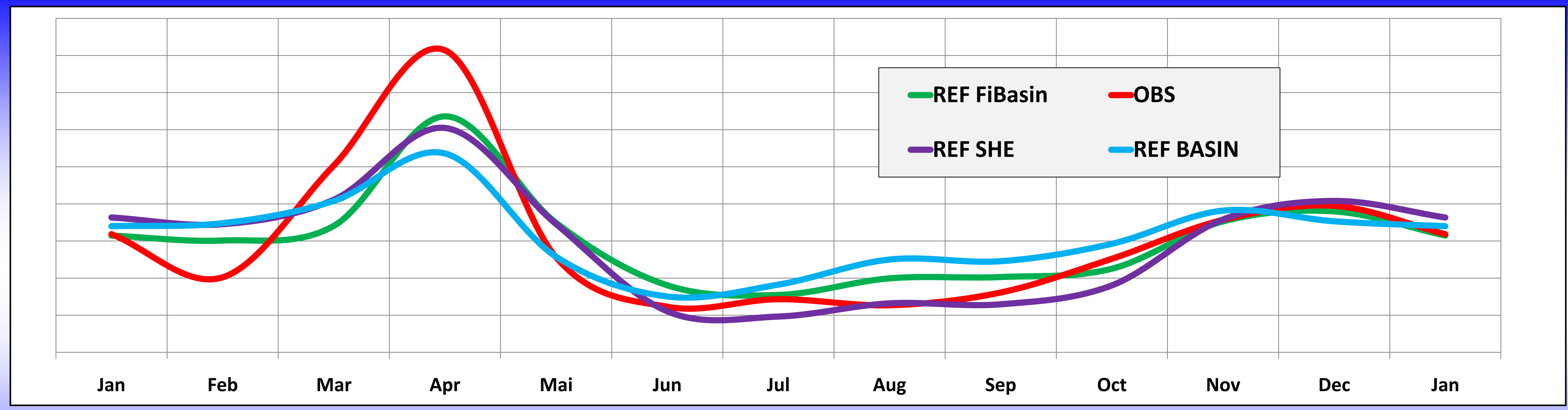
SKILL ASSESSMENT OF REGIONAL CLIMATE MODELS: T/P CORRELATIONS IMPACTS ON HYDROLOGICAL MODELING

P. Bethers, J.Sennikovs, A. Timuhins
Laboratory for Mathematical Modelling of Environmental and Technological Processes, Faculty of Physics and Mathematics, University of Latvia

Abstract

Regional climate models (RCMs) provide a useful source of data for assesment of climate change for hydrology. There are numerous RCMs variating in skill of representing the contemporary climate. There are methodologies to assess this skill. (Sennikovs and Bethers, 2009) composed the methodology based on the representation of temperature, precipitation as well as standard deviation of temperature and precipitation. In this paper we would like to propose a different skill assesment to improve results obtained from using the time series of RCMs as a forcing for hydrological models. While performing calculations by various well calibrated hydrological models it was noted, that there is a problem to represent the magnitude of the spring floods, if using data from RCMs for the contemporary climate.

The goal of our study, was to find the reason of this problem, and try to find the best availble RCM for hydrological modelling. Our main focus lies on the correlation of temperature and precipitation (T/P). The hypothesis made was that RCMs are unable to represent adequately the properties of T/P correlation and that it may be the cause for the inability of the hydrological models to represent the spring flood peak. We have chosen 18 RCM runs from the PRUDENCE (Prediction of Regional scenarios and Uncertainties for Defining EuropeaN Climate change risks and Effects) project and 21 RCM runs from the ENSEMBLES project for the control period 1961-1990 as well as observations for the same period. Bias-correction of daily temperature and precipitation data series as proposed in (Sennikovs and Bethers, 2009) was performed on the RCM data. The T/P correlation was determined for every model and compared with the observed data. Hydrological runs were made for each model. The models' ability to represent the spring floods were compared to the skill of representing T/P correlation.



1.The problem

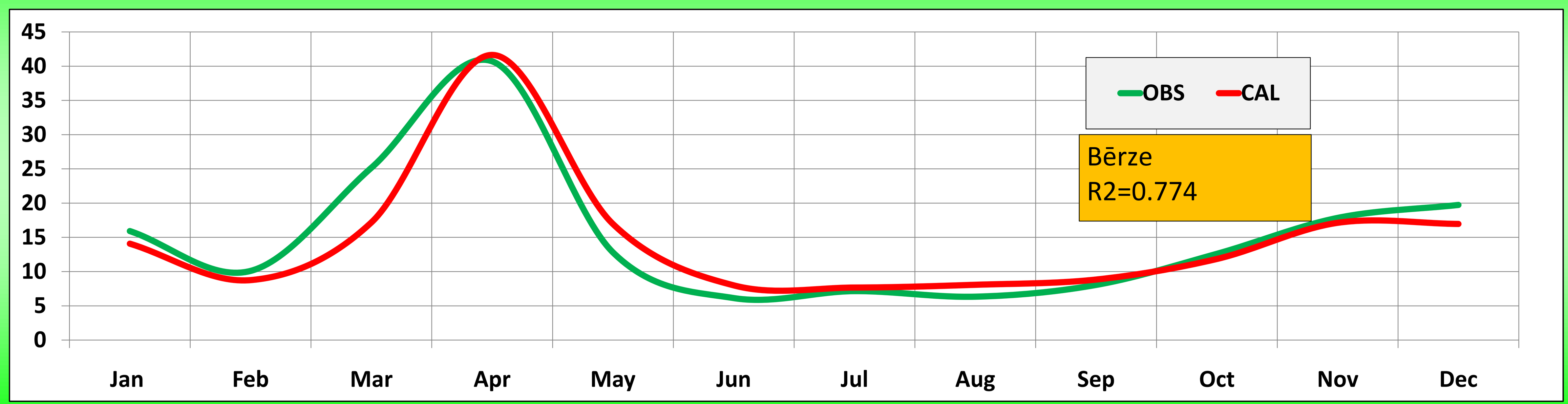
A comparison of different models (FiBasin, Mike SHE, Mike BASIN) and observations (Q) in Bērze basin.
Insufficient model agreement in the spring months is easily noticable.
And it can be noted that the choice of hydrological model doesn't influence this bias.

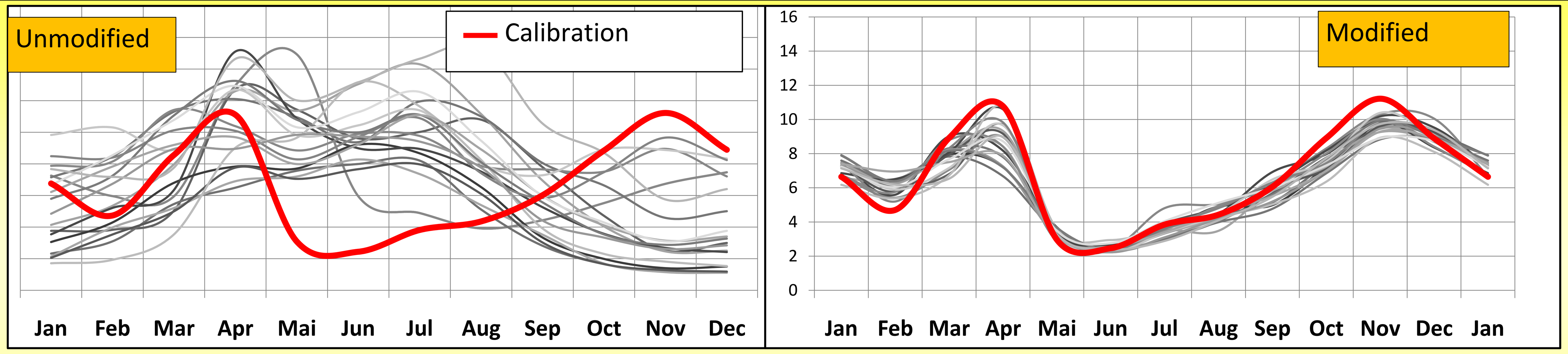
2.Possible causes of problem

- Choice of hydrological model
- Effect of calibration
- Bias correction
- Meterological data

3. Calibration

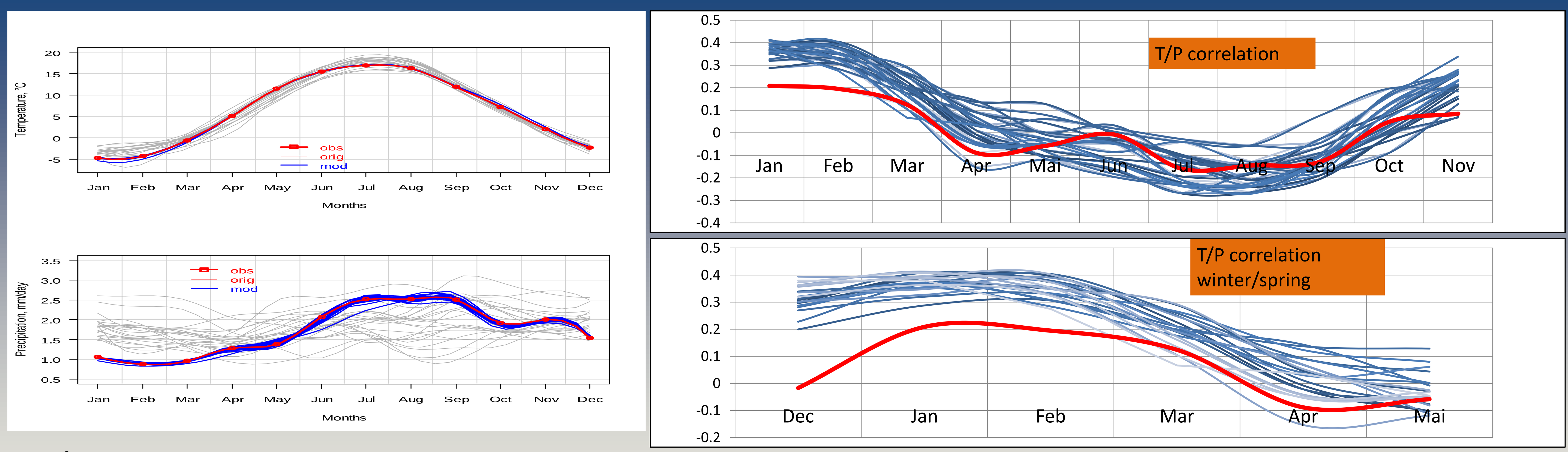
Calibration shows a good fit between the models result (observed meterological data in the forcing (LVGMC)) and observed discharges from the basin. The peak flows are represented well, which indicates that calibration shouldn't cause the problem





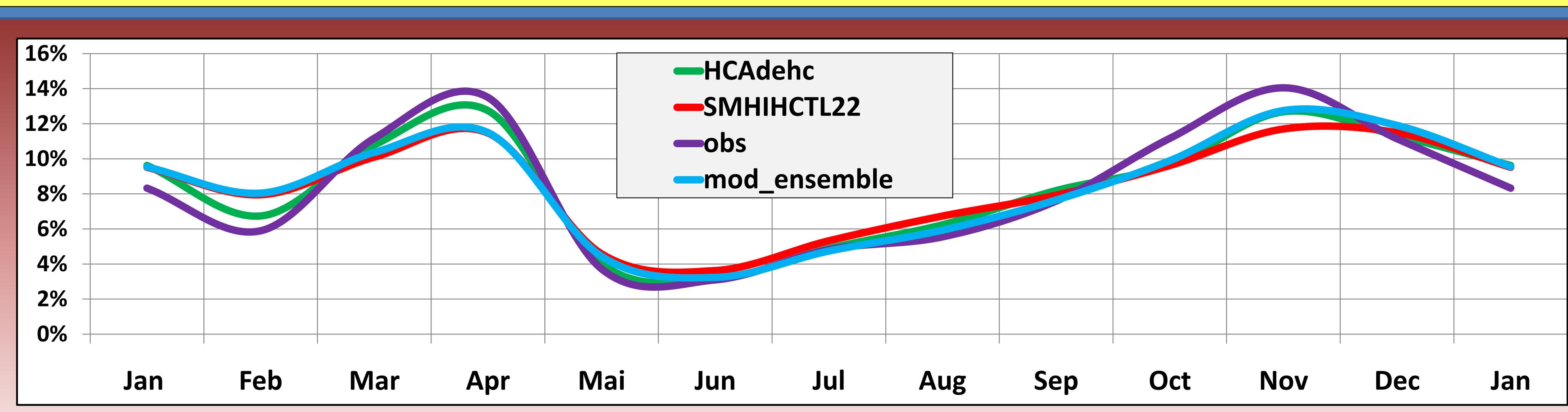
4. Bias correction

Original RCM Vs. Bias correction, meterological data modification (bias correction) helps to at least have a close seasonal fit, as some of the unmodified time series doesn't even show the seasonal cycle of the area, so we can agree that bias corection is needed.



5. T/P correlation

Although the temperature and precipitation seasonal data fits with the observed data (after bias correction) the correlation between these parameters remains almost unchanged. Analysing the results gave us the oportunity to assess how the T/P correlation effects hydrological modelling. We detected that RCMs have a different T/P correlation than the observed data mostly due to higher correlation in the winter months. It was possible to compare different RCMs and how well they cope with the spring floods,thus giving the possibility to choose the RCM which is most suited for usage in hydrological modeling in Latvia.



6.Results

We compared the model with the best meterological data fit (SMHIHCTL22) with the usually proposed method (using an average of all models) and with the model which had the best T/P correlation fit (Hcadehc). T/P correlations skill assesment method gives us the best fit.

7. Main conclusions.

- Bias correction of climate data before use in hydrological modeling is needed for RCMs
- Bias correction doesn't change the T/P correlation
- T/P correlation is overestimated in the RCM models during winter and spring
- Choosing a model with a better T/P correlation during winter months, improves the models performance in representing spring river runoff.

ESF project "Establishment of interdisciplinary scientist group and modelling system for groundwater research"
Project Nr. 2009/0212/1DP/1.1.1.2.0/09/APIA/VIAA/060

KALME VALSTS PĒTĪJUMU PROGRAMMA KLIMATA MAIŅAS IETEKME UZ LATVIJAS ŪDEŅU VIDI