« The coming cooling predicted by Stohzkov et al.
How the IPCC buries it's inconvenient findings »

The tuning of climate models

(link to picture)

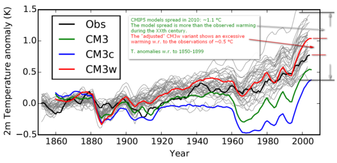
Many (or better practically all) "climate politics" are based on the outcomes of climate models; as these models predict nearly unanimously a future warming due to the expected rise of atmospheric CO2 concentration, their reliability is of a primordial importance. Naively many politicians and environmental lobbies see these models as objective products of hard science, comparable for instance to the many years-long proofed correctness of the structural physics of skyscrapers.

Alas, this is not the case: as the climate system is devilishly complex and chaotic, building a General Circulation Model (GCM) starting with basic physics laws is a daunting task; during its development, each model must take choices for certain parameters (their values, their possible range), a process which is part of what usually one calls "tuning". The choices in tuning are not cast in stone but change with the modeling creators, with time and cultural/ideological preferences.

Frédéric Hourdin from the "Laboratoire de Météorologie Dynamique" in Paris has published in 2016 together with 15 co-authors an extremely interesting and sincere article in the "Bulletin of the American Meteorological Society" titled "**The art and science of climate model tuning**" (**link**) on this problem. I will discuss some of the main arguments given in this excellent paper.

1. **Observations and models**

Hourdin gives in Fig.3 a very telling example how the ensemble of the CMIP5 models (used by the IPCC in AR5) differ in the evaluation of global temperature change, starting from 1850 to 2010 (the temperature anomalies are given with respect to the 1850-1899 average):



I have added the arrows and text box: the spread among the different models (shown by the gray arrows) is awesome, larger than the observed warming (given in the very warming-friendly Hadcrut4 series); even the "adjusted" = tuned variant (the red curve) gives a warming in 2010 that is higher by 0.5°C than the observations. We are far, far away from a scientific consensus, and decisions that ignore this are at best called "naive".

2. Where are the most difficult/uncertain parts in climate models?

Climate models are huge constructs which are built up by different teams over the years; they contain numerous "sub-parts" (or sub-models) with uncertain parameters. One of the most uncertain ones is cloud cover. Just to show the importance, look at these numbers:

- the forcing (cooling) of clouds is estimated at -20 W/m2
- the uncertainty about this parameter at least 5 W/m2
- the forcing thought to be responsible for the post 1850 warming of about 1°C is estimated at 1.7 W/m2.**Conclusion**: the uncertainty of the cloud cover effect is 3 times higher than the cause of the observed warming!

Hourdin asked many modelers about what they think to be the most important cause of model bias, and they correctly include cloud physics and atmospheric convection, as shown in the fig.S6 of the supplement to the paper (highlights and red border added):

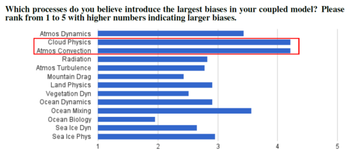


FIG. S6. Which processes do you believe introduce the largest biases? Average Rating

3. Are the differences among the models only due to scientific choices?

The answer is no! Many factors guide the choices in tuning; Hourdin writes that *" there is some diversity and subjectivity in the tuning process"* and that *"different models may be optimized to perform better on a particular metric, related to specific goals, expertise or* ***cultural identity*** *of a given modeling center"*. So as in many other academic domains group-think and group-pressure do certainly play a strong role, showing a consensus that might well be due more to job security or tenure than objective facts.

4. Conclusion

This Hourdin et al. paper is important, as it is one of the first where a major group of "main-stream" researchers puts the finger on a situation that would be unacceptable in other scientific domains: models should not be black boxes whose outcomes demand a quasi religious acceptance. Laying open the algorithms and unavoidable tuning parameters ("*because of the approximate nature of the models*") should be a mandatory premise. It would then be possible to check if some *"models have been inadvertently or intentionally tuned to the 20th century warming"* and possibly correct/modify/adapt/abolish some hastily taken political decisions based on them.

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