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R&D Technical Summary W5C-022

Historical Comparison Between the Met Office Surface Exchange Scheme - Probability Distributed Model (MOSES-PDM) and the Met Office Rainfall and Evaporation Calculation System (MORECS)

Background to R&D project

This project, jointly funded by the Environment Agency and the Met Office, was originally conceived to research the impact of antecedent catchment conditions on flood forecasts. Fundamental to this was the means by which these conditions were estimated. Currently the MORECS soil moisture balance system is used within the Agency to provide information on catchment conditions, primarily for water resource use. The Met Office and CEH Wallingford have developed a replacement for MORECS. The new system, named MOSES is linked to the CEH PDM model, and uses Nimrod actuals as rainfall inputs. At the project definition stage it was clear that the potential and wider benefits to the Agency of a move from MORECS to MOSES-PDM first needed to be considered. A revised project specification was agreed by the joint Agency/Met Office Project Board for a historical comparison between MOSES-PDM and MORECS using derived hourly weather data covering the last 40-years.

Results of R&D project

As no archive of hourly weather data at 5km resolution existed back to 1962 a pseudo-hourly sequence of weather data was derived from the MORECS 40km data set of daily mean weather data. The parameters compared were PE (potential evaporation), AE (actual evaporation), EP (excess precipitation) and SMD (soil moisture deficit). SMD was not initially available as a MOSES-PDM output and its derivation required a method of obtaining field capacity moisture contents for the MOSES 5km x 5km squares. Whilst the parameters are estimated by different methods in both models they have the same definition:

- PE is the maximum loss of water from the surface (leaf canopy plus soil) when there is no restriction due to lack of soil moisture.
- AE is the actual loss of moisture from the surface.
- EP is the water which is lost from the soil profile by surface runoff and drainage.
- SMD is the difference measured in mm between the actual soil moisture state and its state at field capacity.

The differences between the MOSES and MORECS outputs from the historic comparison are due to differences in the soil moisture modelling approaches and differences between the methods of calculating some of the input weather variables. Furthermore future MOSES output will differ from the historic MOSES output as the weather data will be produced by different methods and at 5km resolution. This should ensure that the current operational MOSES-PDM output is superior to the historic MOSES output. The historical comparison sought to demonstrate that the historic MOSES output was superior to MORECS.

Rather than compare model outputs for every MORECS square for every day - a massive task - two extreme hydrological events were investigated: the drought of 1975-76 and the floods of 2000-01, for four contrasting MORECS squares. Each investigation covers 24 months. The intercomparison of the models was contrasted with findings from the available literature in order to assess which was closer to reality. The conclusion was that MOSES-PDM better represents the processes of evaporation, drainage and soil

moisture changes than does MORECS.

Suggestions for further work include a comparison of the operational MOSES-PDM and MORECS, further improvements to the MOSES model and further validation of MOSES-PDM output against observations. It is pointed out that future operational comparisons would still involve data manipulation to enable comparison at the same temporal and spatial resolution. This would involve extracting the 5km MOSES data, summing for 24 hour periods and aggregating up to the 40km MORECS squares.

R&D Outputs and their Use

The above work is covered in a Met Office report dated 2 July 2003 - A historical comparison between the Met Office Surface Exchange Scheme-Probability Distributed Model (MOSES-PDM) and the Met Office Rainfall and Evaporation Calculation System (MORECS). This report will be of interest to all involved in assessing the potential benefits of moving from MORECS to MOSES-PDM for the supply of information on catchment conditions. The report provides a sound basis for assessing the possible ramifications of such a move. The MOSES outputs produced for the historic comparison are also available as a project deliverable.

This R&D Technical Summary relates to R&D Project W5C-022 and the following outputs:

- **Met Office Report - *Historical Comparison Between the Met Office Surface Exchange Scheme - Probability Distributed Model (MOSES-PDM) and the Met Office Rainfall and Evaporation Calculation System (MORECS)*** Published June 2003
- **Generated MOSES Archive**

These titles can be ordered through:

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The above Met Office report is accessible via the Flood Forecasting and Warning Theme on the Environment Agency website www.environment-agency.gov.uk/floodresearch . Copies are held by all EA Regional Information Centres. The Generated MOSES Archive going back to 1962 giving figures for PE, AE, EP and SMD is available to Environment Agency staff from the National Centre for Environment Data and Surveillance. Other interested parties should contact the Met Office Tel: 0870 900 0100 Fax: (+44) 1392 885681 Website: www.metoffice.com

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