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Including observational uncertainty in climate model evaluations

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Abstract: Model evaluations are performed by comparing a modelled quantity with an observation of the same quantity. The observation is generally considered the "truth" and any deviation from this observed quantity is considered an error. However, we know that all observing systems have uncertainties or errors associated with them. When using gridded observations there are additional uncertainties introduced by the gridding process. Investigation of multiple different gridded observational products for the same quantity reveals a range of equally plausible "truths". Thus, the model errors identified depend intimately on the choice of observational product used in the evaluation exercise. In acknowledgement of this problem, some previous studies have repeated the evaluation exercise against several observational products and then used the average (or similar) of these results as the overall outcome. Which is a better though, we suggest, an inadequate approach.

Here we proposed a method that means models are only considered to be in error when they lie outside the range given by several observational datasets (and their internal uncertainties). In practice, this approach requires the production of a pseudo-observation dataset that is equal to: the maximum observation when the model exceeds all observations; the minimum observation when the model falls below all observations; and the model value when it lies within the observational range and hence it is considered to be indistinguishable from observations. This pseudo-observation data can then be used within traditional statistics to calculate the Observation Range Adjusted (ORA) version of that statistic. This talk demonstrates the technique along with its impact on model evaluation.

Keywords: *Observation uncertainty, model evaluation, climate model*