LAI sensitivity testing in HARMONIE-AROME for NWP forecasting for Ireland

Geoffrey Bessardon and Emily Gleeson
Met Éireann, Climate Services, Research, Environment and Applications Division, Dublin 9, Ireland (geoffrey.bessardon@met.ie)

A good representation of surface processes is essential for weather forecasting as it is where most of the thermal, turbulent and humidity exchanges occur. One of the main goals in numerical weather prediction (NWP) at Met Éireann is to improve short-term weather forecasts. One aspect of this work involves improving the description of the Earth’s surface in the models used for short-range weather forecasting. Sample surface information in weather models includes land cover types, tree heights, soil types and Leaf Area Index (LAI).

Met Éireann is involved in developing the HARMONIE-AROME configuration of the shared ALADIN-HIRLAM NWP system for operational weather forecasting. Surface processes and physiography issues cause some of the limitations in the performance of HARMONIE-AROME [1]. The current cycle of HARMONIE-AROME, cycle 43, uses the latest version of the ECOCLIMAP [2] land cover map, ECOCLIMAP-SG [3]. ECOCLIMAP-SG, contrary to previous versions, uses external tree height, albedo and LAI data inputs. The choice of LAI input is important for the wind forecasts as the roughness length over vegetation, which is inversely proportional to wind speeds at the surface, depends on LAI and tree height.

There are two multiyear climatologies suggested as input for ECOCLIMAP-SG [3]: the 2014-2016 Copernicus satellite LAI data at 300 m-resolution, and the 1999-2016 Copernicus satellite LAI data at 1 km-resolution, brought to 300 m resolution using a Kalman filter. Sensitivity testing for the June 2018 drought over Ireland using HARMONIE-AROME cycle 43 showed that LAI multi-year climatologies are not appropriate for representing the LAI during extreme events such as a drought. The implementation of ECOCLIMAP-SG, (including multi-year climatological LAI values) leads to cold biases and an over-prediction of wind speeds [4]. Simulations using near-real-time LAI values are thus necessary to assess the potential for assimilating LAI value in an operational forecasting setup. This led to establishing a special project running through 2021 at ECMWF consisting of a series of 16 1-month long HARMONIE-AROME cycle43 simulations comparing the use of multi-year climatologies and near-real-time data. The chosen months were selected across the 4 seasons showing the different behaviour of the real-time LAI compared to the multiyear climatologies [5]. This work presents the initial results of this project.

http://www.umr-cnrm.fr/aladin/spip.php?article344