

A roadmap to Earth surface kilometre-scale simulations

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The strive to produce increasingly more accurate forecasts has pushed horizontal resolutions of global Earth System Models (ESM) to break into single-digit kilometre-scale (e.g. 9 km for global HRES forecasts at ECMWF with a vision to increase it further towards 2025), and several National Meteo-Hydrological Services already run at 1-2 km resolution on wide regional domains.

At about 1km on a global domain there is close to a billion grid points covering the Earth surface involving the use of High Performance Computing to be timely simulated.

However, there are not only computing and software challenges involved, as simulations' accuracy requires to be able to characterise the surface ancillary conditions at those resolutions (orographic elevation, vegetation and soil types, water-land-ice fractions, bathymetry and any meteorologically relevant properties) therefore involving the use of satellite remote sensing observations and optimisation/inversion algorithms to estimate non-observable quantities. Global high-resolution simulation capacity at the surface can benefit enormously next generation reanalyses products when combined with refinements in the treatment of physical processes to better account for regional and local meteorological/climate/human-induced changes.

This presentation will cover current efforts to characterise the Earth surface at kilometre-scale making use of recent remote-sensing dataset and it will illustrate some of the challenges related to internal consistency across datasets and to their use in long reanalysis.