Time invariant input parameter processing for applications in the COSMO-CLM Model

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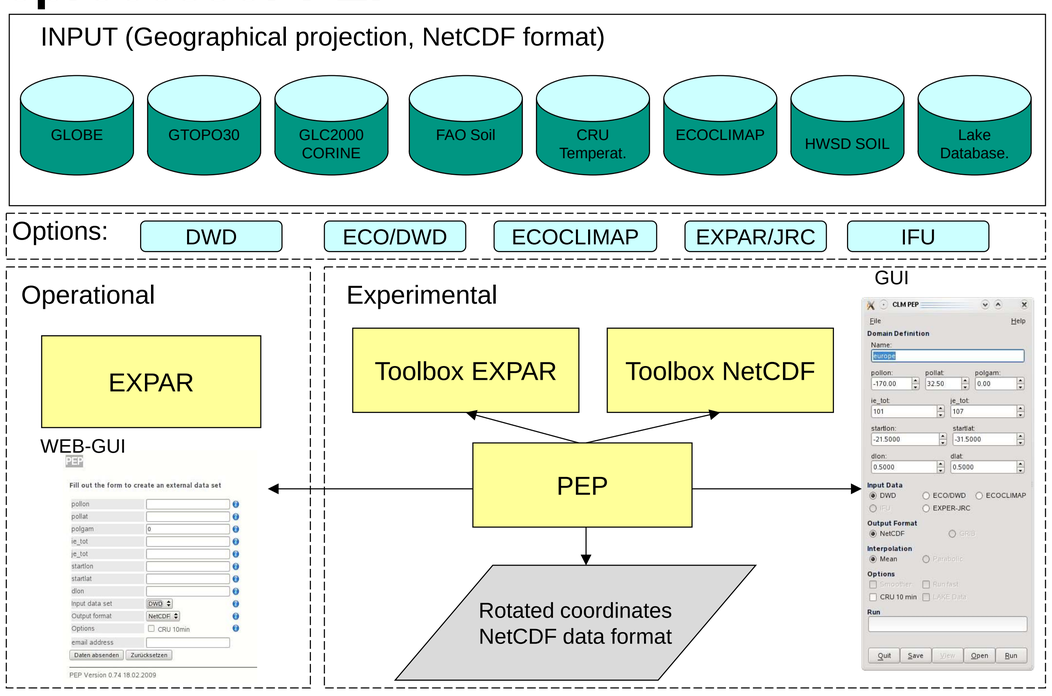
Introduction

Topography, soil characteristics, land use and land cover as well as associated vegetation parameters are key information in Soil-Vegetation-Atmosphere-Transfer (SVAT) schemes widely applied in atmospheric models in parameterization of surface exchange processes. With exception of seasonal changes in the leaf area index (LAI), vegetation fraction or roughness length, the geodata input is usually kept constant in a simulation and can therefore be considered as a time-invariant parameter. Within COSMO-CLM the data processing is performed with the PEP preprocessor

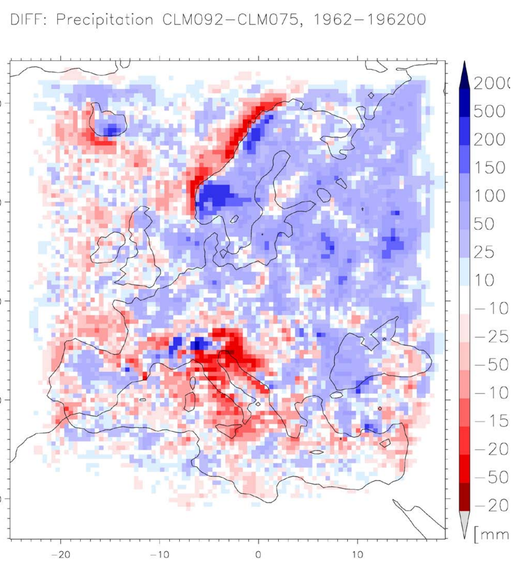
Preprocessor PEP

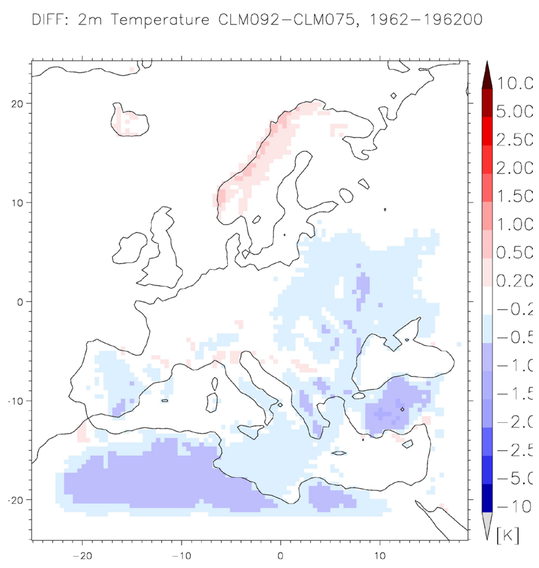


- Data base of topography, land use and vegetation parameters
  Soil characteristics, lake characteristics and others
- Interface to the data and suite of processing programs:
  - EXPAR preprocessor of the COSMO model
  - GUI and WEB Service for easy data access
- Several operational and experimental options:

Option	Topography		Land Use		Soil Data			Deep Soil Temp.		Lakes
	GLOBE	GTOPO30	GLC2000	ECOCLIMAP	FAO	HWSD	JRC	CRU	CRU10	LAKEDB
DWD	●		●		●			●	●	●
DWD/ECO	●			●	●			●	●	
ECOCLIMAP	●			●			●	●	●	
IFU	●			●		●2D		●	●	

The quality of the time invariant data can have a substantial effects on the model results. The Figures below show the influence of the newly introduced subgridscale orography (SSO) parameters required for the SSO parameterization.





→ With recent data base extensions the data quality has been considerably improved (see section “Recent data base extensions”).

→ The data processing can have an significant influence on the data quality (see section “Data Processing”)

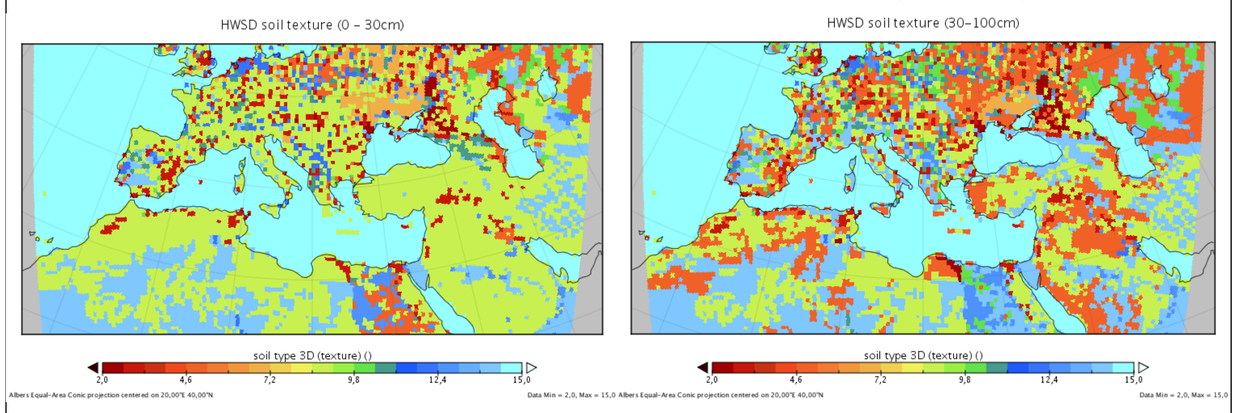
References

1. FAO/IIASA/ISRIC/ISSCAS/JRC, 2009. *Harmonized World Soil Database (version 1.1)*. FAO, Rome, Italy and IIASA, Laxenburg, Austria.

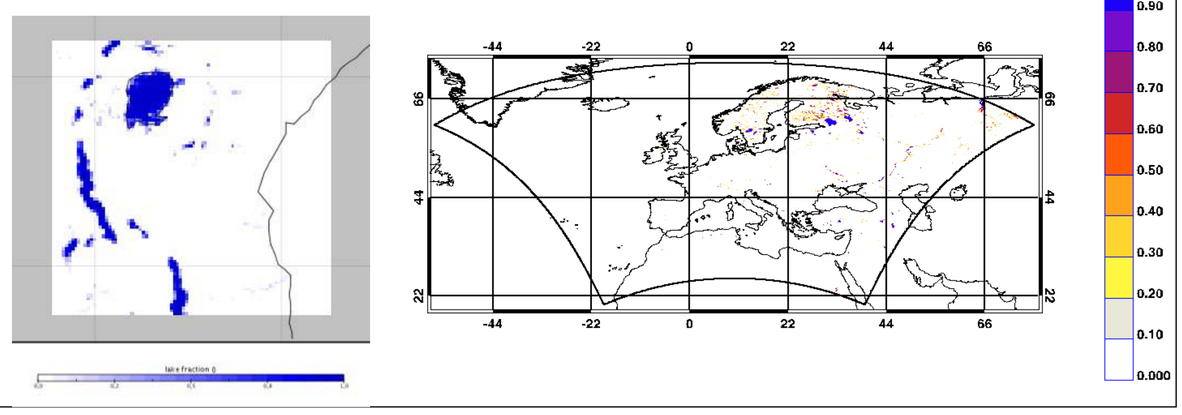
2. Masson, V., J.-L. Champeaux, F. Chauvin, C. Meriguet, and R. Lacaze (2003), A global database of land surface parameters at 1-km resolution in meteorological and climate models, Journal of Climate, 16, 1261-1282.

Recent data base extensions

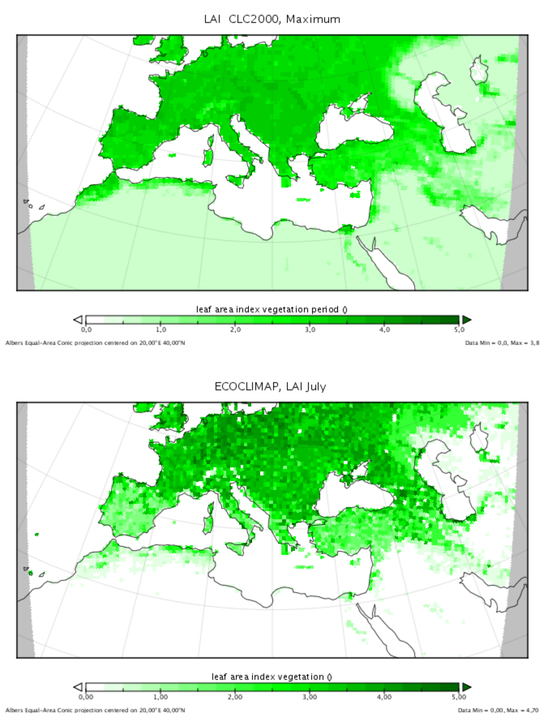
- Monthly LAI values
- Monthly vegetation fraction
- Monthly values for roughness length
- JRC Soil Map (Europe)
- Soil data from Harmonized World Soil Database (1) (2 layers):

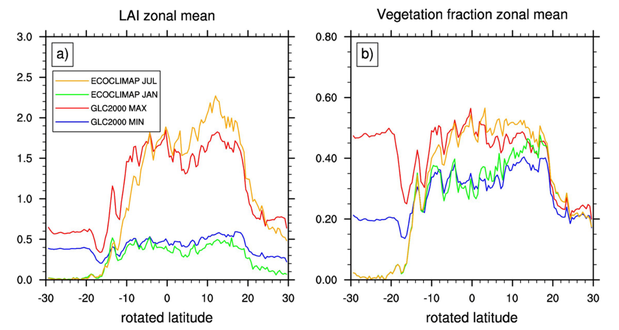


- Experimental lake depth data:



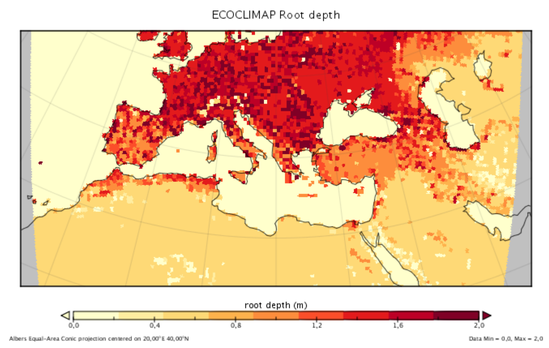
Data processing





Differences can result from different

- Look up tables
  ECOCLIMAP (2) applies look up tables adjusted to climatic regions (see LAI and Root depth)
- Computational environment (processor type, compiler etc., compiler options)



Differences in topography in meters. Data calculated at two different hosts