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Verification and bias correction of ECMWF weather forecasts for inclusion in an Irish grass growth model

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Daily forecasts from the European Centre for Medium-Range Weather Forecasts (ECMWF) predicting up to ten days in advance were verified at 25 Irish weather stations between 2007 and 2013 to test their viability for inclusion in grass growth models (GGMs). Although GGMs have been developed with retrospective weather observations as inputs, weather forecasts have not yet been included. A predictive GGM would greatly aid farmers in their daily management of grasslands. Since grazed grass is the cheapest feed source available to Irish beef and dairy farmers, it is in their interest to best utilize this valuable resource. Weather variables relevant to grass growth were examined: maximum, minimum and mean 2 m air temperature, rainfall and soil temperatures at six depths. Various forecast bias-correction methods were assessed to improve forecast quality. Predictions from a GGM using observed weather, as well as ECMWF and bias-corrected forecasts from 2008 to 2013 were compared to each other and to observed on-farm grass growth data. This analysis was conducted using day-1 to day-10 forecasts to evaluate the length of the predictive ability of the model.

ECMWF forecasts of soil and air temperature variables generally performed well at all locations up to ten days. For example, the root mean squared error of forecasts with observations for 2 m mean air temperatures rose from 0.89°C at day-1 to 2.70°C at day-10. However, ECMWF forecasts often struggled to predict large rainfall events. The mean absolute error for forecasts predicting five days in advance with observations between 40 and 50 mm was 31.3 mm, compared to 2.2 mm for observations between 0 and 10 mm. A bias correction approach using a regression model generally gave the best improvements in forecast accuracy for all temperature variables, with small improvements in rainfall forecasting.

Predictions from the GGM were similar when weather forecasts and observations were included. However, grass growth predictions decreased in accuracy as forecast lead time increased and were less precise when high rainfall events occurred. Overall, the work suggests that utilising weather forecasts, along with other relevant variables, in predicting future grass growth could be a valuable tool to farm management leading to better efficiency of grassland usage, increased productivity and reduced costs.