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Developments in modelling and validation of land surface models

N Gedney

Met Office, Hadley Centre, JCHMR, Crowmarsh-Gifford, Wallingford, United Kingdom (nicola.gedney@metoffice.gov.uk, 0044 1491 692338)

One of the motivations for modelling the land surface at coarse scales is the need to provide adequate boundary conditions for weather forecasting and climate models.

Historically, modelling the land surface initially comprised of bucket-type models whereby both evaporation and runoff were simple functions of the fullness of the bucket. Since then significant development has occurred, including modelling of the vertical transfer of water through the soil and the physical effects of soil and vegetation in limiting evaporative loss. Much of this work initially focussed on vertical detail. Spatial heterogeneity has more recently been incorporated into some of these models, including variations in surface types, soil properties and orography.

The latest generation of schemes have also incorporated vegetation growth and competition. Wetland methane and biogenic volatile organic compound emissions, and the impact of ozone on vegetation have also been modelled. In all these developments the interaction between soil, plant and atmosphere are critical.

With increasing model complexity, parameter estimation and model validation becomes more challenging. Here we summarise the latest modelling developments and validation techniques in land surface models. This includes the use of multi-flux optimisation techniques and the latest satellite data. We discuss the areas where there is largest uncertainty in the models and how these might be addressed.