Advancing Data Assimilation in Global NWP and Climate: the ECMWF Perspective

Massimo Bonavita[*1]

[1]ECMWF – Reading, United Kingdom

Abstract

Data assimilation (DA) is traditionally used to combine observations and models in a statistically optimal fashion in order to provide the best estimates of the initial state of the Earth system, given the assumed uncertainties of their inputs. This is a crucial activity in alloperational NWP and Climate Centre, as the accuracy and reliability of the analysis pdf is one of the main drivers of forecast skill from hour to seasonal predictions.

Standard DA systems need to evolve to respond to the opportunities and challenges presented by emerging trends in e.g. the ever increasing availability, density and temporal frequency of new observations; the increasing importance of nonlinearities in both observations and model; the rapidly increasing resolution of the prognostic models; the demands of a seamless and physically consistent initialisation across the Earth system components. In the first part of the talk we review the recent evolution of the ECMWF DA system and its planned future developments aimed at tackling the methodological challenges connected to these trends in observations and model.

More recently, there has been a growing realisation that limitations and imperfections of the current generation of prognostic models are arguably the biggest hurdle in order to overcome historical predictability barriers in both NWP and Climate prediction. This has led to renewed efforts to extend data assimilation methodologies and employ new hybrid DA-Machine Learning techniques to enhance, improve and correct forecast models. In the second part of the talk we describe the ECMWF experience and plans in this area and discuss some of the opportunities and challenges ahead in light of the ambitious goals set out in the ECMWF 2021-2030 Strategy.

Keywords: Operational Global NWP, Data Assimilation Methodology, Machine Learning

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[*]Speaker