Global Changes of Köppen-Trewartha Climate Zones Derived from RegCM CORDEX-CORE Simulations

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Abstract

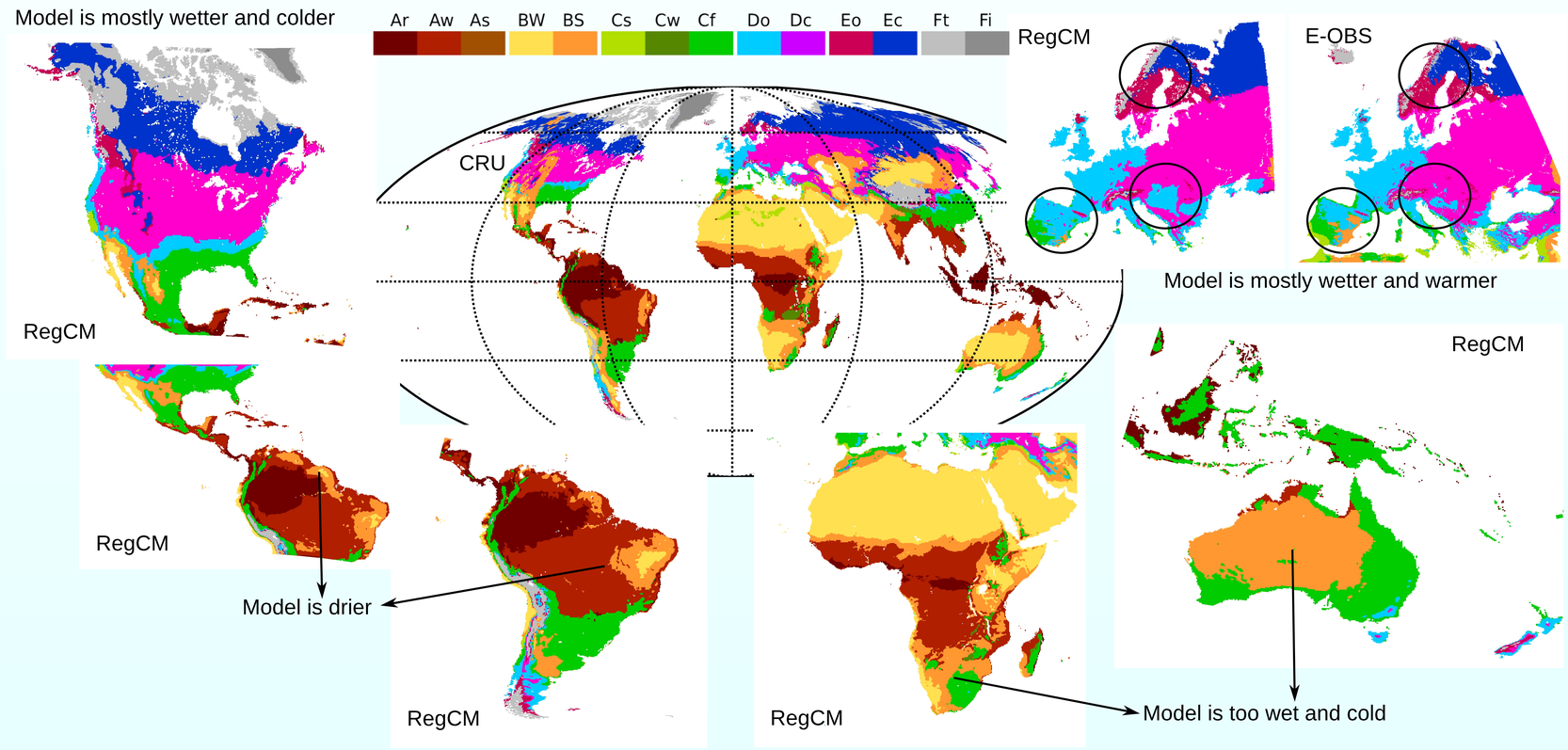
The analysis of climate patterns can be performed for each climate variable separately or the data can be aggregated using e.g. some kind of climate classification. These classifications usually correspond to vegetation distribution in the sense that each climate type is dominated by one vegetation zone or eco-region. Climate classifications thus represent a convenient tool for the assessment and validation of climate models and for the analysis of simulated future climate changes. In this work, RegCM simulations performed within the CORDEX-CORE experiment are analyzed in terms of Köppen-Trewartha climate classification.

Köppen-Trewartha Climate Classification

Definition of types and subtypes in the Köppen-Trewartha climate classification (KTC) according to Trewartha and Horn (1980). *T* denotes mean annual temperature (°C), *Pmean* is the mean annual rainfall (cm), *R* is Patton's precipitation threshold. *Tcold* (*Twarm*) stands for monthly mean air temperature of the coldest (warmest) month.

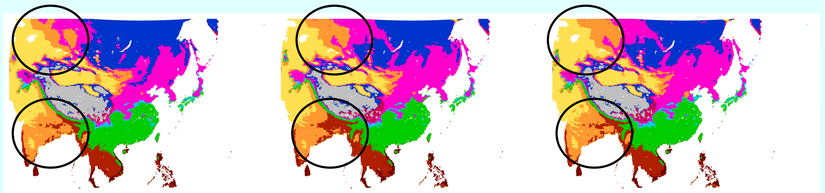
Type	Criteria	Subtype	Rainfall regime
A	Tcold > 18 °C	Ar	10 to 12 months wet; 0 to 2 months dry
	Pmean above value given in B	Aw	winter (low-sun period) dry; more than 2 months dry
		As	summer (high-sun period) dry; rare in A climates
B	Pmean < R (R = 2.3T - 0.64 Pw +41)	BS	R/2 < Pmean < R
		BW	Pmean < R/2
C	8-12 months with T > 10 °C	Cs	summer dry; Rwinter > 3*Rsummer; Rdry < 3 cm; Ryear < 89 cm
		Cw	winter dry; Rsummer > 10*Rwinter
		Cf	no dry season; Rdry > 3 cm
D	4-7 months with T > 10 °C	Do	Tcold > 0 °C
		Dc	Tcold < 0 °C
E	1-3 months with T > 10 °C	*Same subdivision as for type D with -10 °C threshold*	
F	1-3 months with T > 10 °C	Ft	Twarm > 0 °C
		Fi	Twarm < 0 °C

ERA-Interim driven experiments in period 1980-2009 compared to CRU and E-OBS



Future climate simulations for RCP2.6 and RCP8.5

East Asia domain (EAS-22, 25 km resolution)



Acknowledgment

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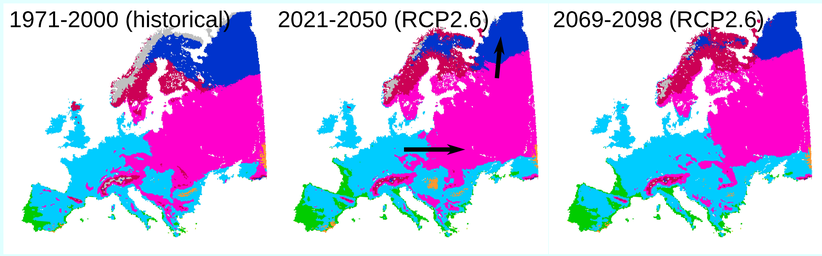
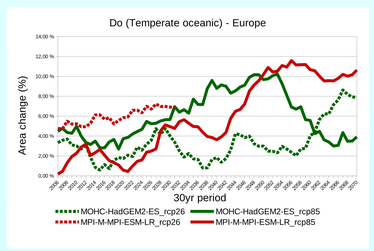
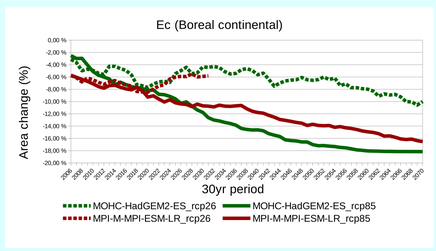
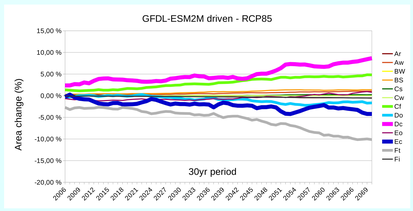
European domain (EUR-11, 12 km resolution)

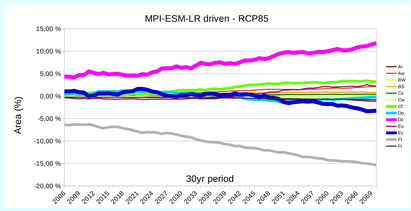






North America (NAM-22, 25 km resolution)





Conclusions

- increase of the *D* (temperate) and *Cf* (subtropical humid) type and decline of the boreal *Ec* and tundra climate *Ft* in the Northern hemishere; in Europe *Do* (oceanic) while in North America *Dc* (continental) more prominent in the future projections
- much steeper changes with stronger forcing
- shift north- and eastward in Europe
- emergence of dry types *B*, mostly steppe, in some parts even desert type *BW* under 8.5 scenario
- shift towards *A*, *B* and *D* types in Asia
- bounce-back to the current climate in South Asia by the end of the century under 2.6 scenario