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Water balance changes in the Western Dvina river basin

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STUDY AREA

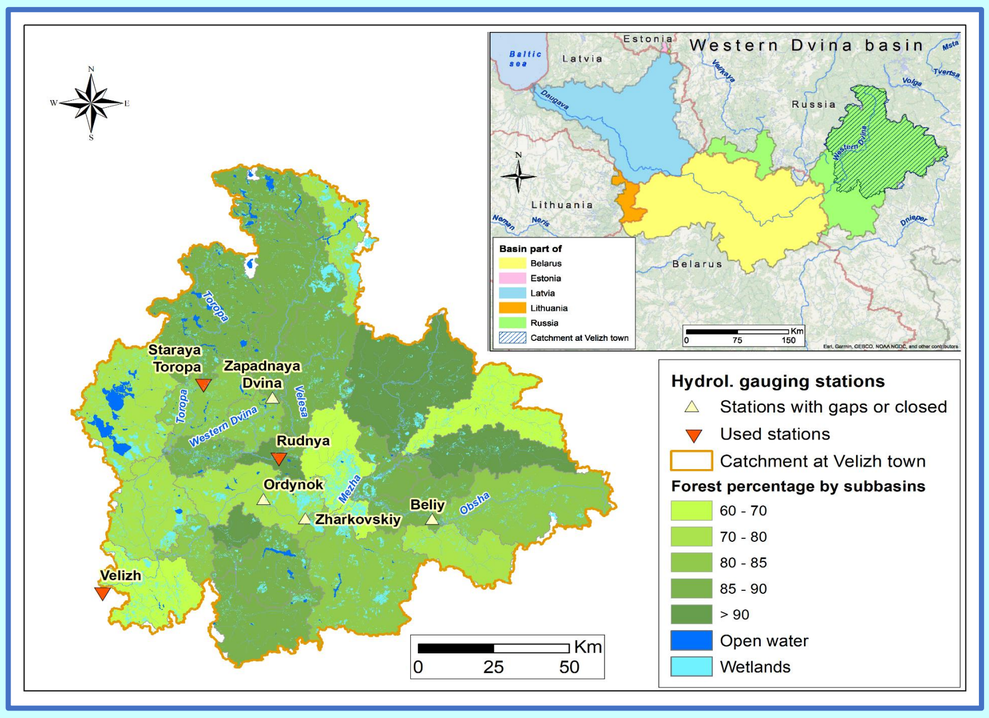
The Western Dvina River basin (Russian part). The river flows through three countries: Russia, Belarus and Latvia. Total catchment area is 87,900 km^2. Russian part is 17,000 km2

OBJECTIVES OF THE STUDY

1) To provide a unified tool (SWAT based) for water balance components assessment
2) To understand the influence of catchment processes on water resources
3) To study how climate change affects water balance components in the near and far future based on several accepted climatic scenarios in the world.

BACKGROUND

MANTRA-Rivers project (Management of Transboundary Rivers) aims at a transnational system analysis of river basins within the IWRM framework (Integrated Water Resources Management) and a dialog between riparian countries. The European Union, Ukraine and Russia share various river basins.



Materials and Methods

For this study, the ready-made calibrated SWAT-model of the Russian part of the Western Dvina catchment was used.
To evaluate the changes in the water balance components until 2100, the calibrated model was launched based on forecast weather data based on IPCC climate scenarios (Intergovernmental Panel on Climate Change, IPCC) using different global (MPI-ESM and EC Earth) and regional (REMO and RCA4) climate models.

Weather data sources:

ECA&D

NOAA

CDIAC

ECMWF

Meteo.ru

Catchment data:

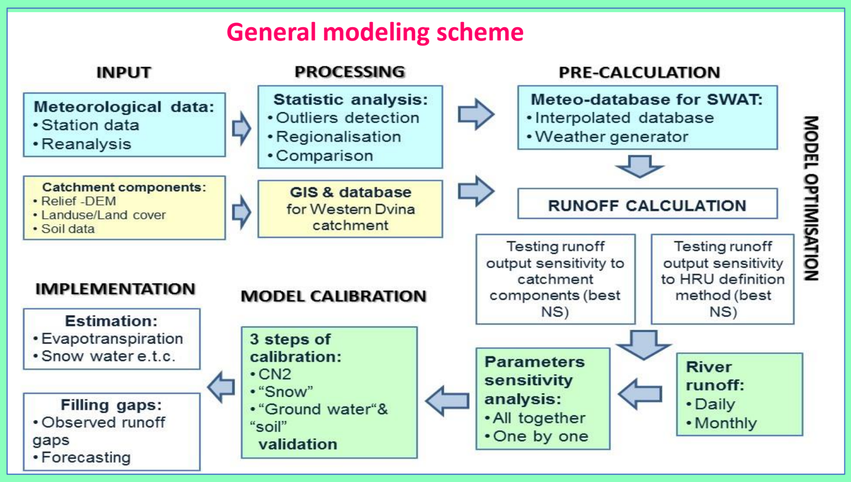
Relief: SRTM, ALOS

Land cover:

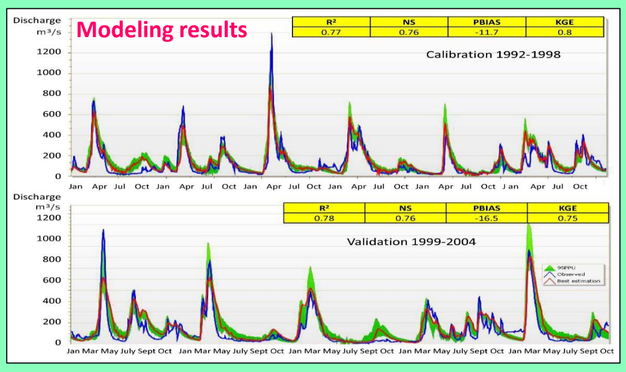
Globallandcover30,

CORINE LandCover

Soil: FAO-HWSD



The catchment model was built with the ArcSWAT2012 GIS-interface. SWAT-CUP used for calibration. Model performance is good. Simulated mean annual river runoff corresponds to observed, actual evapotranspiration is almost the same estimated by MODIS.



Calculation series were divided into the periods:

1984-2013: base period

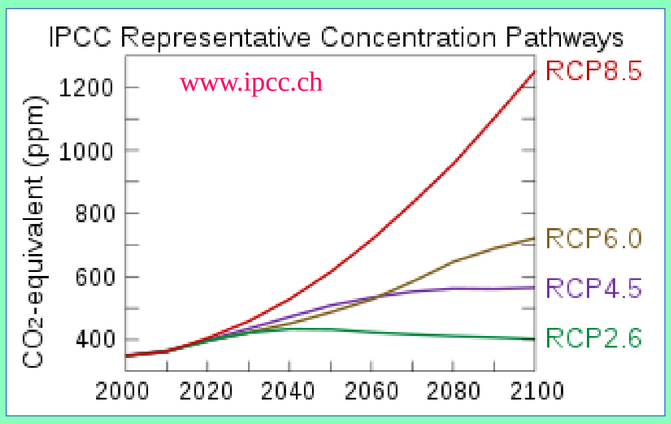
2021-2050: near future

2071-2100: far future

Climatic models:

GCM's - MPI-ESM, EC Earth

GCM's – RCA4, REMO

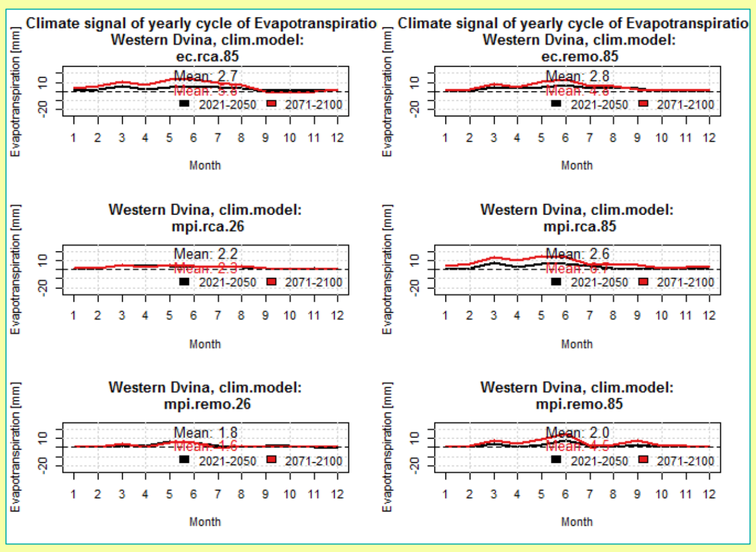


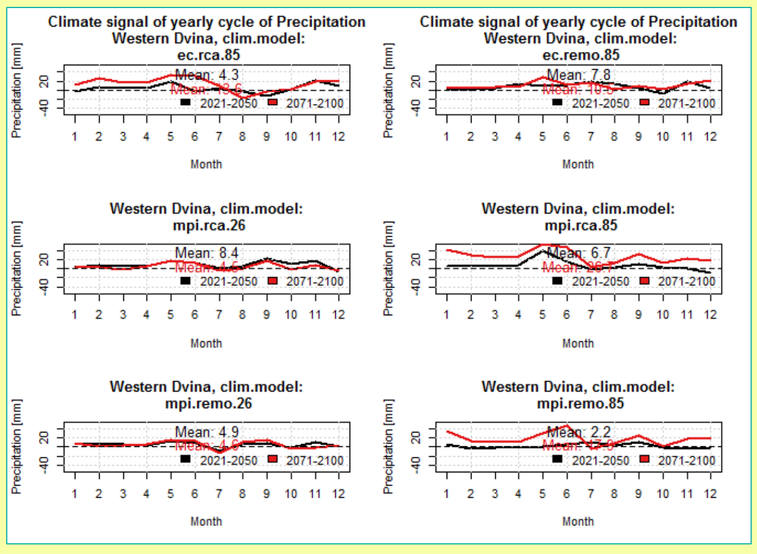
Scenarios RCP:

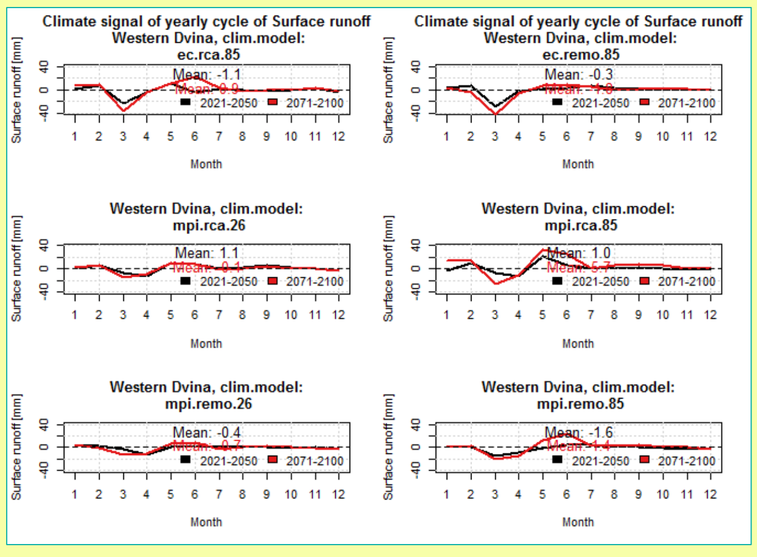
RCP 8.5 (Carbon dioxide emissions will continue to grow for a century, the lack of measures to limit greenhouse gas emissions)

RCP 2.6 (The peak of greenhouse gas emissions will occur in 2010-2020, after which there will be a decline)

Main results







Conclusions: In XXI cent. **the beginning of snowmelt** and the **spring flood rate** tend to shift to earlier months (from April to March). Snowmelt, redistribution of water output and an increase in summer evaporation will lead to **a fairly stable state of water output in summer**, despite the overall increase in precipitation in the near and far future.

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