From Weather to Fire: from Fire to Weather

Francesca Di Giuseppe

Florian Pappenberger

Claudia Vitolo

Fredrik Wetterhall

Blazej Krzeminski

Angela Benedetti

Adrian Tompkins

The European Centre for Medium-Range Weather Forecasts is a leading institution in numerical weather prediction. In the last years, thanks to its crucial role in the management of some of the European Copernicus programs, ECMWF has been particularly active in demonstrating the capability of its weather forecasts to support sectoral applications. This effort has invested all time scales from the medium range (up to 10 days forecast) to the seasonal scale (up to 7 months), including the the subseasonal to seasonal (S2S) range as well. The Global ECMWF Fire Forecast (GEFF) system is the main operational effort related to fire forecasting. As of today the GEFF system provides several datasets from three different fire danger rating systems; an historical reanalysis dataset, a daily medium-range forecast and an extended range forecast. Following the Copernicus general data-policy, all data are freely available to any user both public and commercial.

As more and more weather driven applications are producing fields that are being incorporated in the catalogue of ECMWF products there is a real urge to showcase possible feedbacks of this knowledge into its mainstream research which is the actual weather forecast. Fire predictions offer an unique opportunity, given the impact that fire emissions from large fires have in modifying the surface radiative budget at the global scale. The longer range forecasts is the most likely time scale being affected by fire emissions and subsequent smoke aerosols transport. S2S simulations performed prescribing observed fire emissions have already highlighted how the inclusion of this missing component can improve forecast scores up to 4 weeks. In its current setup, ECMWF model does not forecast emissions from fires while allowing these to be prescribed. Attempts have been made to use the Fire Weather Index (FWI) which is a measure of fire danger, to modulate fire emissions during short range forecasts. However the challenge remains to design and implement a fully dynamical fire model which could allow to ignite and extinguish fires as required by long range simulations.

In this paper we will revise the activities of ECMWF in the field of fire danger forecast and present results from the ultimate challenge of including interactive fires into its numerical weather prediction system.