COSMO-TERRA vs. COSMO-CLM in the hot European summer of 2015

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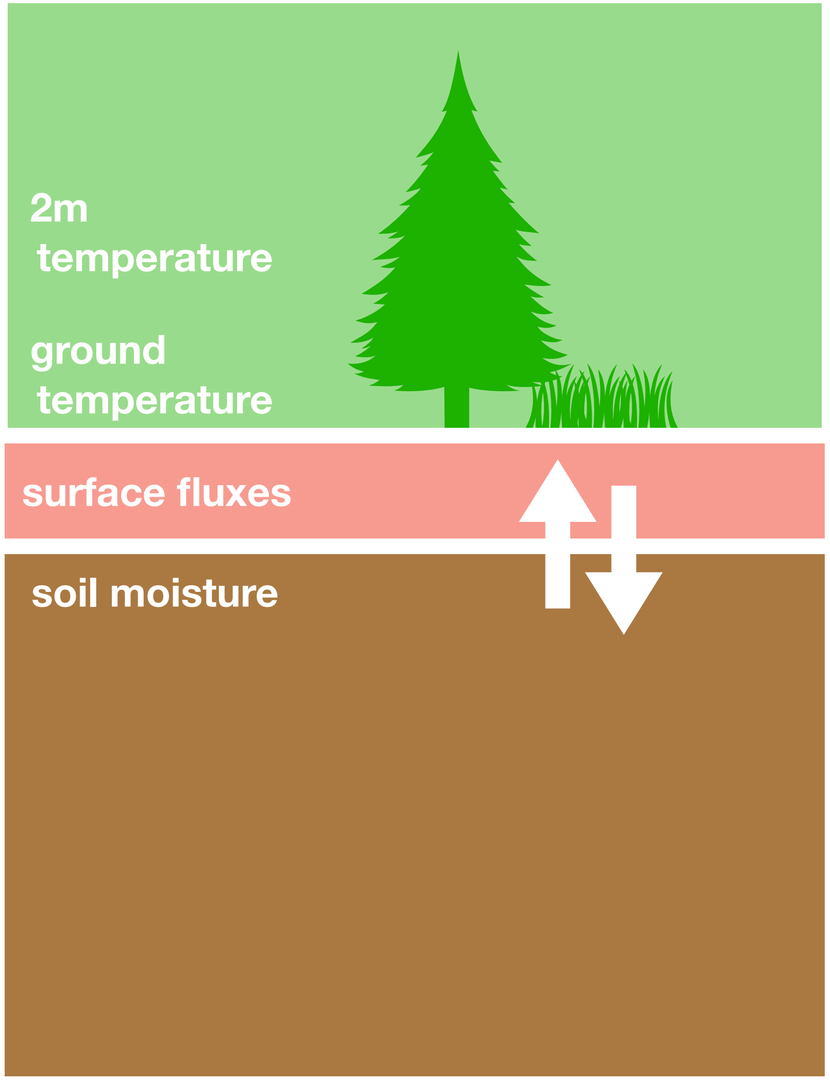
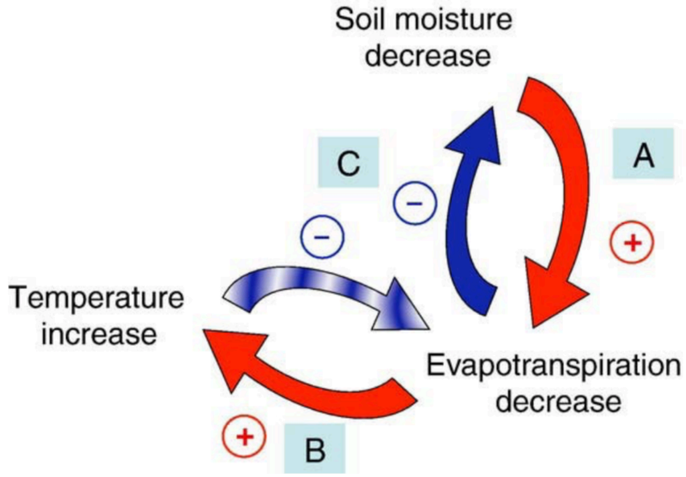
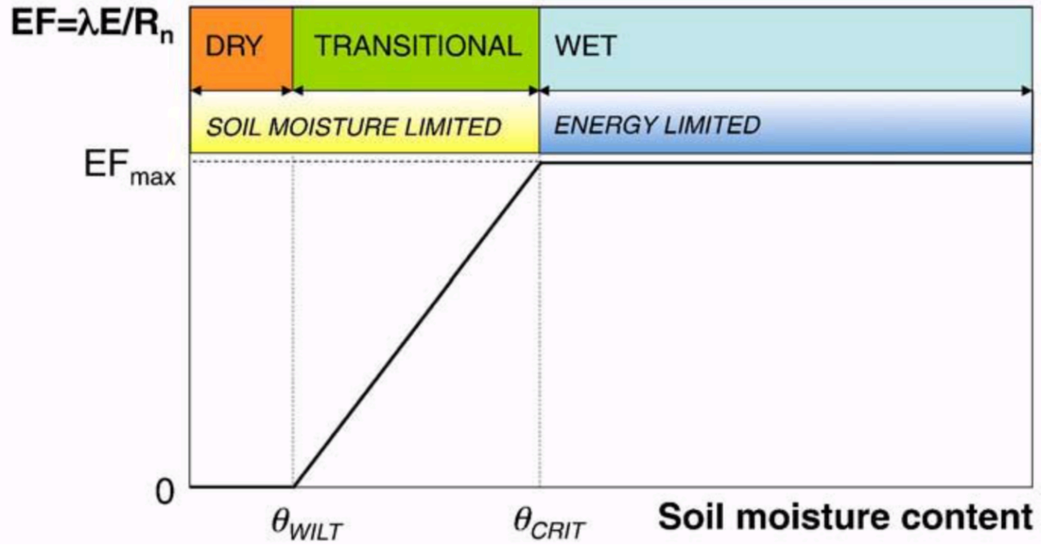
ICCARUS 2019

Mean temperature anomaly in Switzerland, 1864-2017
Ed Hawkins, Climate Lab Book

Soil moisture control on heat extremes

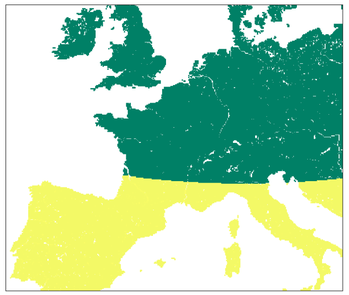






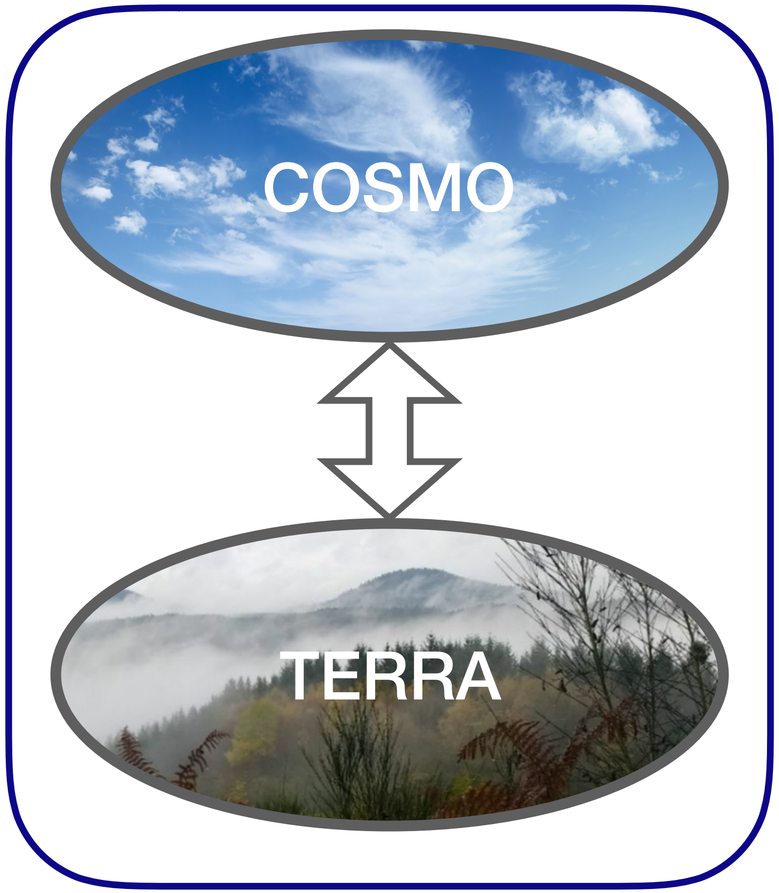
Seneviratne et al 2010

Framework

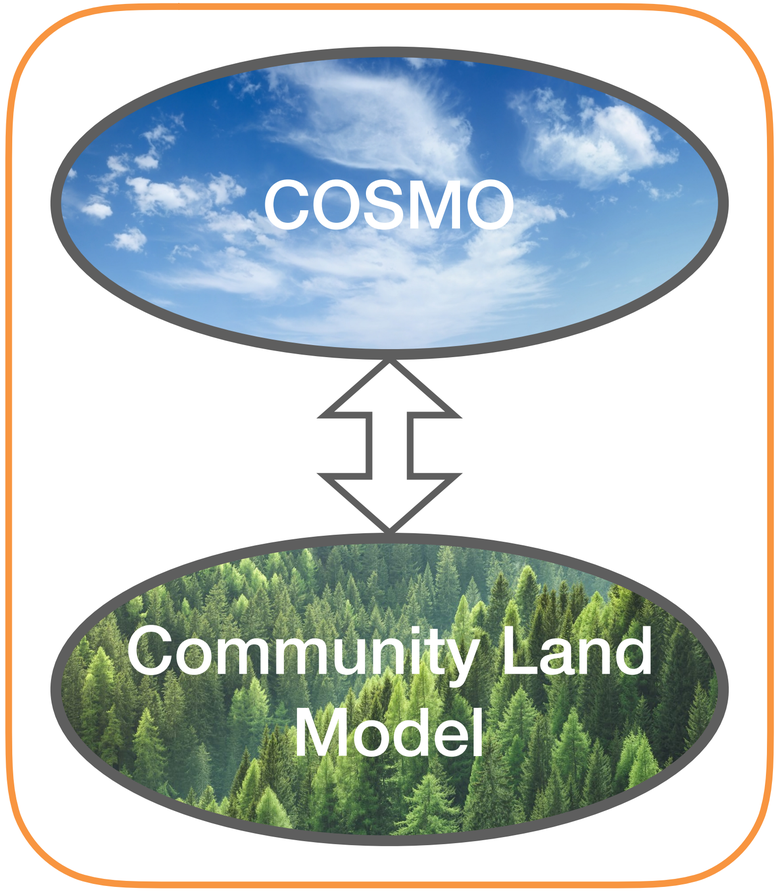


6.6km
European domain
hourly resolution
2015

COSMO-TERRA



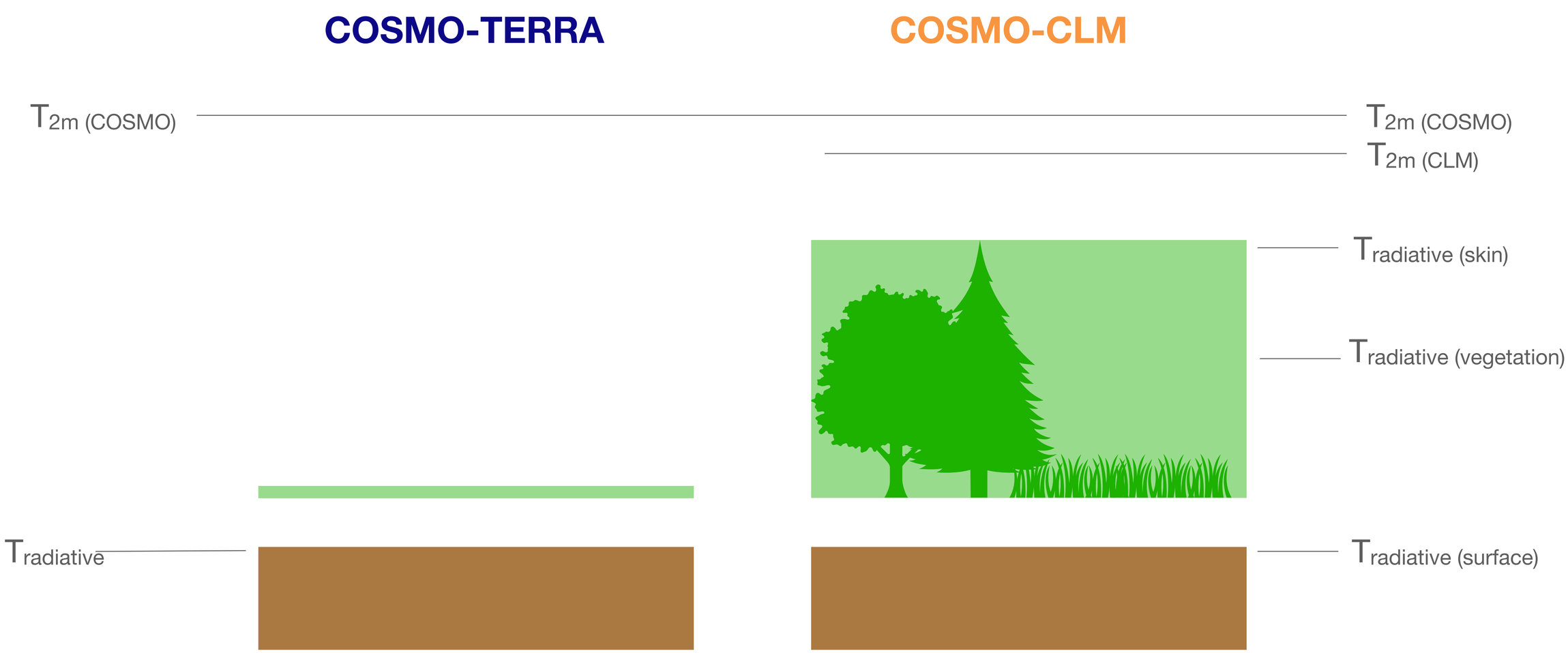
COSMO-CLM



ETH zürich

adapted from Edouard Davin

The main model differences



adapted from Vogel et al 2015

model family

	COSMO-TERRA					COSMO-CLM			
	terrav500	**terrabsc**	**terrabs2**	**terrabs4**	**terra_SKC**	**clmv40 oldaer**	**clmv40**	**clmv45**	**clmv45bhs**
LSM	TERRA	TERRA	TERRA	TERRA		CLM	CLM	CLM	CLM
COSMO version	v5.0	v5.05	v5.05	v5.05		v5.0	v5.0	v5.0	v5.0
CLM version						v4.0	v4.0	v4.5	v4.5
itype_aerosol	1	1	2	2		1	2	2	2
itype_evsl	2	2	2	4					
config	BASIC	BASIC	ADV	ADV					

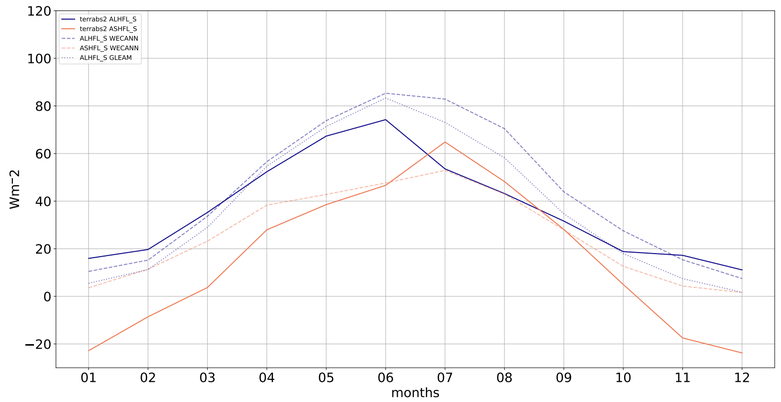
itype_aerosol = 1: Tanre
itype_aerosol = 2: Tegen

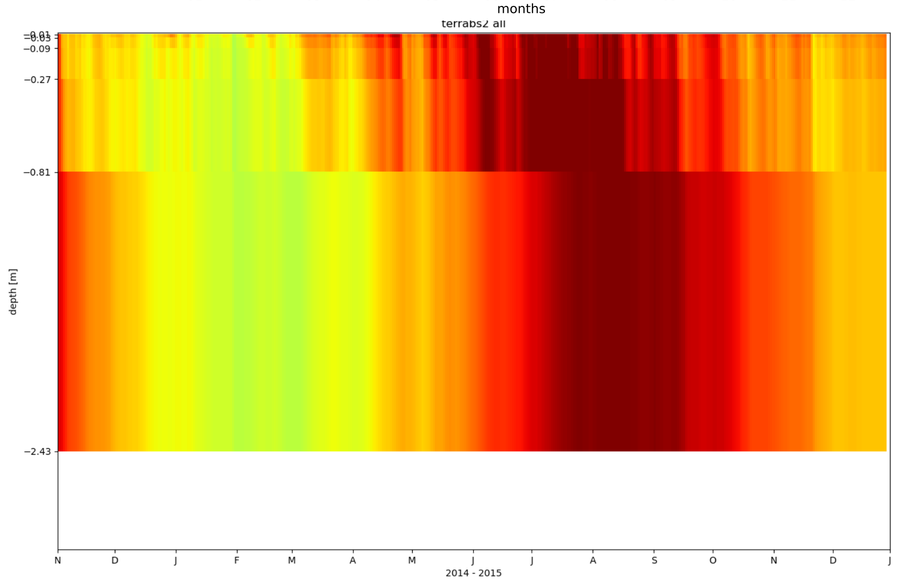
soil moisture and surface fluxes

surface fluxes

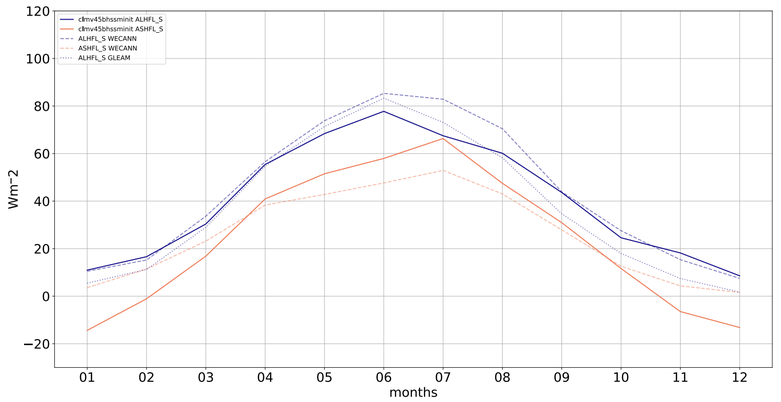
soil moisture

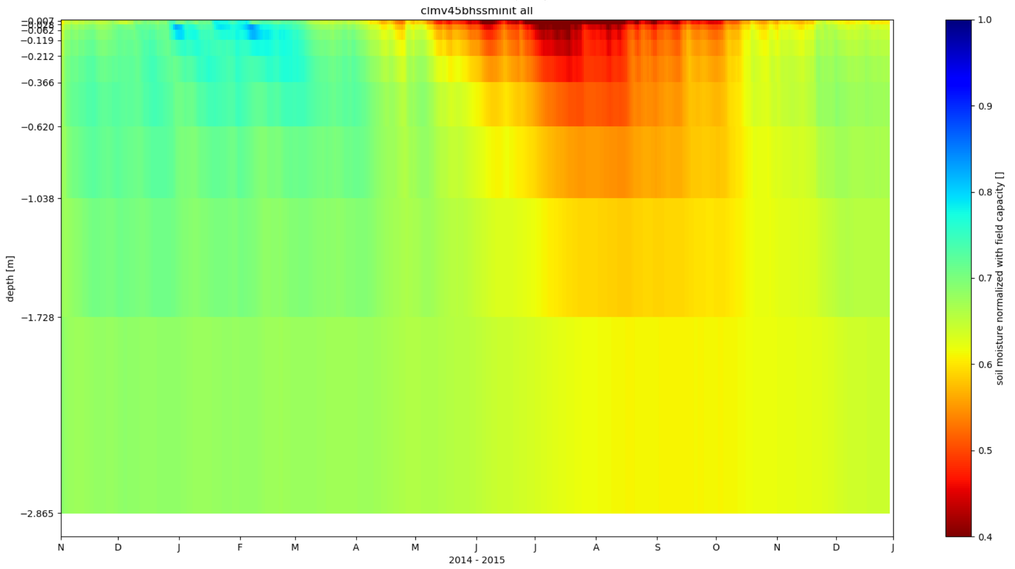
COSMO-TERRA bs2





COSMO-CLM v45bhs

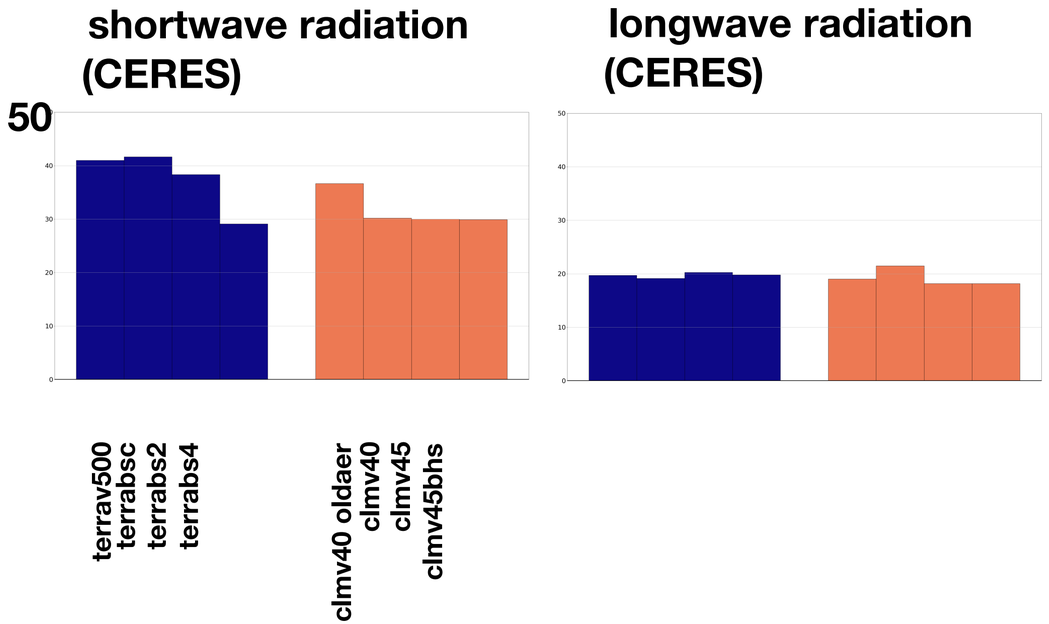




RMSE on surface fluxes

surface fluxes

soil moisture



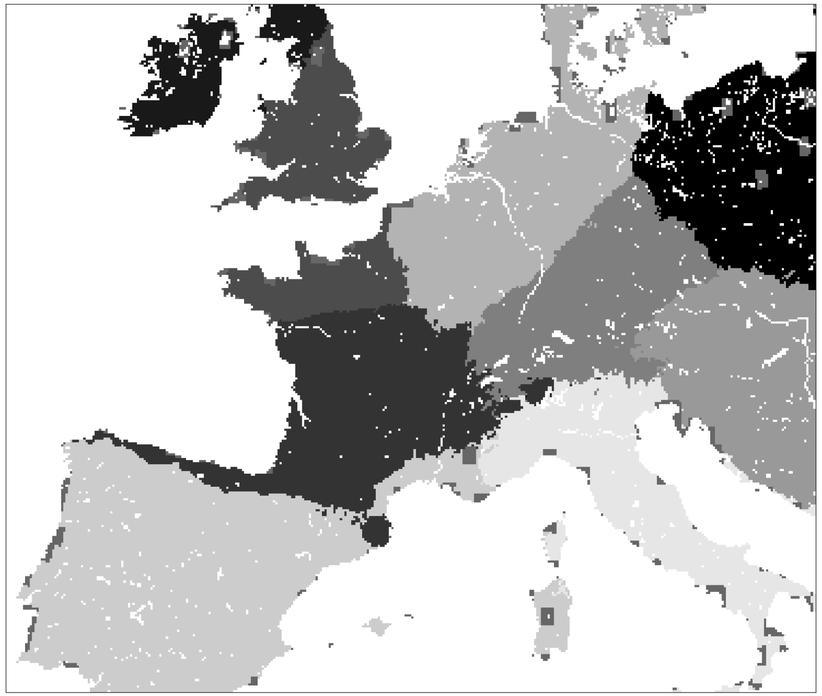
Benchmark experiment

(1) separate the domain in subdomains of similar points with kmeans algorithm

(2) train a ridge regression on each subdomain (year 2006)

$$f(SW_{COSMO}, PRECIP_{COSMO}) = w_1 SW_{COSMO} + w_2 PRECIP_{COSMO} + w_0 = LH_{GLEAM}$$

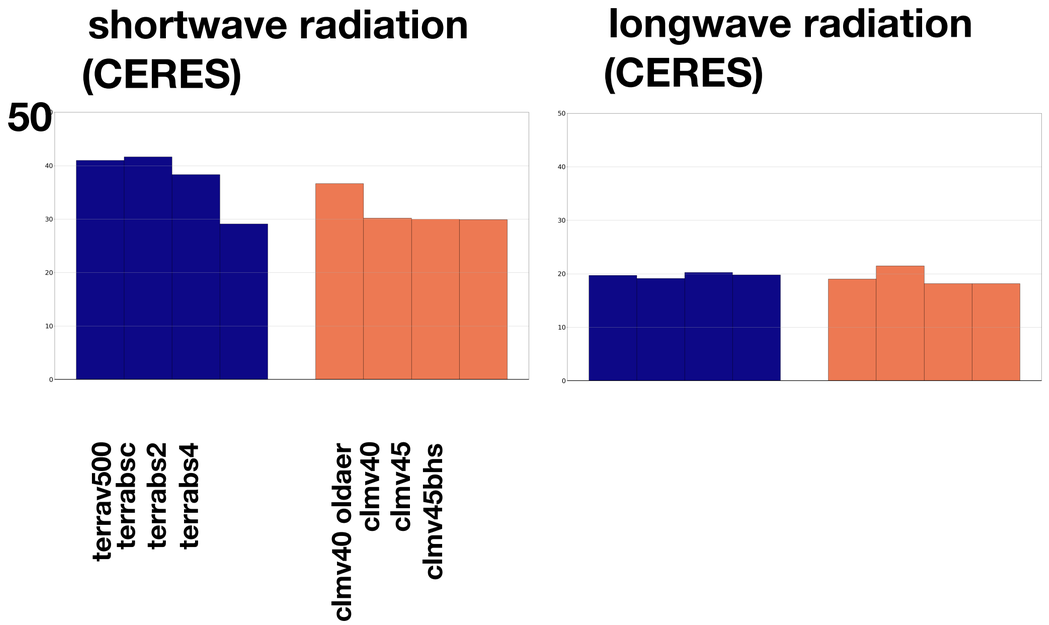
(3) estimate latent heat from regression for test data (year 2015)

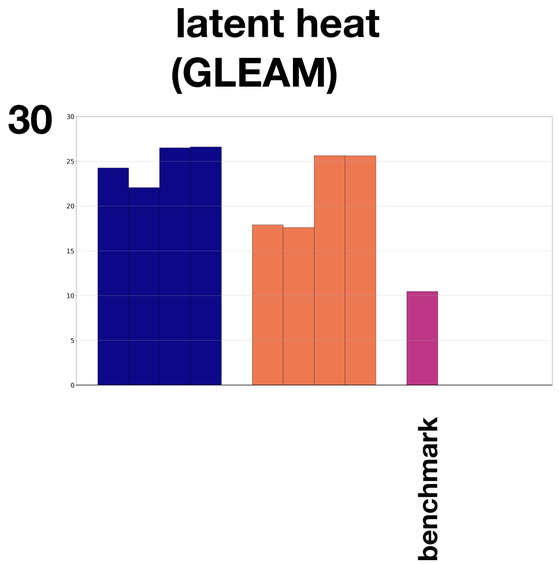


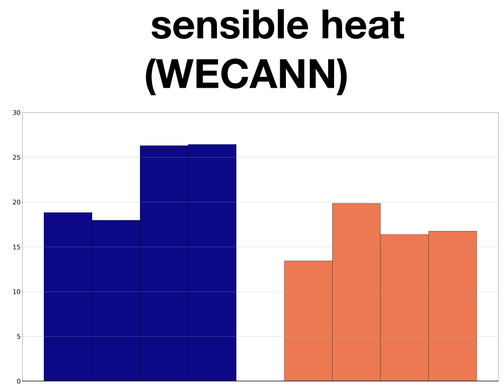
RMSE on surface fluxes

surface fluxes

soil moisture







temperature

tmean

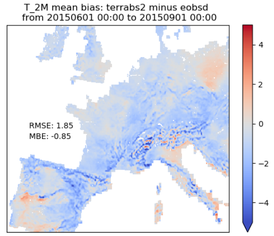
2m temperature

ground temperature

soil moisture

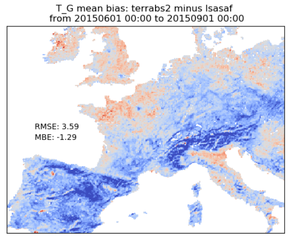
COSMO-TERRA

T_2M

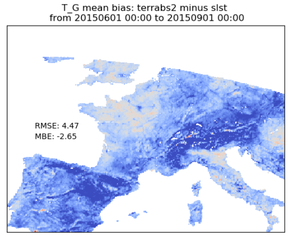


LSA SAF

T_G

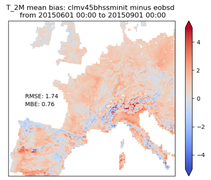


SLST

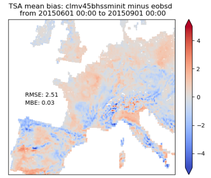


COSMO-CLM

T_2M

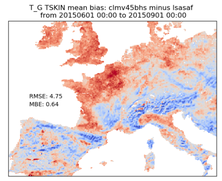


TSA

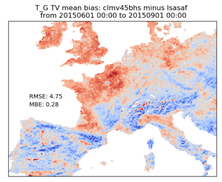


LSA SAF

T_SKIN



TV



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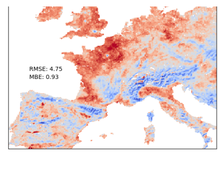

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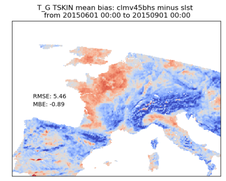
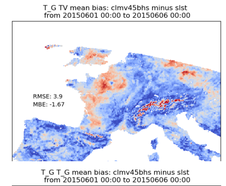
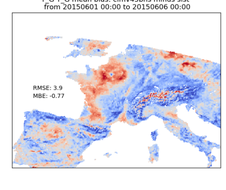






MBE on temperature

2m temperature

ground temperature

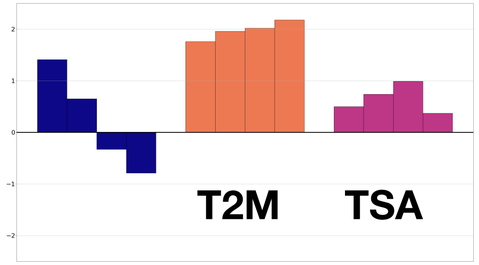
soil moisture

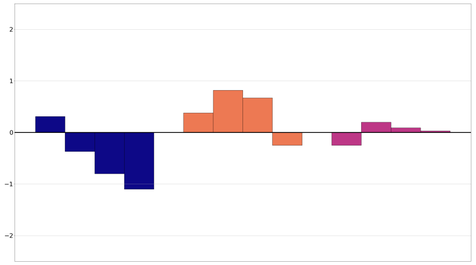
t2m daily min

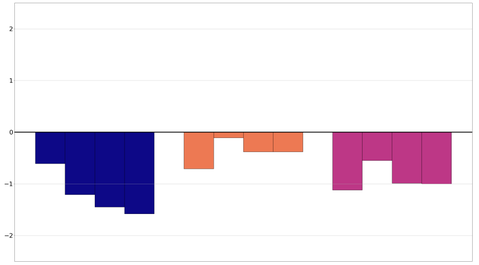
t2m daily mean

t2m daily max

EOBS





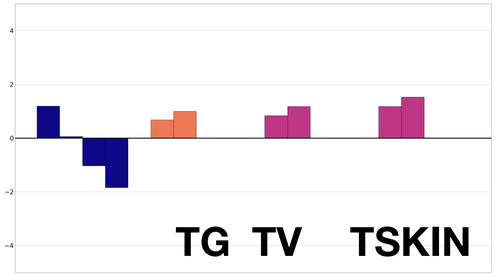


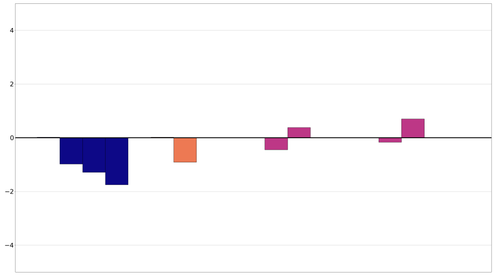
tg daily min

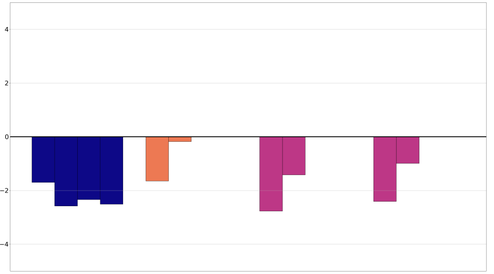
tg daily mean

tg daily max

LSA SAF







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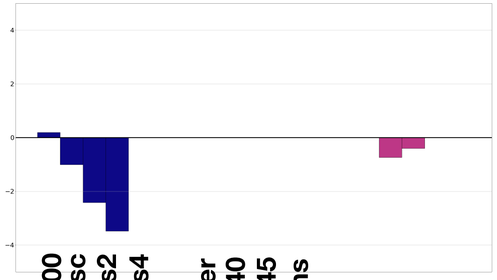

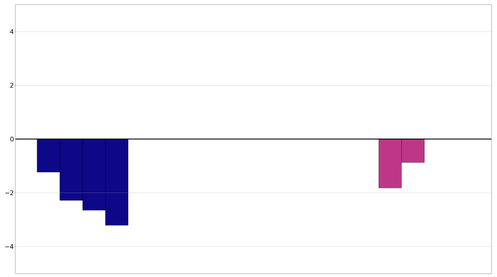

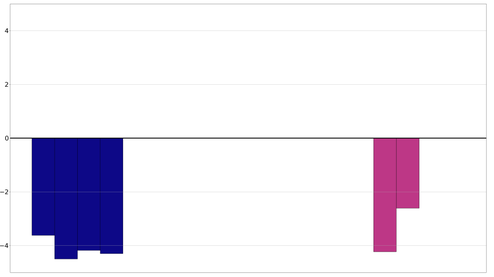

terrav500
terrabsc
terrabs2
terrabs4
clmv40 oldaer
clmv40
clmv45
clmv45bhs