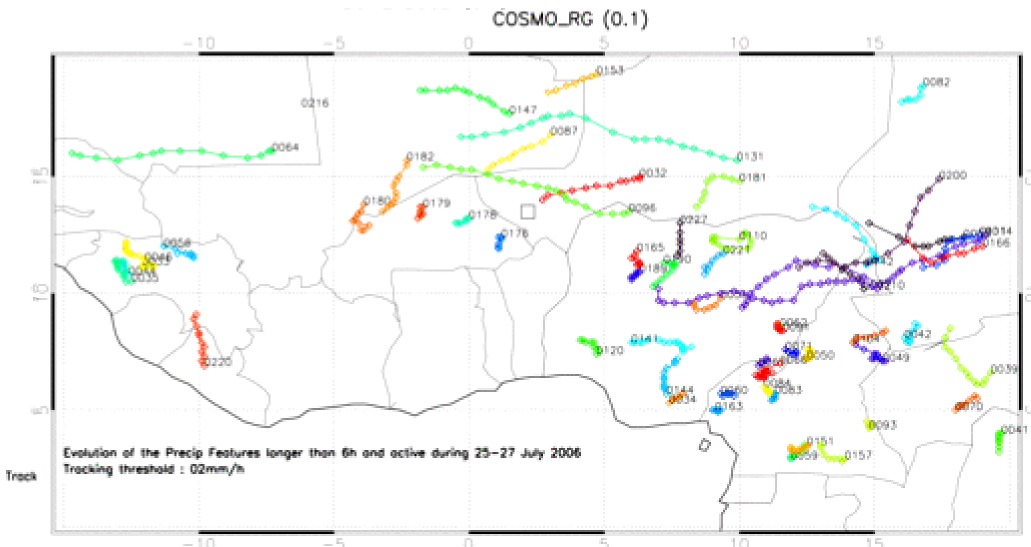
MCS tracking – definition of “blobs”





MCS tracking 25/07 and 26/07

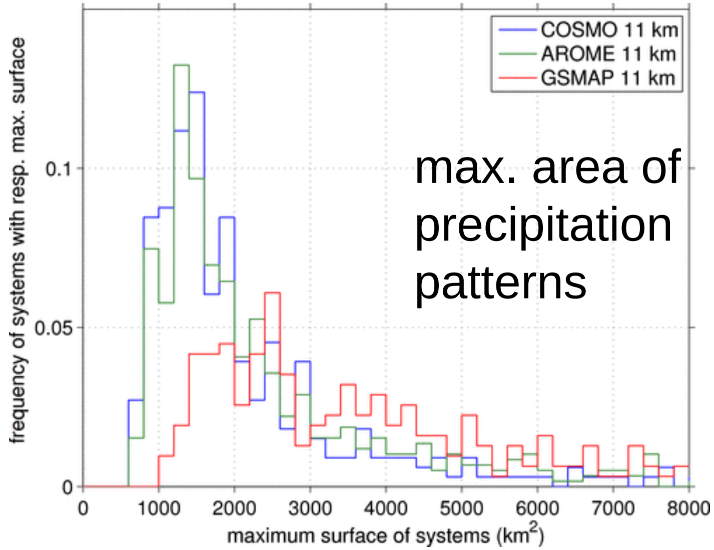


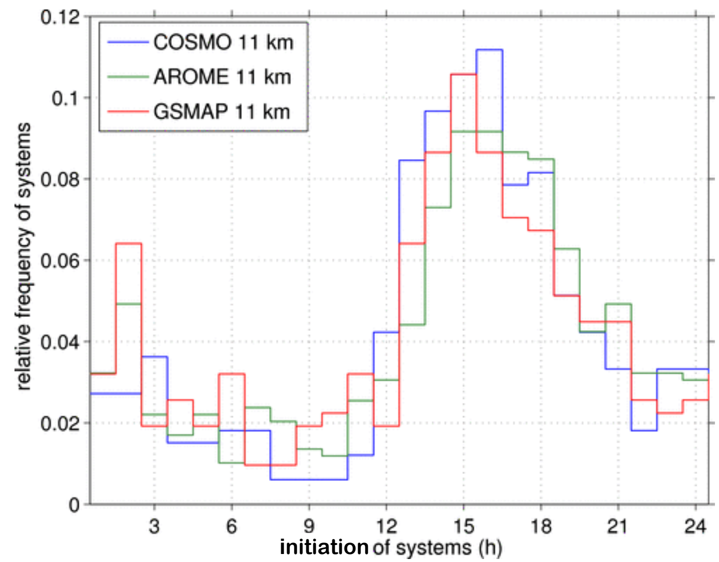


MCS tracks derived from GSMAP precipitation product

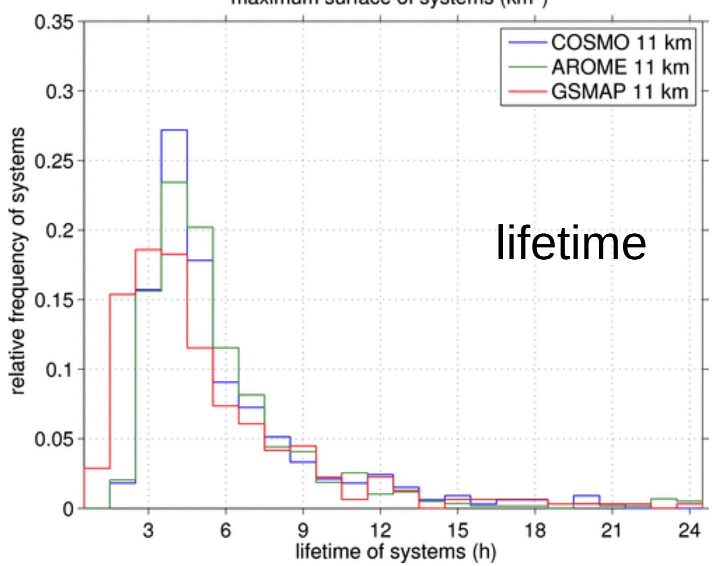
tracks derived from COSMO hourly precip-itation data interpolated to 0.1°

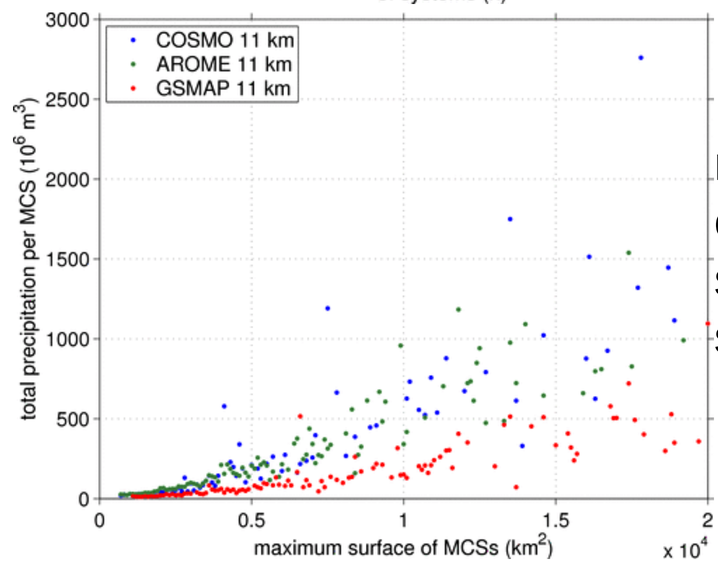
MCS tracking - statistics





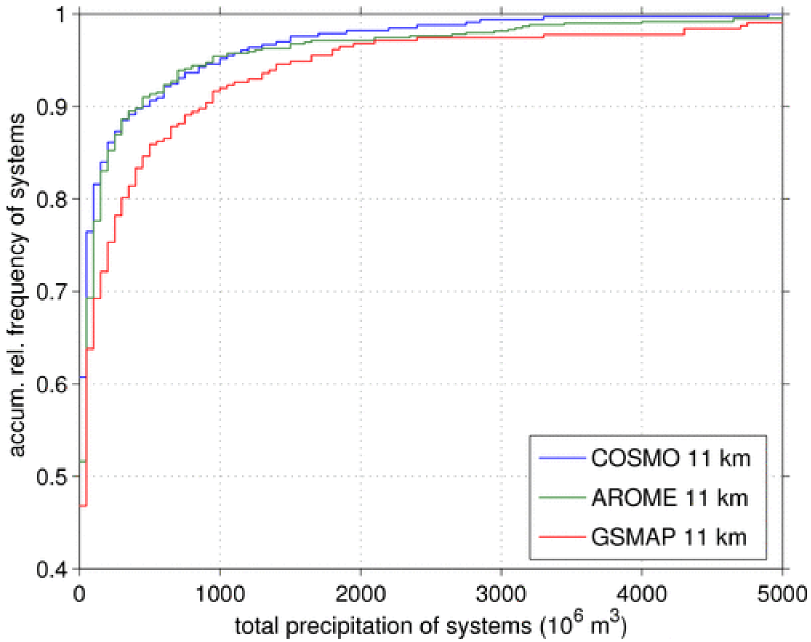
first occurrence of precipitation

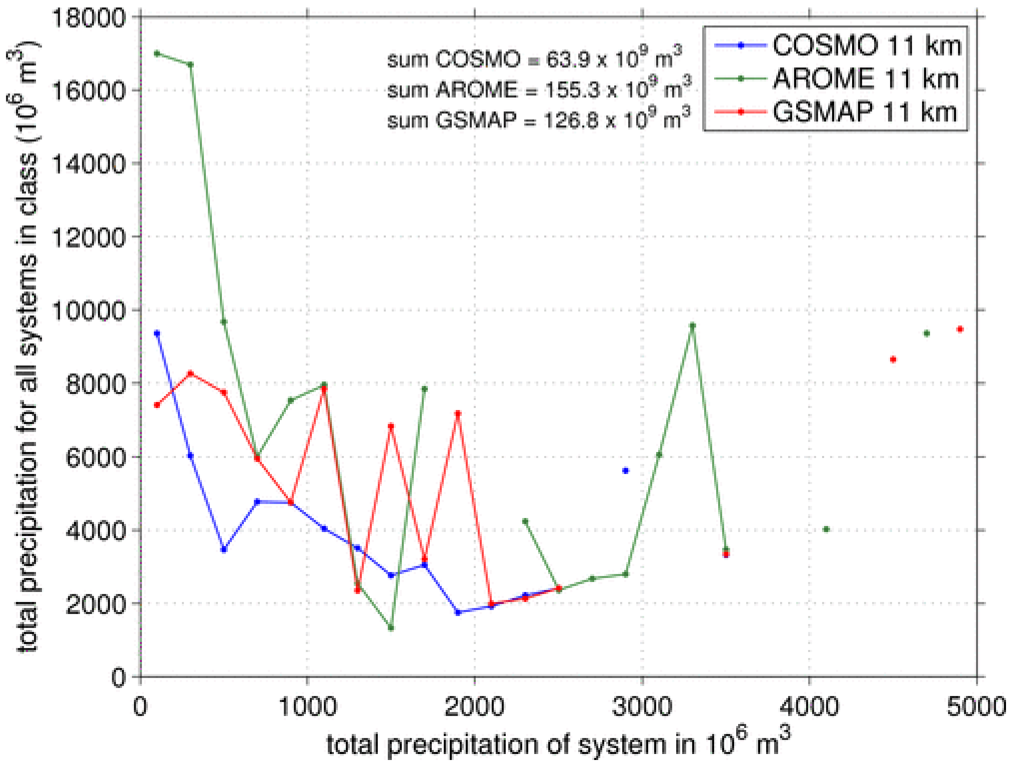




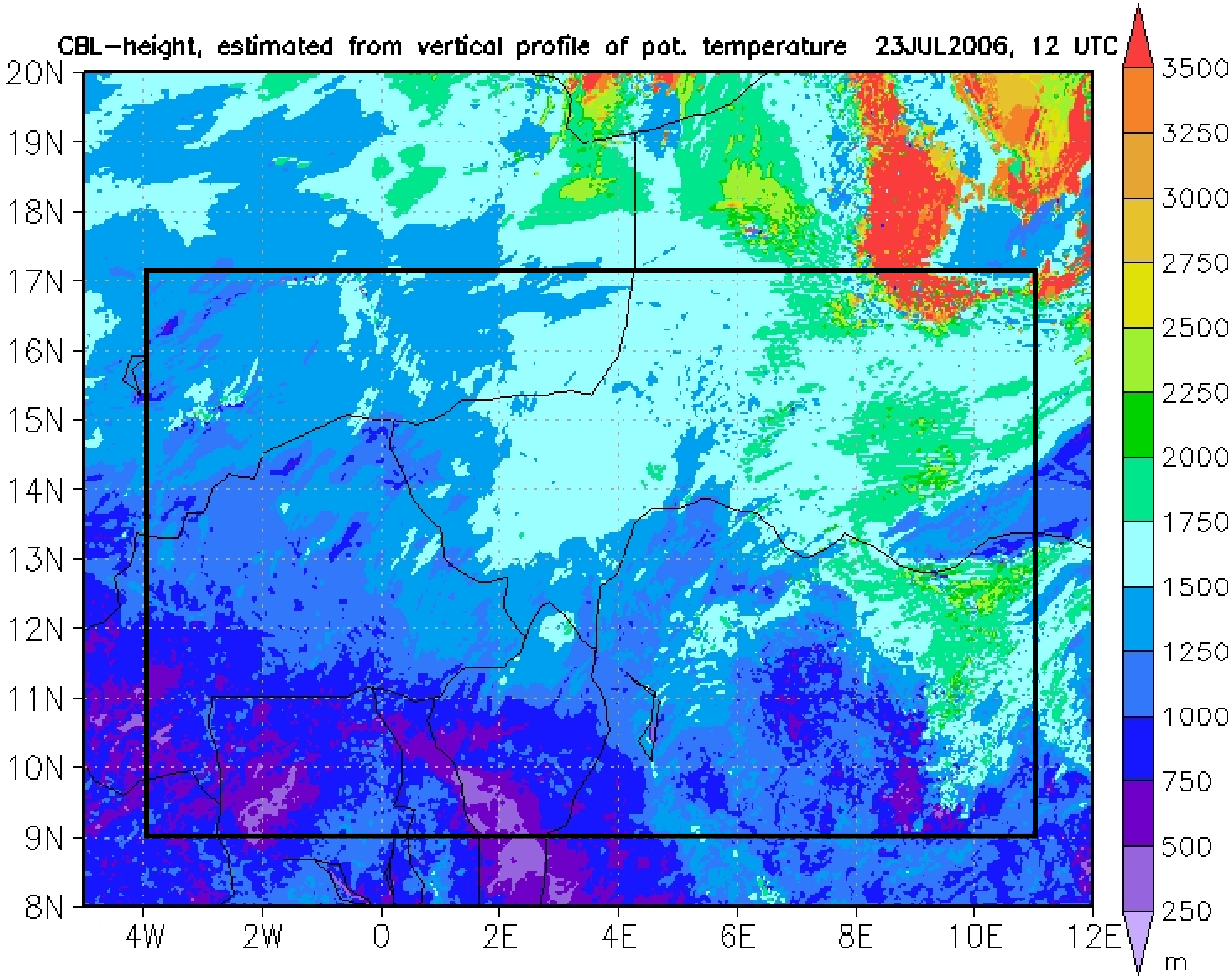
mean total precipitation of systems with same area

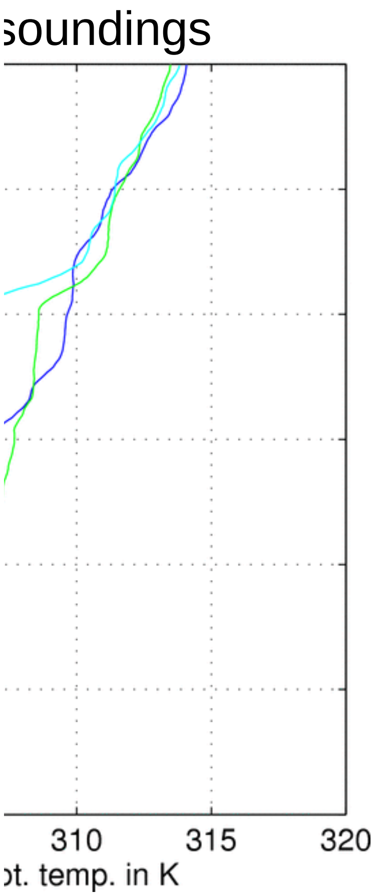
MCS tracking – statistics (2)



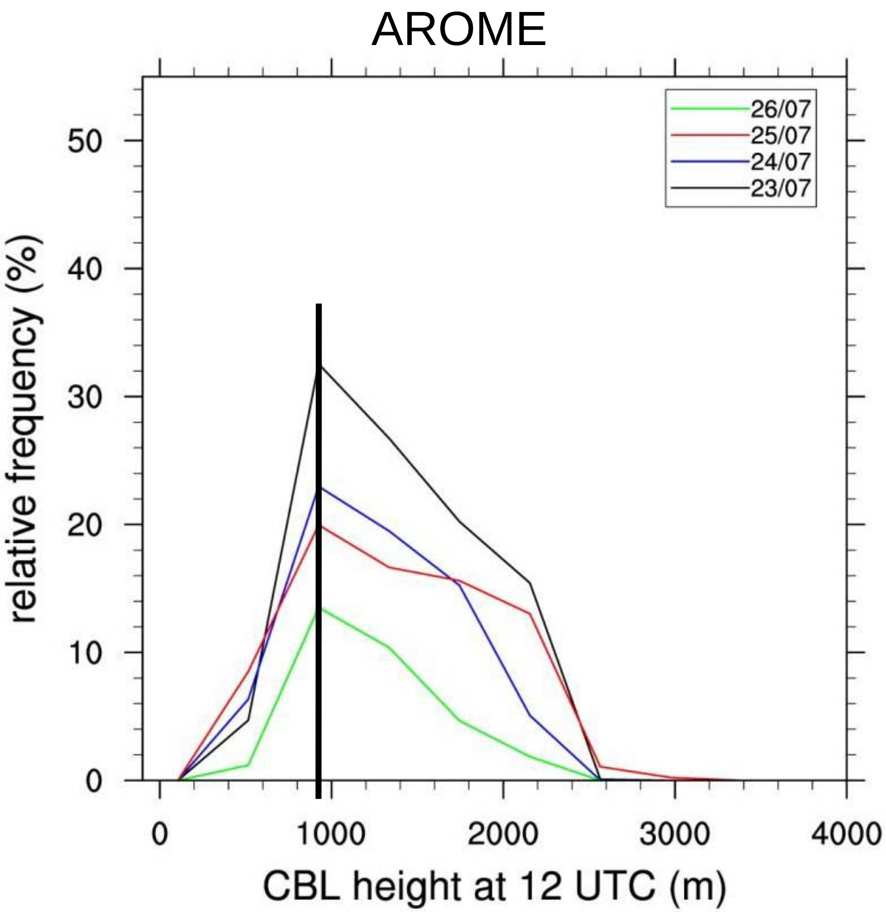


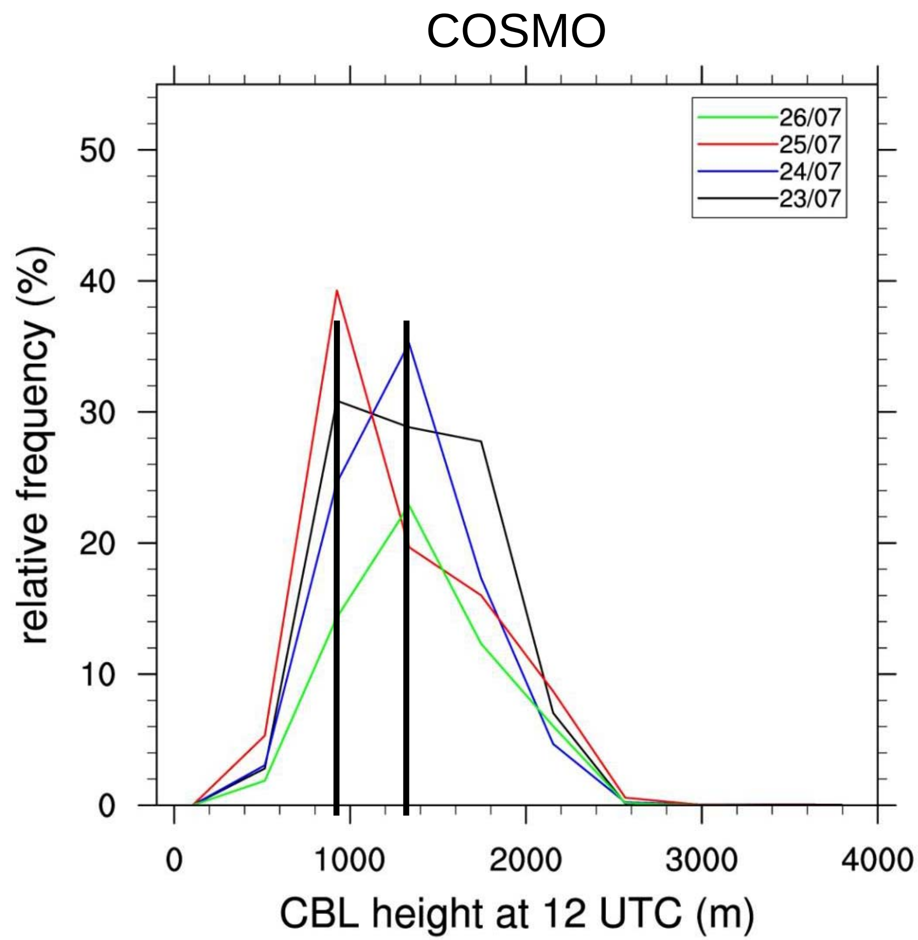
boundary layer - vertical profiles at 12 UTC



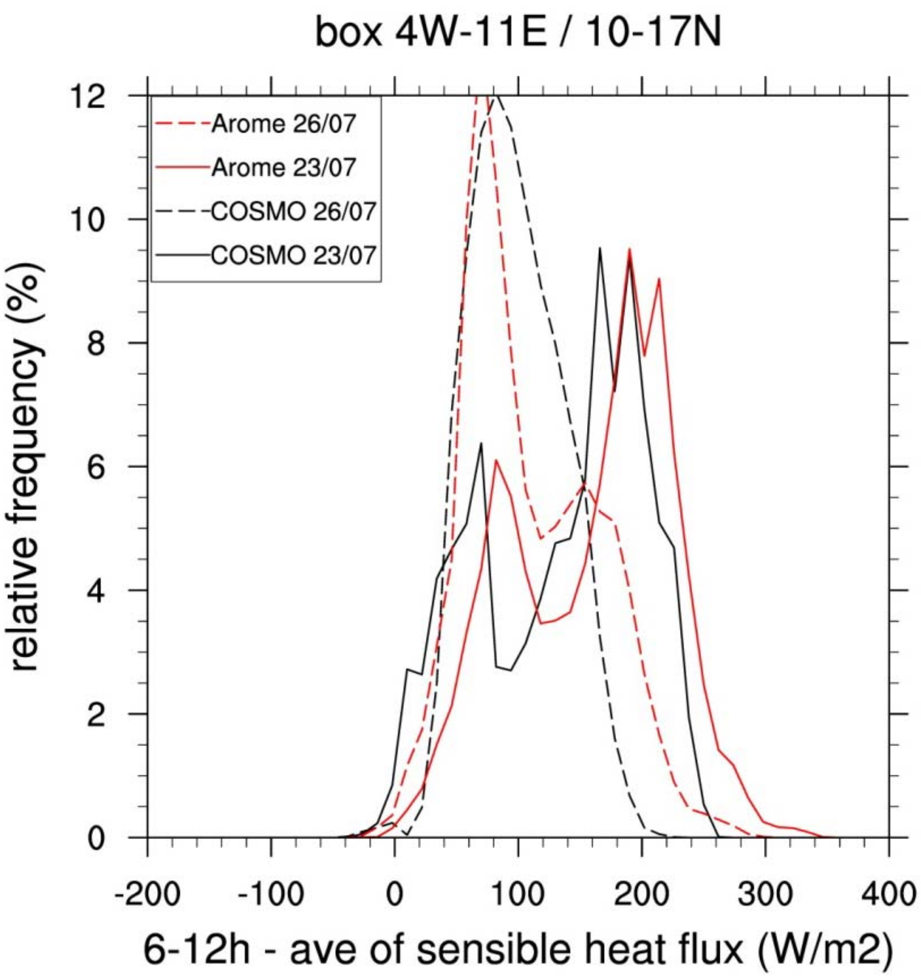


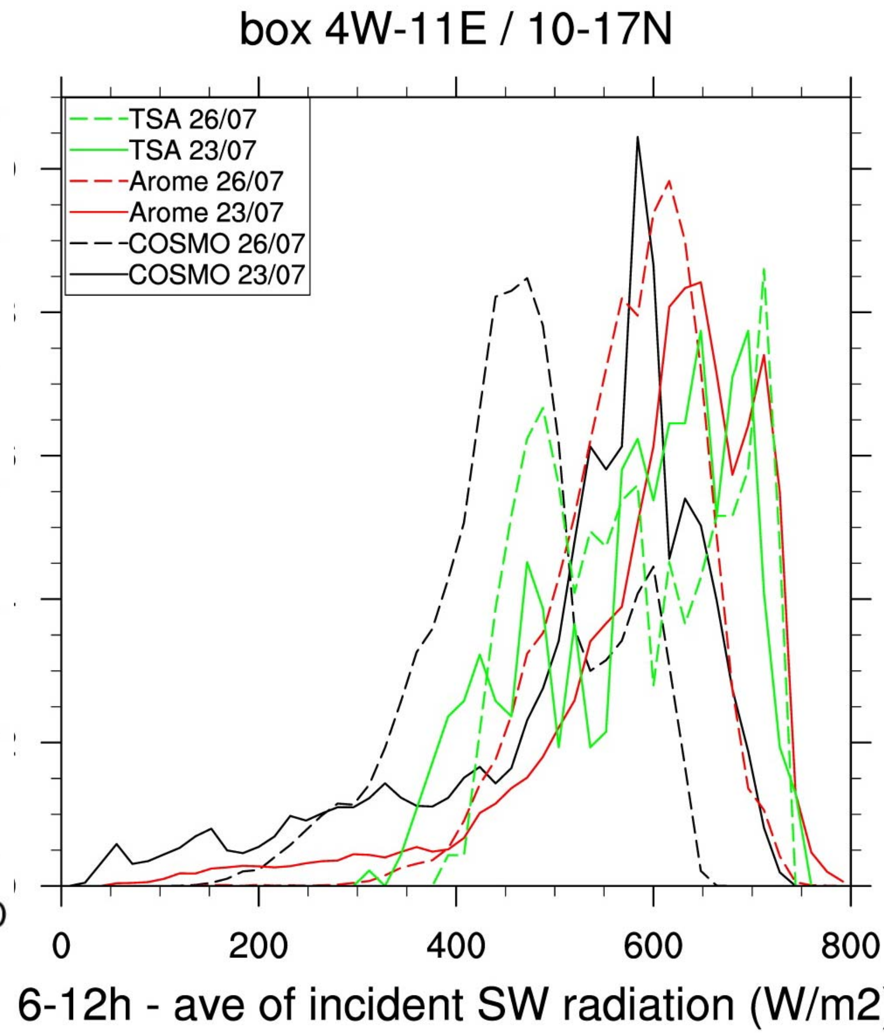
distribution of boundary-layer heights



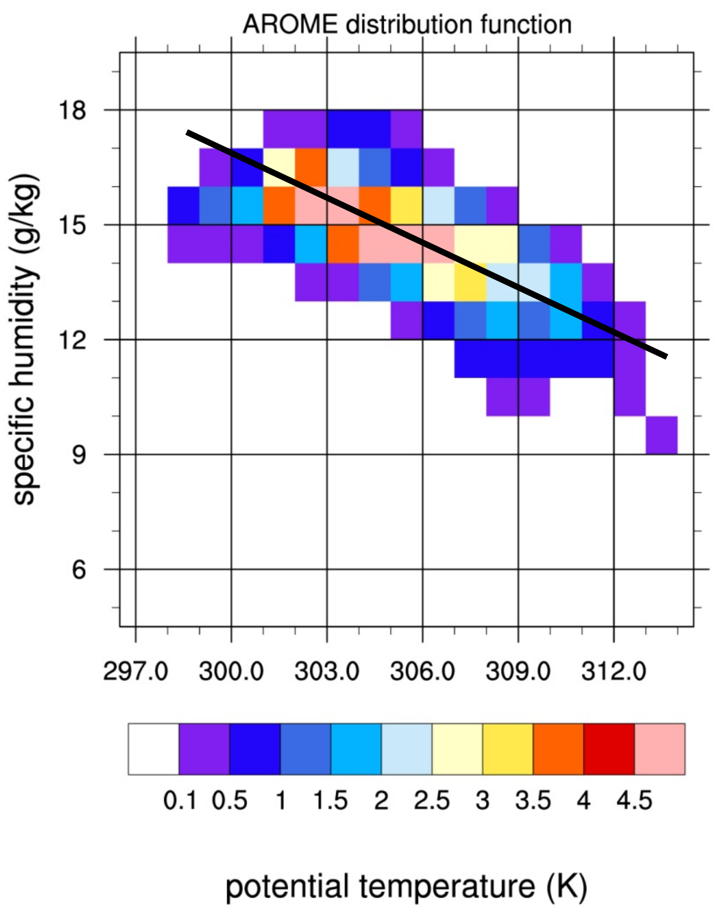


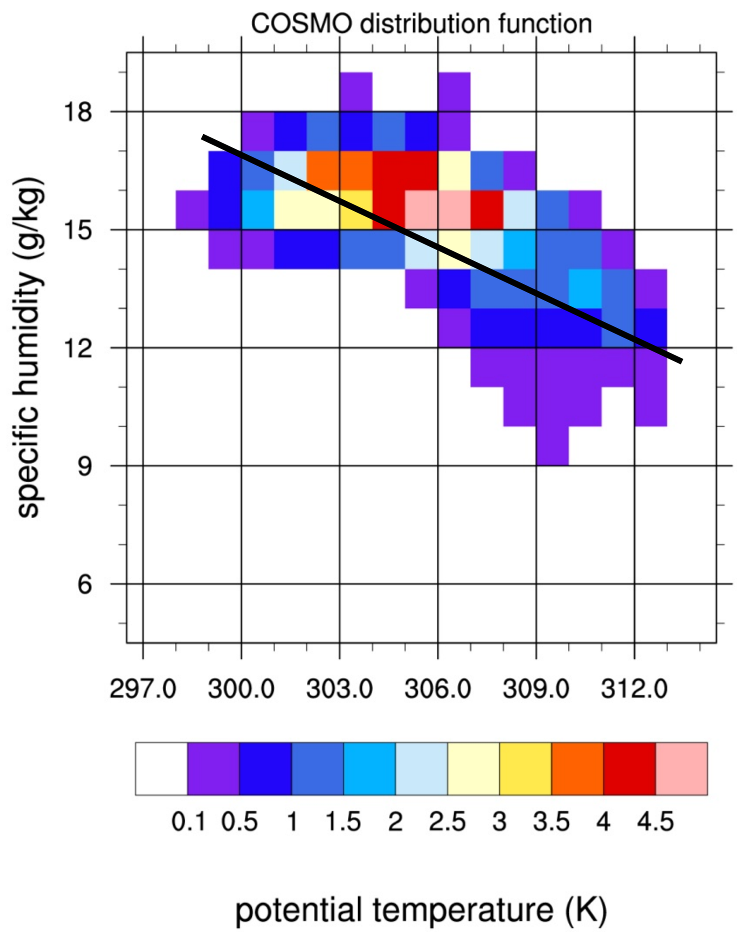
comparison of boundary-layer characterisics





surface layer – humidity and potential temperature





Conclusions

- intercomparison of two simulations with similar setup but different initial and boundary conditions
- displacement of convective activity towards the south by AROME and towards north by COSMO
- daily cycle of convective systems for both simulations in accordance with precipitation product
- maximum surface of systems underestimated, intensity overestimated wrt GsMAP (under investigation)
- overestimation of total precipitation sum by AROME and underestimation by COSMO → general behavior of each model for convective situations ?

- different boundary layer states: COSMO warmer and moister than AROME
- day-to-day variability larger in COSMO (more clouds, higher variations in turbulent fluxes)
- no clear explanation for differences in precipitation amounts

zonal wind component at eastern boundary