



University of Twente, Enschede Friday, 22 April 2022

Plenary Lecture

Speaker: Peter Bauer (European Centre for Medium-Range Weather Forecasts, Reading UK)

Title: High-performance computing and big data handling: The biggest challenge for weather and climate prediction

Abstract:

High-performance computing and big data handling: The biggest challenges for weather and climate prediction

Weather and climate prediction are high-performance computing applications with outstanding societal and economic impact ranging from the daily decision-making of citizens to that of civil services for emergency response, and from predicting environmental impacts on food, agriculture and energy markets as well as for risk and loss management by insurances. The uncertain evolution of weather extremes with climate change adds significant political pressure and decision makers need best possible information basis but also convenient access to data and information.

Forecasts are based on millions of observations made every day around the globe and physically based numerical models that represent processes acting on scales from hundreds of meters to thousands of kilometers in the atmosphere, the ocean, the land surface and the cryosphere. Forecast production and product dissemination to users is always time critical and forecast output data volumes already reach petabytes per week.

Meeting the future requirements for forecast reliability and timeliness needs 100-1000 times bigger high-performance computing and data management resources than today – towards what's generally called 'exascale'. To meet these needs, the weather and climate prediction community is undergoing one of its biggest revolutions since its foundation in the early 20th century.

This revolution encompasses a fundamental redesign of mathematical algorithms and numerical methods, the adaptation to new programming models, the implementation of dynamic and resilient workflows and the efficient post-processing and handling of big data. Due to these enormous computing and data challenges, new computing hardware technologies but also artificial intelligence methods offer significant potential for gaining efficiency and for making optimal use of information crucial for our society.

These challenges reach dimensions that require substantial international collaboration at scientific, technological and political level. Given the urgency of climate change and the socio-economic impacts, funding the accelerated progress and initiating wider collaboration should have the highest priority.