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Precipitation weather typing over the South Pacific: application to the TRMM satellite product calibration

Oscar Mirones¹, Joaquín Bedia^{1,2}, Juan A. Fernández-Granja³, Sixto Herrera¹, Sara O. Van Vloten⁴, Andrea Pozo⁴, Laura Cagigal⁴, and Fernando J. Méndez⁴

¹Dept. of Applied Mathematics and Computer Science (MACC), Universidad de Cantabria, 39005 Santander, Spain
(mironeso@unican.es)

²Grupo de Meteorología y Computación, Universidad de Cantabria, Unidad Asociada al CSIC, 39005 Santander, Spain
(bediaj@unican.es)

³Santander Meteorology Group. Institute of Physics of Cantabria (IFCA), CSIC-UC, 39005 Santander, Spain

⁴Geomatics and Ocean Engineering Group. Departamento de Ciencias y Técnicas del Agua y del Medio Ambiente, Universidad de Cantabria, 39005 Santander, Spain

In the South Pacific region, the precipitation patterns are mostly driven by a number of processes operating at spatial and temporal scales. One of the most important features is the South Pacific Convergence Zone (SPCZ).

Five Daily Weather Types (WT) of precipitation are presented, based on Principal Component Analysis (PCA) and k -means clustering using ERA5 precipitation and atmospheric circulation variables such as mean sea-level pressure (SLP), day-to-day difference of mean daily SLP or northward and eastward 10-m wind component fields, able to capture distinct precipitation spatio-temporal patterns, interpretable in terms of salient regional climate features such as the SPCZ state and tropical cyclone activity. We then undertake a weather-type conditioned calibration of the TRMM (Tropical Rainfall Measuring Mission) product using in-situ rain gauge records from the PACRAIN database as reference. "Conditioning" is here based on applying separate statistical corrections for each of the generated WTs, since biases might be dependent on specific atmospheric situations that can be partially captured by the clustering procedure, thus adapting the correction factors to specific synoptic conditions.

Our results indicate that the WT-conditioned calibration provides an overall marginal added value over the unconditioned approach, although it makes a significant difference for a better correction of extreme rainfall events, critical in many impact studies. The approach can be extended to compound extreme events, in which several variables are involved (e.g. precipitation, sea level, wind, etc.), in order to better preserve multi-variable consistency.