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Forecasting heavy precipitation at subseasonal time scales: application to the southwest tropical Pacific

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The southwest tropical Pacific is very sensitive to precipitation variability. On the one hand, it is regularly affected by heavy rainfall events, including tropical cyclones. On the other hand, some areas are repeatedly exposed to drought. In this region, rainfall is driven by specific large-scale features, namely the two convergence zones (ITCZ and SPCZ), as well as monsoonal activity in the northernmost part. Consequently, it exhibits links with global climate drivers such as ENSO and the Madden-Julian Oscillation. These drivers are reasonably well captured by subseasonal forecasting systems and are therefore expected to provide a basis for some skill in precipitation forecasts over the area. This study aims to assess the predictability of southwest tropical Pacific rainfall in the GCM forecasts from the Subseasonal-to-Seasonal (S2S) database. It also investigates how these forecasts can be improved through two approaches: multimodel ensemble and statistical-dynamical prediction.

In this study, skill is defined as the ability to predict the occurrence of specific events within weekly windows corresponding to typical intraseasonal lead times (week 1, week 2...). We assess probabilistic skill using measures such as the ROC skill score and the Brier Score, but also the skill of the ensemble mean using correlation. Verification focuses on the austral summer season (DJF), which is the rainiest season for the area and the period for which the MJO and ENSO impacts are the strongest.

Skill is evaluated in S2S re-forecasts from six different models (BoM, CMA, ECCC, ECMWF, Météo-France and UKMO) on the common period 1996-2013. These models are assessed separately by choosing the same number of members per model (4). They are also combined into a balanced 24-member multimodel ensemble for which the skill is compared to that of the individual models. Results show the multimodel approach for intraseasonal rainfall prediction bears some added value compared to using a single model, both in terms of forecast quality and robustness of skill evaluations

The skill scores obtained with model output from S2S re-forecasts are then enhanced by a statistical-dynamical approach. Large-scale predictors forecast by the models are used as input to simple statistical models to build probabilistic predictions of the event of interest at the grid point level. The clearest improvement is found at long lead times when ENSO is the main source of predictability.