Calibration and Application of LUOM (Luo 2007) in Southern Guam Watersheds with and without Flow Data

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Principal Investigators:
Charles Luo and Shahram Khosrowpanah

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The Large-scale, Unified and Optimization Model, LUOM (Luo, 2007) is a fully physically based, 2-dimensionally distributed watershed model simulating the hydrologic cycle on a watershed scale. The model discretizes the watershed into rectangular grid cells and makes use of spatial distributed GIS (Geographic Information Systems) data such as DEM (Digital Elevation Model), vegetation, soil and aquifer data. The model comprises of a series of sub-models for climate data distribution, evapotranspiration, infiltration, groundwater, surface flow, etc. The surface flow sub-model solves the two-dimensional Saint Venant equations. Making use of climate input data, mainly precipitation, temperature and wind speed, the model is able to generate not only one-dimensional output – discharge hydrographs, but also two-dimensional hydrologic quantities such as evapotranspiration, infiltration, soil moisture, groundwater table and surface water depth. Simulating impacts of land use (vegetation) transformation and global climate changes are within the model's capability.

In southern Guam, there are some watersheds with both rainfall and flow gages. But some other watersheds have only rainfall gages but no flow gages. In these watersheds without a flow gage, it is obviously difficult to carry out watershed management studies which require flow data. Even in some those watersheds with a flow gage, the flow gage is not always located at the watershed outlet but a distance upstream of the outlet.

The objective of this research is to calibrate the LUOM (Luo, 2007) in a watershed with both rainfall and flow gages such as Ugum Watershed. Then to apply the calibrated model to those watersheds without a stream flow gage or the whole watershed that the flow gage is not located at the outlet. The application of the calibrated model will generate hydrographs for the whole watershed.

The benefits of this project will be enormous not only to Guam but also to other island in Western Pacific. Researchers will be able to implement various watershed management practices within the watershed. For example, by having flow data, researchers could develop a correlation between stream flow, rainfall, and turbidity at various section of a watershed for studying the impact of various watershed management practices. The model will benefit to Agencies such as Guam Water Authority (GWA) for exploring potential sources of drinking water in Southern Guam. As mentioned earlier, there are 16 streams that are not gauged; by having flow data, potential sites for developing drinking water supply such as construction of small dam will be identified.