

Earth Syst. Dynam. Discuss., community comment CC2
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Reply on RC2

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Community comment on "Balanced estimate and uncertainty assessment of European climate change using the large EURO-CORDEX regional climate model ensemble" by Guillaume Evin et al., Earth Syst. Dynam. Discuss., <https://doi.org/10.5194/esd-2021-8-CC2>, 2021

The context for articles like this one is that the IPCC reports (and many other reports and journal articles) claim that certain climate parameters have a fairly precise probability of occurring or being exceeded by X%. For example, the IPCC WGI reports make statements like the probability of a certain scenario exceeding a 2.0 degree C global temperature increase by 2100 is 66% or greater. But as acknowledged in the comments to this article, this percentage does NOT represent a real-world chance of occurring as the text usually makes it seem, but it merely represents where a given result resides with respect to a range of model results. Thus, such a percentage like 66% implicitly says more about the range of model structures and input assumptions, than it says something truthful about the real world's climate. However, most readers of these reports and most policy makers do not understand this key point.

The problem I find with this article is that this basic conceptual difference is not clearly spelled out and is not clearly incorporated into the analysis at each relevant point. But it must keep reminding the reader when the uncertainties being discussed apply to the real world physical processes of climate change, or to the models individually, or to the range of model results collectively. Similarly, the uncertainties associated with each of these three levels must be clearly distinguished throughout the text. Yet, this will be very difficult to accomplish properly, and it is almost never accomplished in similar articles in the literature, whether dealing with regional or global models. Conceptually, it does not matter what the scope of the model is. But, in general, uncertainties usually increase in percentage terms when smaller areas of the earth's surface are modeled in comparison to when global models are run. This fact is due to fluctuating and difficult to model weather patterns at the regional level.

As far as I know, the "bottom line" of attempts like this article at uncertainty analysis is that it is fairly hopeless to succeed at results that have much physical meaning or policy making value. Consider the results for global climate sensitivity. Roughly the results for many years have been 3.0 degrees C plus or minus 1.5 degrees C. This range is primarily due just to the differences in model results within an ensemble, without consideration of the other two kinds of uncertainty noted above. But even considering this one kind of uncertainty, the size of the uncertainty band is comparable to the size of the effect being

forecast, i.e. an uncertainty range of 3.0 degrees C for a likely effect of 3.0 degrees C. Thus consideration of the other two kinds of uncertainty will only increase the total range of uncertainty relative to the median projection of about 3.0 degrees C. So what is the point of trying to perform a total uncertainty analysis on a firm scientific basis. I suggest that the result is basically unknowable. Of course, if we just look at the history of global climate change from about 1978 to today (2021) we find a fairly steady increase at about 0.15-0.20 degrees C per decade in actual fact, which will give policy makers a far more likely range of uncertainty in global climate change if projected linearly for at least the next few decades (at least to 2050), which is the most important time period if climate change is going to be effectively mitigated. The results of a more sophisticated and comprehensive uncertainty analysis taking all three conceptual levels of uncertainty into account is not likely to be more useful for policy makers (or anyone else) at this point in time.

Thus, I do not believe that this paper rises to the level of useful publishable material unless the ensemble model results can be connected to the real history of the world in a way that **reduces** the uncertainty range and does not increase it. But I think this is impossible given the complex system involved.