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Blending dynamical climate forecasts with climatology

A. P. Weigel, M. A. Liniger and **C. Appenzeller**

Federal Office of Meteorology and Climatology (MeteoSwiss), Zurich, Switzerland
(christof.appenzeller@meteoswiss.ch)

Short term climate forecasts based on probabilistic ensemble prediction systems have found a wide range of applications in weather and climate risk management. Despite considerable progress in model and system developments, there are still forecast contexts (i.e. locations, seasons, lead-times, variables, ...) under which the dynamical prediction systems are outperformed by climatological guessing. This limits the general applicability of ensemble short-term climate prediction systems. To remedy this deficiency, we propose an optimally weighted "dual-model" consisting of both an ensemble prediction system ("Model 1") and a climatological forecast ("Model 2"). For each forecast context optimum weights are determined such that the average information deficit ("ignorance") of a user, who is in possession of the forecasts but does not know the true outcome, becomes as small as possible. The success of this "dual model", in particular the gain in average prediction skill, is evaluated both with a synthetic toy climate model and with a state of the art seasonal ensemble forecasts system, the ECMWF System 3. It is shown that the combination algorithm assigns full weight to the ensemble predictions only as long as they have significant skill with respect to climatology. Otherwise, simply climatology is issued as a forecast. Since this "dual-model" is often better than or equal to the climatological reference, but never poorer than climatology, a general application is possible. Examples are given for near surface temperature predictions over Europe and world wide.