Session 27: Hazards and Extreme events

(Abstract N° 1663)

Evaluating cut-off lows forecast from the NCEP Global Ensemble Forecasting System (GEFS) in southern South America

BELEN CHOQUEHUANCA[1,2,3], Alejandro Godoy[4,5], Ramiro Saurral[1,2,3,6]
[1] Facultad de Ciencias Exactas y Naturales, Departamento de Ciencias de la Atmósfera y los Océanos, Universidad de Buenos Aires, Buenos Aires, Argentina.
[2] Centro de Investigaciones del Mar y la Atmósfera (CONICET-UBA), Buenos Aires, Argentina.
[3] IRL IFAECI/CNRS-IRD-CONICET-UBA, Buenos Aires, Argentina.
[4] Servicio Meteorológico Nacional (SMN), Buenos Aires, Argentina.
[5] Facultad de Ciencias Astronómicas y Geofísicas (UNLP), La Plata, Argentina.
[6] Barcelona Supercomputing Center (BSC), Barcelona, Spain

Abstract

Heavy precipitation, intense winds, and flooding frequently occur in association with Cut-off Lows (COLs). COLs are synoptic-scale cyclonic systems in the middle and upper levels of the troposphere that often affect populated regions in the mid-latitudes. In South America, for instance, COLs forecasts are of high social relevance, as they can lead to loss of human lives, affect economic activities (e.g., agriculture), and cause widespread infrastructural damage. Therefore, the need to improve knowledge on the predictability of COLs by the numerical weather prediction (NWP) systems over southern South America motivates this study. The main objective is to assess the quality of COLs forecasts from the NCEP Global Ensemble Forecasting System (GEFS) over the greatest frequency region of COLs in South America, considering forecasts of up to 14 days. To achieve this goal, the GEFS Reforecast Version 2 dataset was evaluated, focusing on two verification frameworks. First, a feature-based tracking method was used in which each COL was identified as an extreme value. Next, the forecast trajectories and diverse metrics were calculated to determine the position and intensity errors as a function of forecast lead time. Second, the weekly forecast skill was evaluated in the representation of the large-scale environment in order to extend the predictability of COL by identifying precursor patterns, focusing on the first (week-1, days 2-8) and second week (week-2, days 8-14) of forecast. For this, we used statistical verification metrics commonly used in the validation of NWP forecasts.

The results showed that the GEFS skillfully captures between 94,74% and 100% of all COLs for forecasts produced 3 days in advance. However, the percentage of predicted COLs decreases to 68,42% and 21,05% at a forecast lead time of 4 and 7 days, respectively. Further analysis showed that GEFS COLs forecasts are slower and to the right of observed trajectories and generally underestimate intensity at longer forecast lead times. On the other hand, the large-scale circulation observed during the week preceding the onset of COLs was associated with a precursor Rossby wave packet over the South Pacific Ocean, in agreement with previous studies. The results of forecast verification showed that this pattern can be well predicted one week in advance, both in terms of position and intensity. However, the week- 2 forecasts were inaccurate and lacked confidence levels, although they were able to predict some features of the circulation.

Keywords

Cut-off Low, Forecasting, Forecast verification