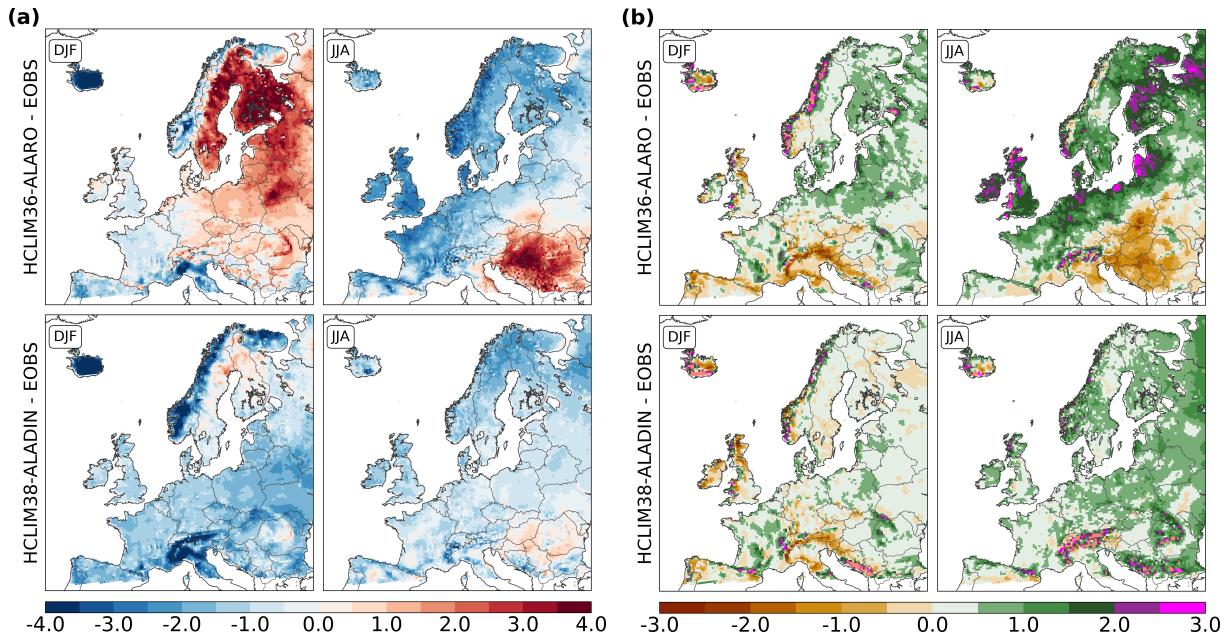
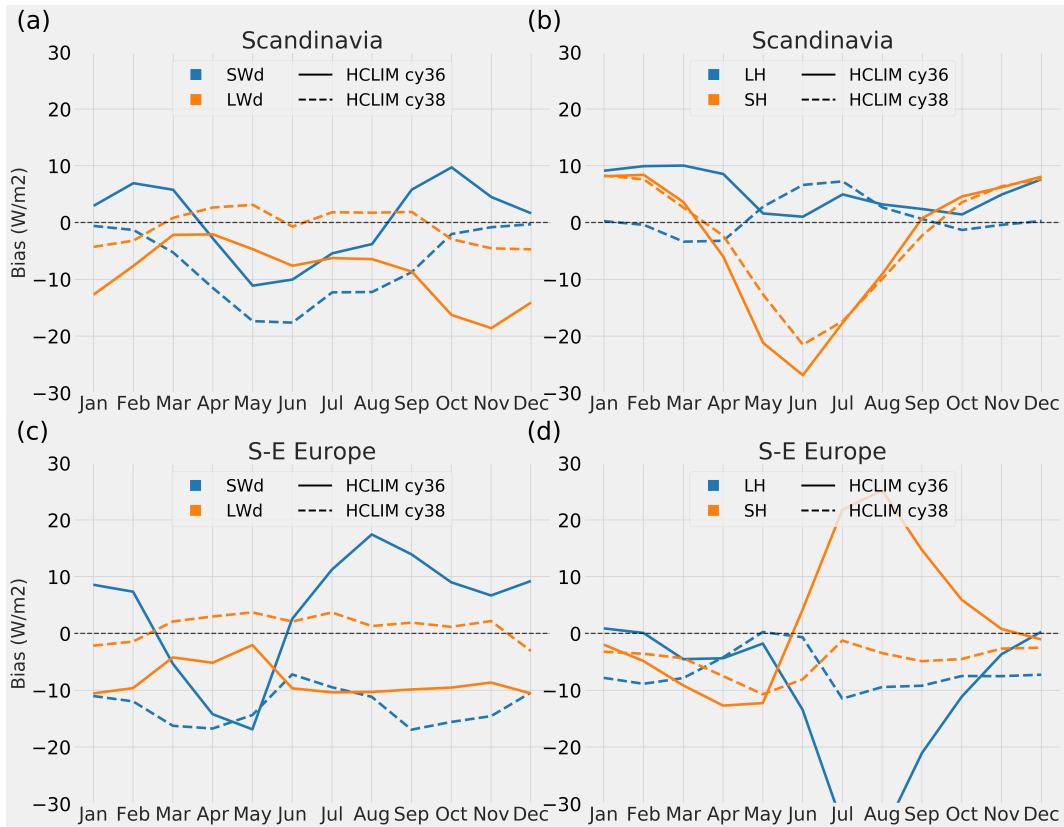


# Supplementary material

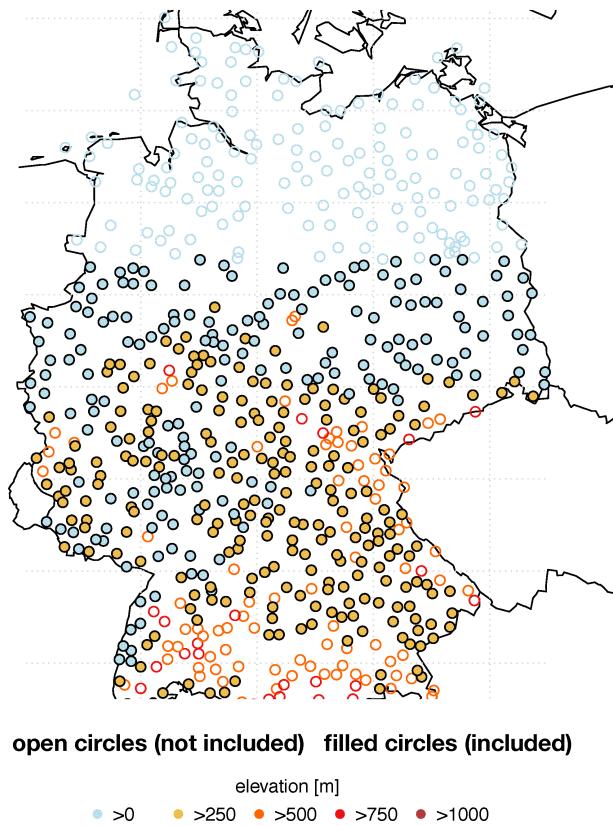


**Figure S1.** Winter (DJF) and summer (JJA) (a) near-surface temperature and (b) precipitation anomalies, comparing HCLIM cycle 36 and 38 with EOBS for 1999–2007. EOBS is available only over land.

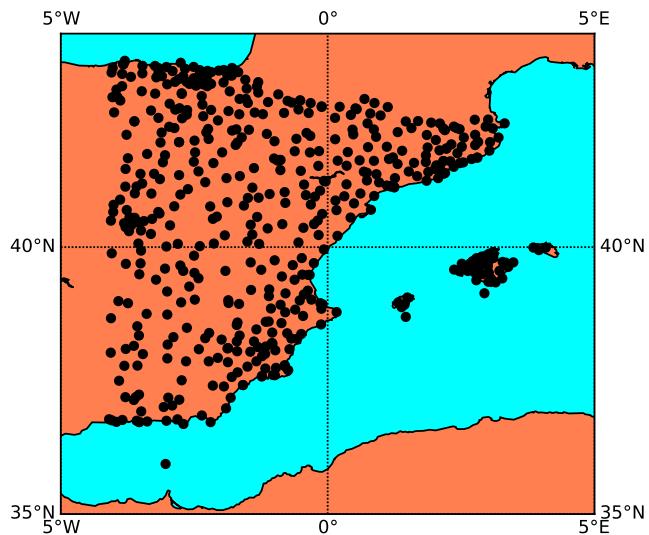


**Figure S2.** HCLIM36 and HCLIM38 monthly anomalies compared to ERA-Interim of (a), (c) surface short-wave (SWd) and long-wave (LWd) down-welling radiation, and (b), (d) latent (LH) and sensible (SH) heat fluxes, for 1999–2007. Shown are averages over two regions: (a), (b) Scandinavia and (c), (d) South-East Europe.

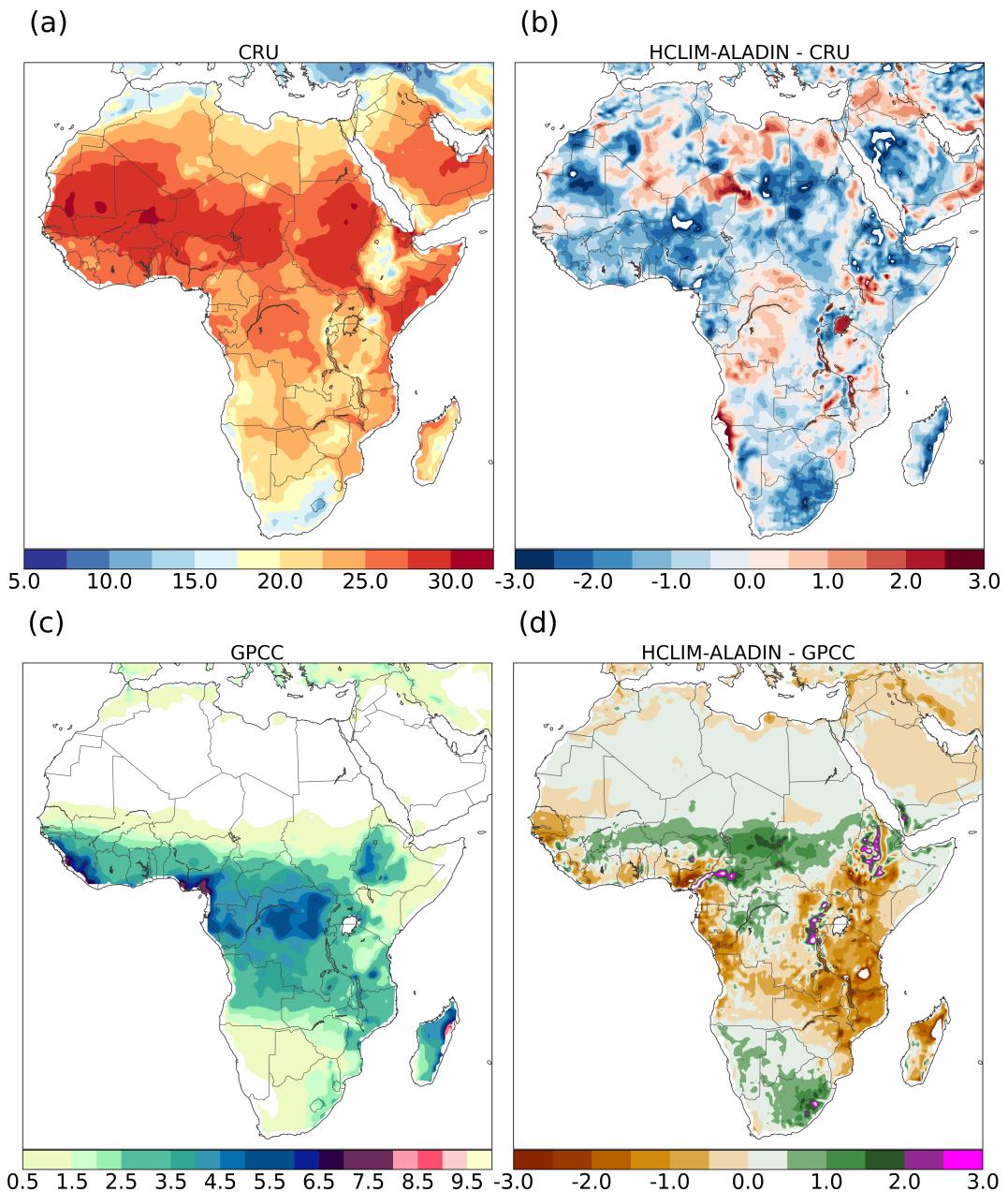
### German rain gauge stations



**Figure S3.** Available German rain gauges (circles) and those used in the analysis (filled circles, altitudes below 500 m) with coloring indicating altitude.



**Figure S4.** Observations used in the precipitation evaluation over Spain (black points).



**Figure S5.** (a) Annual mean of near-surface temperature ( $^{\circ}\text{C}$ ) from CRU observations and (b) the corresponding differences between HCLIM38-ALADIN and CRU. (c) Annual mean of daily precipitation ( $\text{mm day}^{-1}$ ) 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 experiments.

Experiment	Period	Simulation domain	Horizontal resolution	Model	Forcing mode/I/data
Pan-Europe	1999-2008	Similar to EURO-CORDEX	12 km	HCLIM38-ALADIN	ERA-Interim
Norway	2004-2016	Norway, parts of Sweden, Finland and Russia	2.5 km	HCLIM38-AROME	HCLIM38-ALADIN, 24 km resolution
		EURO-CORDEX	0.11°	RACMO2	ERA-Interim
The Netherlands and Germany	2000-2009	Pan-Alpine region extending to north-west	2.5 km	HCLIM38-AROME (KNMI)	RACMO2
		Extended Pan-Alpine region	12 km	HCLIM38-ALADIN	ERA-Interim
Iberian Peninsula	1990-1999	Iberian Peninsula	3 km	HCLIM38-AROME (SMHI)	HCLIM38-ALADIN
sula	2005-2014	Europe	2.5 km	HCLIM38-AROME	ERA-Interim
Arctic region	Summer of 2014	North of 60°N	12 km	HCLIM38-ALADIN	ERA-Interim
Africa	2000-2009	CORDEX-Africa	24 km	HCLIM38-ALADIN	ERA-Interim
The Lake Victoria Basin	2005-2006	Eastern Africa	24 km	HCLIM38-ALADIN	ERA-Interim
		The Lake Victoria Basin	12 km	HCLIM38-ALADIN	ERA-Interim
Note	The forcing models were run with the ERA-Interim data.				
					HCLIM38-ALADIN