Texas A & M University and U.S. Bureau of Reclamation

Hydrologic Modeling Inventory
Model Description Form
July 18, 2007

Name of Model: WATFLOOD™

Model Type: Grid based Grouped Response Unit (GRU).

Model Objective(s): Flood/flow forecasting; Environmental Impact Studies

Agency and Office: University of Waterloo (see next)

Technical Contact and Address: N. Kouwen. Civil and Environmental Engineering, University of Waterloo, Waterloo, ON. Canada. N2L 3G1 519-922-2602 (home) kouwen@uwaterloo.ca

Model Structure or Mathematical Basis: Hydrology: Green and Ampt and Hargreaves; Snow: Anderson model (hourly) with land cover based SDC curves; Hydraulic: Gridded Storage routingfor rivers and lakes with coupled wetland/bank storage.

Model Parameters: Many. One set for each land cover class. One set for each river class. No watershed-specific parameters.

Spatial Scale Employed in the Model: 1 - 25 km grid size; domain 10 – 2,000,000 km^2 (small watershed to continental)

Temporal Scale Employed in the Model: hourly hydrology. Smaller time steps for routing as needed

Input Data Requirements: DEM, Landcover, gridded precipitation and temperatures. (Preprocessor for distributing precipitation and temperature data included.) (Post processor: ENSIM-HYDROLOGIC available seperately from NRC-CHC Canada http://www.chc.nrc.ca/English/main_e.html)

Computer Requirements: Highend PC with Windows or Unix; storage depends on number of grids and length of simulation.

Model Output: Gridded Streamfow; Groundwater contribution;

Parameter Estimation / Model Calibration: Manual; Pattern Search (Monro); DDS ALGORITHM (see Tolson & Shoemaker (2007) http://www.agu.org/journals/wr/wr0701/2005WR004723/)

Model Testing and Verification:

1. Kouwen, N, M. Danard, A. Bingeman, W. Luo, F.R. Seglenieks and E.D. Soulis. 2005. “Case Study: Watershed Modeling with Numerical Weather Model Data”, *Journal of Hydrologic Engineering*, ASCE. 10 (1), 23-38
2. Bingeman, A.K, N. Kouwen, M. ASCE and E. D. Soulis, 2006, “Validation of the hydrological processes in a hydrological model.” *Journal of Hydrologic Engineering*, ASCE. 11 (5),451-463.

Model Sensitivity: Allyson Bingeman Ph. D. thesis: bingeman.pdf on www.watflood.ca

Model Reliability:

Model Application / Case Studies: Major studies: Columbia River (BC Hydro); Great Lakes Model (Environment Canada); Saskatchewan River (Env. Can.) Mackenzie River (GEWEX); Upper reaches of the Danube, Rhine, Rhone and Po for MAP; Many smaller watersheds for various applications.

Documentation: WATFLOOD Manual (Approx. 200 pages) www.watflood.ca

Other Comments: Recent publications

3. Bingeman, A.K, N. Kouwen, M. ASCE and E. D. Soulis, 2006, “Validation of the hydrological processes in a hydrological model.” *Journal of Hydrologic Engineering*, ASCE. 11 (5),451-463.
4. Toth, B., A. Pietroniro, F.M. Conley and N. Kouwen. 2006. “Modelling climate change impacts in the Peace and Athabasca catchment and delta I – hydrological model application. Hydrological Process 20, Special Northern Rivers Ecosystem Initiative Issue. In Print
5. Pietroniro, A., R. Leconte, B. Toth, D.L. Peters, N. Kouwen F.M. Conley and T. Prowse. 2006. “Modelling climate change impacts in the Peace and Athabasca catchment and delta III – Integrated model assessment Hydrological Process 20, Special Northern Rivers Ecosystem Initiative Issue. In Print
6. Stadnyk, T., N. St.Amour, N. Kouwen, T.W.D. Edwards, A. Pietroniro and J.J. Gibson. 2005. “A groundwater separation study in boreal wetland terrain: The WATFLOOD hydrological model compared with stable isotope tracers”, *Isotopes in Environmental and Health Studies*, 41(1), 49-68.
7. Kouwen, N, M. Danard, A. Bingeman, W. Luo, F.R. Seglenieks and E.D. Soulis. 2005. “Case Study: Watershed Modeling with Numerical Weather Model Data”, *Journal of Hydrologic Engineering*, ASCE. 10 (1), 23-38