EGU21-1292
https://doi.org/10.5194/egusphere-egu21-1292
EGU General Assembly 2021
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A statistical-dynamical approach to improve subseasonal precipitation forecasts: application to the southwest tropical Pacific

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Although there is an increasing interest in precipitation information at the subseasonal timescales in a wide range of sectors, the use of subseasonal precipitation forecasts from general circulation models is often impaired by poor reliability and low forecast skill. One crucial step to improve forecast quality is statistical correction and post-processing, which is particularly important for a parameterized variable like rainfall. This study introduces and evaluates a statistical-dynamical post-processing scheme, based on a Bayesian framework, that aims at providing more skillful and more reliable subseasonal forecasts of weekly precipitation. On the one hand, this method relies on the statistical relationship between observed and dynamically-forecast precipitation, that is determined in a set of reforecasts and depends on the lead time. On the other hand, it also takes advantage of the climatological impacts of large-scale drivers affecting rainfall, that are generally better represented by numerical models than rainfall itself. These two aspects of the method are respectively called calibration and bridging.

This statistical-dynamical prediction scheme is illustrated with an application to the austral summer precipitation in the southwest tropical Pacific, using the Météo-France and ECMWF reforecasts in the Subseasonal-to-seasonal (S2S) database. Indices representing El Niño Southern Oscillation and the Madden-Julian Oscillation – the major sources of predictability in the area – are used for bridging. Probabilistic forecasts of heavy rainfall spells are evaluated in terms of discrimination (ROC skill score) and reliability, which are both improved by the Bayesian method at all lead times (from week 1 to week 4). Additional results show that the calibration part of the method, using forecast precipitation as a predictor, is necessary to enhance forecast skill. The bridging part also provides additional discrimination skill, that is mostly due to the ENSO-related information.