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Performance of the Prognocean Plus system during the El Niño 2015/2016: predictions of sea level anomalies as tools for forecasting El Niño

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The aim of this paper is to present the performance of the Prognocean Plus system, which produces long-term predictions of sea level anomalies, during the El Niño 2015/2016. The main objective of work is to identify such ocean areas in which long-term forecasts of sea level anomalies during El Niño 2015/2016 reveal a considerable accuracy. At present, the system produces prognoses using four data-based models and their combinations: polynomial-harmonic model, autoregressive model, threshold autoregressive model and multivariate autoregressive model. The system offers weekly forecasts, with lead time up to 12 weeks.
Several statistics that describe the efficiency of the available prediction models in four seasons used for estimating Oceanic Niño index (ONI) are calculated. The accuracies/skills of the predicting models were computed in the specific locations in the equatorial Pacific, namely the geometrically-determined central points of all Niño regions. For the said locations, we focused on the forecasts which targeted at the local maximum of sea level, driven by the El Niño 2015/2016. As a result, a series of the "spaghetti" graphs (for each point, season and model) as well as plots presenting the prognostic performance of every model – for all lead times, seasons and locations – were created.
It is found that the Prognocean Plus system has a potential to become a new solution which may enhance the diagnostic discussions on the El Niño development. The forecasts produced by the threshold autoregressive model, for lead times of 5–6 weeks and 9 weeks, within the Niño1+2 region for the November-to-January (NDJ) season anticipated the culmination of the El Niño 2015/2016. The longest forecasts (8–12 weeks) were found to be the most accurate in the phase of transition from El Niño to normal conditions (the multivariate autoregressive model, central point of Niño1+2 region, the December-to-February season).
The study was conducted to verify the ability and usefulness of sea level anomaly forecasts in predicting phenomena that are controlled by the ocean-atmosphere processes, such as El Niño Southern Oscillation or North Atlantic Oscillation. The results may support further investigations into long-term forecasting of the quantitative indices of these oscillations, solely based on prognoses of sea level change. In particular, comparing the accuracies of prognoses of the North Atlantic Oscillation index remains one of the tasks of the research project no. 2016/21/N/ST10/03231, financed by the National Science Center of Poland.