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A multi-model ensemble weighting method (ClimWIP) in ESMValTool

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Too often model evaluation has no impact on how a multi-model ensemble is analysed. It has been argued that projection and prediction uncertainties can be decreased by giving more weight to those models in multi-model ensembles that are more skillful and realistic for a specific process or application. In addition, some models in multi-model ensembles are not independent and it is not always clear how to include available initial condition ensemble members which are becoming larger in number e.g. in CMIP6.

A weighting approach has been proposed which takes into account both of these aspects (Climate model Weighting by Independence and Performance- ClimWIP) and is able to deal with included initial condition ensemble members. This approach has been shown to decrease uncertainties in multiple use cases such as projections of Arctic September sea ice, North American summer maximum temperatures, European temperature and precipitation, as well as projected global mean temperatures. Even though the basic equation to calculate a model's weight is straight forward, the user needs to make several decisions, such as which metric to use to measure performance or independence, which variables to include etc. and potential pitfalls were identified. For the actual implementation a range of points need to be considered: (1) data from different modelling centers need to be processed and compared in a consistent way, (2) the strength of the performance and independence contributions is determined through two parameters that must also be calibrated, (3) results should be provided in a form that allows backtracing to the original data and code to allow reproducibility. To facilitate re-use for new applications, the method was recently implemented into the ESMValTool. We will discuss advantages and disadvantages of the method, show results from some of the use cases, explain how the implementation into ESMValTool was done and how the method can now be more easily used.