Geophysical Research Abstracts
Vol. 21, EGU2019-13290, 2019
EGU General Assembly 2019

Development of Hydrological Modeling Platform: Catchment Hydrologic Cycle Assessment Tool (CAT) for Water Resources Management and Seasonal Streamflow Forecasting

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Hydrologic models have been proposed to assess the impact of urbanization and climate change on water resources. The Catchment Hydrologic Cycle Assessment Tool (CAT) is a semi-distributed hydrological model based on physical parameters and it has a link-node model structure (Kim and Jang, 2017). The model includes evapotranspiration, infiltration, groundwater movement, and channel routing sub-modules. Particularly, the hydrologic process in paddy fields and other areas can be simulated with improved facilities such as pond, infiltration trench, bio-retention, wetland, and rainwater harvesting. The improved facilities support to evaluate the potential damages caused by human interruption and play a vital rule to establish sustainable environmental gains in Asian catchments. The CAT model has been tested and verified from small to large size catchments in Korea (Birhanu et al., 2018; Jang et al., 2016). In addition, it was applied for a small peri-urban catchment in U.K. (Miller et al., 2014) and paddy irrigation area in Thailand. The model conceptualization and development is based on single layered unconfined aquifers assumptions. The Darcy–Weisbach equation is used to compute the groundwater movement. The rainfall-runoff process depends on the response of pervious, impervious and paddy areas. The infiltration can be simulated using Green-Ampt, Rainfall Excess, and Horton equations. The Kinematic Wave, Muskingum-Cunge and Muskingum methods are implemented for channel routing. The recent model is upgraded to CAT version 3.0, it integrates GIS pre-processor that allows extracting physical parameters and catchment characteristics from DEM, land use and soil map. In addition, it allows estimating potential evapotranspiration other than Penman-Monteith equation using the Blaney-Criddle, Hamon, Turc, Hargreaves methods. The upgraded model was released in May 2018 (watercycle.kict.re.kr) and several conceptual lumped models (GR4J, GSM, HBV, SYMHYD, TANK, TPHM) including PEST parameter optimization is integrated. The integration of multiple model structures with PEST optimization algorithm enables the user to implement a simple model structure for areas with limited data and facilitates the calibration process.

Acknowledgments: This research is supported by the Research Program (20190101-001) of Korea Institute of Civil Engineering & Building Technology and by the Korea Environmental Industry & Technology Institute (KEITI) grant funded by the Ministry of Environment (Grant 18AWMP-B083066-05).

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