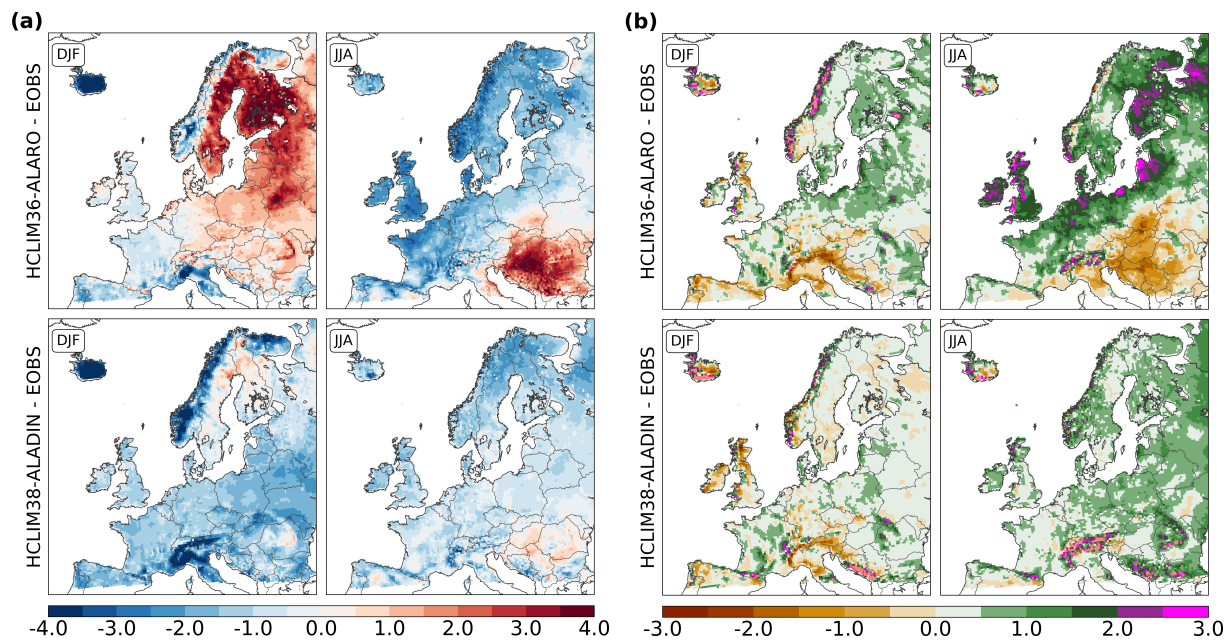# Supplementary material

Figure S1. Winter (DJF) and summer (JJA) (a) near-surface temperature and (b) precipitation anomalies, comparing HCLIM cycle 36 and 38 with E-OBS for 1999–2007. E-OBS is available only over land.
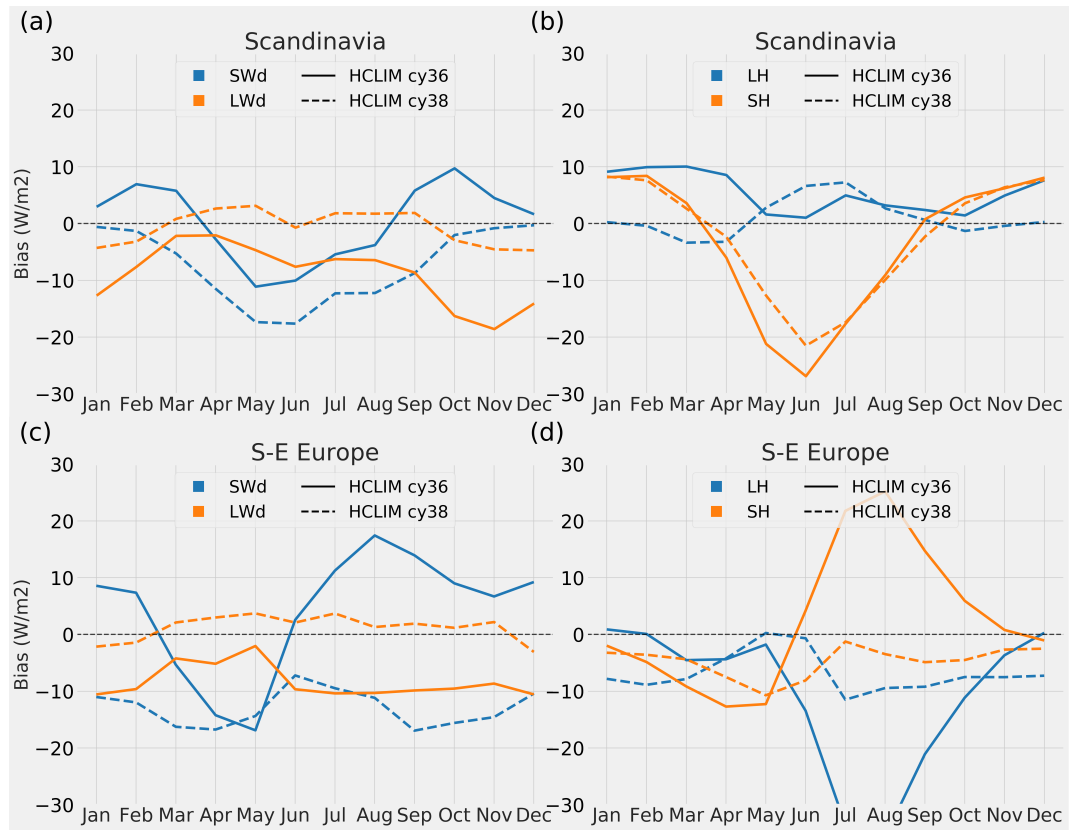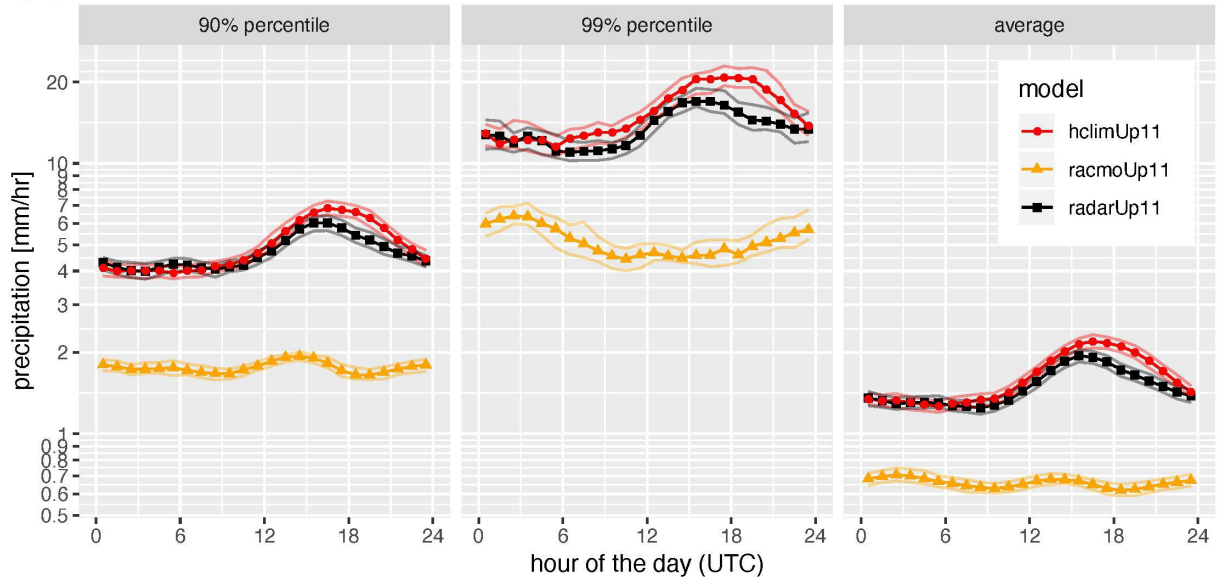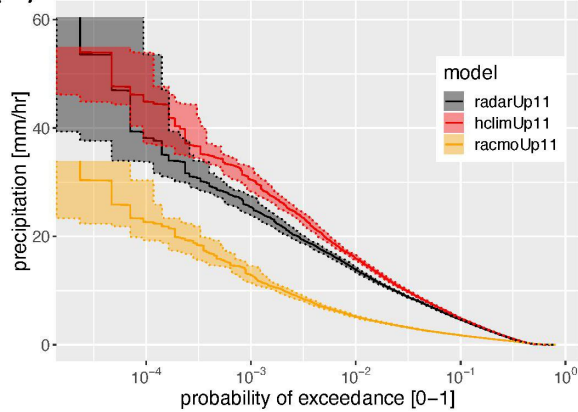
Figure S2. HCLIM36 and HCLIM38 monthly anomalies compared to ERA-Interim of (a), (c) surface short-wave (SWd) and long-wave (LWd) down-welling radiation, and (b), (d) latent (LH) and sensible (SH) heat fluxes, for 1999–2007. Shown are averages over two regions: (a), (b) Scandinavia and (c), (d) South-East Europe.
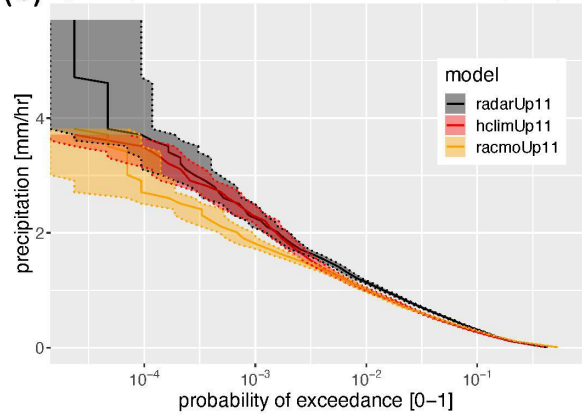
Figure S3. As in Fig. 5 (in the main text), but for upscaled precipitation statistics. Prior to analysis the input-data has been re-gridded to same resolution as the the driving RCM (12 km). The labels in the figure now carry an additional "Up11" in their name to indicate that upscaling has been done prior to analysis.
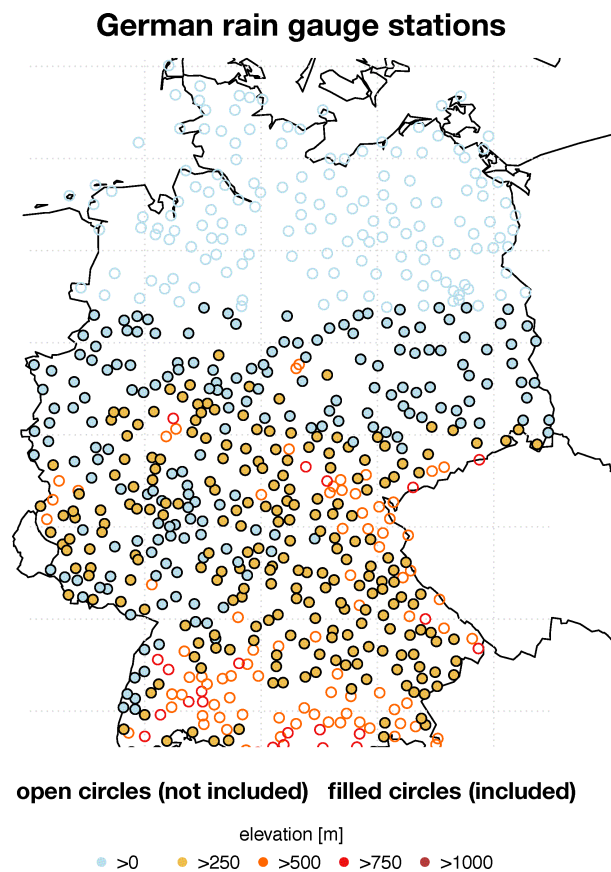
German rain gauge stations

Figure S4. Available German rain gauges (circles) and those used in the analysis (filled circles, altitudes below 500 m) with coloring indicating altitude.
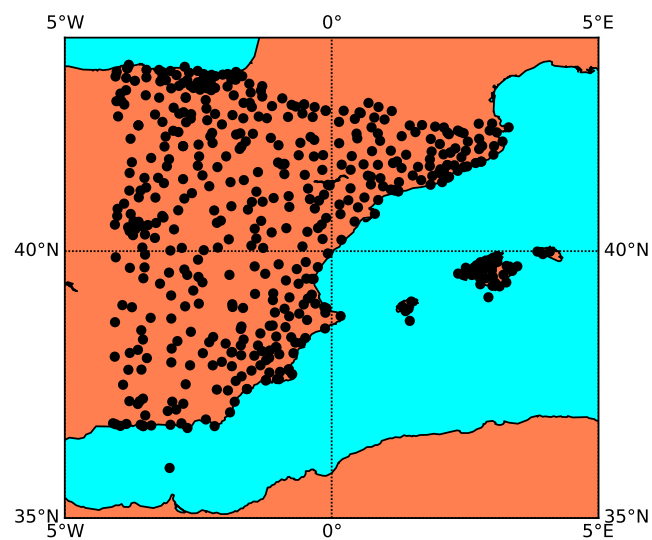
Figure S5. Observations used in the precipitation evaluation over Spain (black points).

Figure S6. (a) Annual mean of near-surface temperature (°C) from CRU observations and (b) the corresponding differences between HCLIM38-ALADIN and CRU. (c) Annual mean of daily precipitation (mm day^{-1}) from GPCC observations and (d) the corresponding differences between HCLIM38-ALADIN and GPCC. The analysed period is 1980–2010 and HCLIM38-ALADIN grid spacing is 50 km.

Table S1. The summary of HCLIM38 experiments in this study.
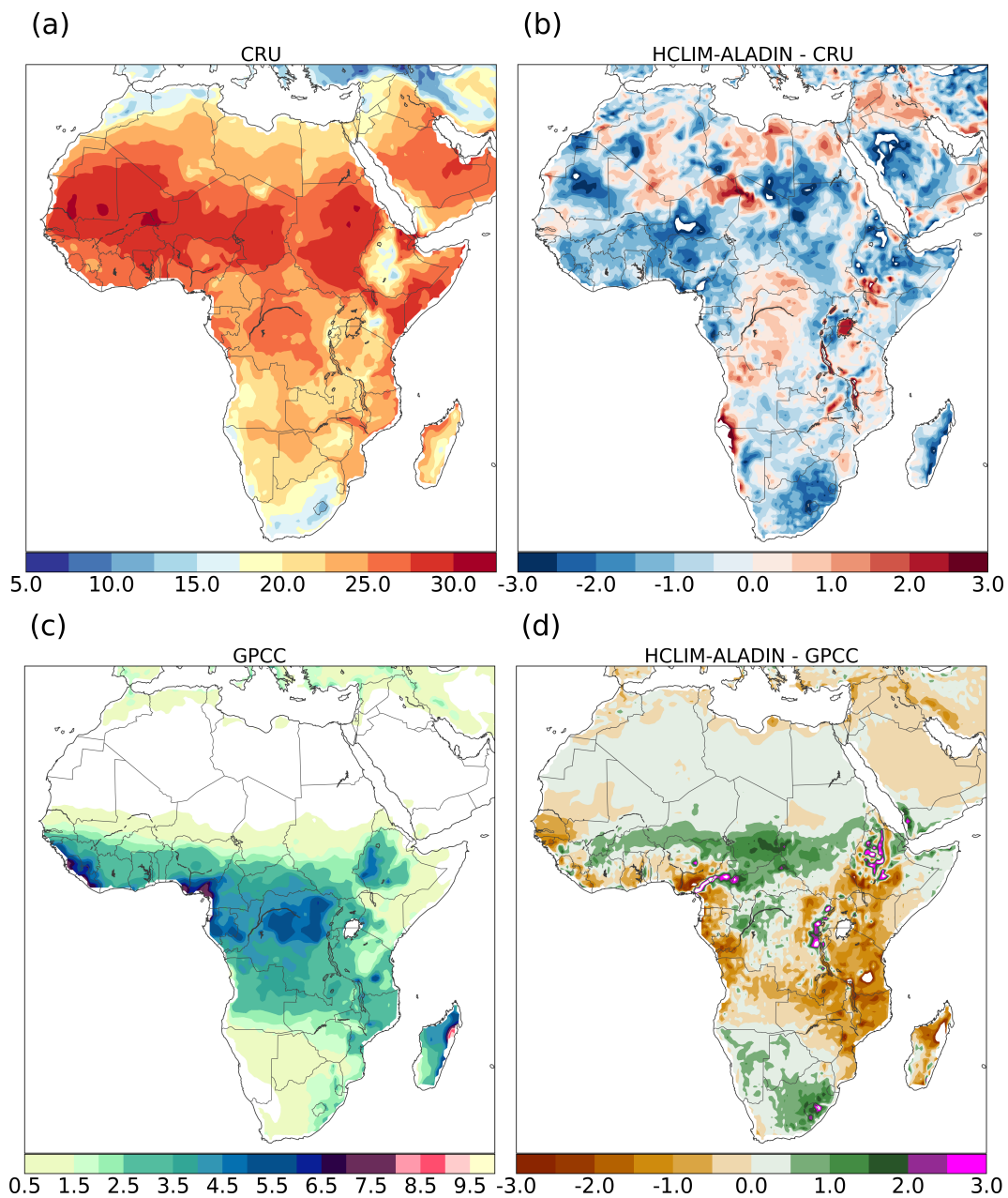
Experiment	Period	Simulation domain[1]	Resolution in km (time step in s)	Model[2]	Lateral boundary data[3] (update interval in h)
Pan-Europe	1999-2008	Reduced Eur N (REU12_N)	12 (300)	HCLIM38-ALADIN	ERA-Interim (6)
Norway	2004-2016	NORWAY2.5	2.5 (60)	HCLIM38-AROME	HCLIM38-ALARO (6)
The Netherlands and Germany	2000-2009	Large pan-Alpine (PALP2.5)	2.5 (60)	HCLIM38-AROME	RACMO2 (1)
		Reduced Eur S (REU12_S)	12 (300)	HCLIM38-ALADIN	ERA-Interim (6)
		Pan-Alpine (PALP3)	3 (75)	HCLIM38-AROME	HCLIM38-ALADIN (3)
Iberian Peninsula	2005-2014	REU12_S	12 (300)	HCLIM38-ALADIN	ERA-Interim (6)
	1990-1999	IBERIA2.5	2.5 (60)	HCLIM38-AROME	ERA-Interim (6)
			24 (600)	HCLIM38-ALARO	ERA-Interim (6)
Arctic region	Summer of 2014	ARCTIC24/12	24 (600)	HCLIM38-ALADIN	ERA-Interim (6)
			12 (300)	HCLIM38-ALADIN	ERA-Interim (6)
Africa	2000-2009	AFRICA50	50 (1200)	HCLIM38-ALADIN	ERA-Interim (6)
The Lake Victoria Basin	2005-2006	EAFR25/12.5	25 (600)	HCLIM38-ALADIN	ERA-Interim (6)
			12.5 (360)	HCLIM38-ALADIN	ERA-Interim (6)
		LVIC2.5	2.5 (60)	HCLIM38-AROME	HCLIM38-ALADIN (3)

[1] Domains (with the names in capital letters) are described in the attached file Harmonie_domains.pm

[2] Core hours per simulated month per grid point multiplied with the time step are about 0.75 (1.1) for ALADIN (AROME)

[3] The regional models providing lateral boundary data have used ERA-Interim at their lateral boundaries