

COST-VALUE Workshop on GCM Bias Correction

Notes from the discussions

Pedro MM Soares, Thursday 16/10/2014, Hamburg

This discussion follows from talks by Douglas Maraun (GCM Bias Correction - Some General Considerations), Ingo Richter (Tropical Atlantic Biases and their impact on simulated interannual variability), Stefan Hagemann, (Role of soil moisture for dry biases over Amazon and Congo, Juergen Baden (Tropical Vibes), Sebastien ??? (and Fredrik Boberg (Temperature dependent climate projection biases in ENSEMBLES and CMIP5).

- The first question raised was which are the most relevant global climate model biases? Generally accepted the ones focused are the temperature biases over the northwestern Atlantic, the southeastern Atlantic (in the Benguela region) and the Southeastern Pacific (off coast Peru);
- Douglas referred the proposal to bias correction dependent on circulation type? To be further discussed.
- About some of the bias over ocean: CMIP5 models present a southern shift of ITCZ, similarly to AMIP, pointing out that bias are not an ocean-atmosphere coupling problems;
- Even higher resolution GCMs, like syntax reveal problems on the representation of the surface winds over the ocean, it simulates badly the alongshore winds and the equatorial winds. Ingo referred that atmospheric internal variability is more important for the winds than the SSTs.
- Ted added that for the ITCZ biases the influence of the extratropics maybe important.
- Martin asked for comments on the consequences of these biases on the climate change signal over the regions? Martin advanced that North Atlantic biases and too little storms can affect the future projections immensely.
- Related to the previous issue, Douglas raised also the question How present climate biases can impact on future model spread;
- Richard Chandler mentioned the misconnection between naïve bias correction and model development. Downwind how impact modelers should cope with these biases? And, if this problem can be tackled mapping the variability in the right phase;
- Douglas asked in what measure the correction of fluxes biases is a way and how it will work in the future;
- Still on the predictability Martin referred that predictability is zero if the features are not represented. In some studies predictability is added when using higher resolution (Pedro). Martin also added that statistical models are not are not bad for El niño, but are worse for the Atlantic. Ingo referred a study (Stockdale 2006) where statistical models beat the dynamical;
- Following the presentation of Juergen where models are divided in two classes, concerning the ones with important precipitation biases either on Brazil or in the Gulf of Guinea. Richard shows some reflectance to accept this two classes. Stefan mentioned that the triggering and motion transport is vital to better represent the precipitation pattern in these two regions. Martin asked if there was some systematic signal in climate change on the 2 classes, and it seems that there isn't.
- Sebastien showed that resolution (associated with orography) can mitigate the warm bias in the Benguela region, but Ingo noticed that too strong winds compensate the warm bias.
- Douglas going back to internal variability stated that is vital to quantify internal variability; a large ensemble with high resolution can help but it may be too expensive computationally. Of course, resolution will solve some of the problems (Pedro) but

still biases will occur, and these are difficult to assess in these regions due to the lack of confidence on observations.

- Stefan in his presentation showed the precipitation bias in Amazonian region, too little convergence occur and too much moisture divergence is happening in the model. Too low moisture recycling.
- Martin again tried to focus the discussion raising another question: Could we distinguish between regions where bias correction can work and other where not? Based for example on an analysis where local features are not captured by DD?
- Frederik showed a simple method to correct bias based on temperature. And Andreas mentioned that not doing the same to precipitation can introduce important inconsistencies.

Wrap-up

- Douglas started dividing the three groups involved: GCM modelers, RCM modelers and End-Users; and the funding priorities! Scientifically, if the model dynamics is wrong how to conciliate with bias correction?
- Ted urged people to focus on regions and regional processes.
- Douglas stated that to apply bias correction to Amazonas is hopeless;
- Ted again stressed the need to approach the problem on concrete cases;
- Ingo made the distinction between what can be done on seasonal prediction and climate change;
- Re-centering the problem Martin and Douglas asked a specific attention to Europe and the storm-track problem over the Atlantic, and some other difficult problem.
- Richard emphasized the responsibilities of modelers on how they communicate the results to end-users;
- Douglas again asked Where bias correction make sense?
- Radan stated that we have to see bias correction as a technical problem, and not a physical one.
- Douglas mentioned that is important to get physical understanding involved. Radan asked if it does matter if we have the right precipitation to have as well the right storm tracks? Douglas said yes, otherwise how can we trust on climate change signal.

This discussion follows from the talk by Ted Shepherd (Potential impact of systematic errors in jet-stream position).

- Ted characterized the atmospheric circulation as a source of uncertainties.
- The separation between thermodynamics and dynamics is artificial, and should be viewed combined.
- Douglas referred the need to progress to discuss the emergent constraints.

Wrap-up

- As an example we focused in Europe, storm-tracks and precipitation.
- What if we only map precipitation like end users want?
- Which conditions should we impose to bias correction?
- Mapping is important but persistence of precipitation is also fundamental to force hydrological models (Richard);
- Douglas emphasized the need of not only mapping but having the storm tracks right.
- The problem in jet-stream is an important source of error (Martin).
- Two approaches were draw:
 1. Naïve approach

GCM -> bias correction -> RCM
GCM -> RCM -> bias correction

2. Systematic conservative approach

Separate error types and correct only the local errors

3. Emergent constraints

4. Fluctuations – Dissipation theorem

- Even if it is possible the approach (GCM -> bias correction -> RCM) we still have to bias correct the RCM, then we ll have :

GCM -> bias correction -> RCM -> bias correction

- But, the discussion made very clear how difficult is to bias correct the GCMs to then force RCMs.
- A Table on this three ways was built in: What could go wrong? And What goes right? Douglas has the full table.
- During the building of the Table some issues and ideas were raised, like to identify regions where climate change is not important because climate variability is rather more important;
- Ted raised the idea of bias correct the future climate based on multi-model mean as a reference, focused in a regions and not globally;
- Can we link present day errors to the climate change signal?
 - We could see how parameters of weather generators change in future, but we need time series...