Geophysical Research Abstracts
Vol. 17, EGU2015-10403, 2015
EGU General Assembly 2015

A physical interpretation of hydrologic model complexity

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It is intuitive that instability of hydrological system representation, in the sense of how perturbations in input forcings translate into perturbation in a hydrologic response, may depend on its hydrological characteristics. Responses of unstable systems are thus complex to model. We interpret complexity in this context and define complexity as a measure of instability in hydrological system representation. We provide algorithms to quantify model complexity in this context. We use Sacramento soil moisture accounting model (SAC-SMA) parameterized for MOPEX basins and quantify complexities of corresponding models. Relationships between hydrologic characteristics of MOPEX basins such as location, precipitation seasonality index, slope, hydrologic ratios, saturated hydraulic conductivity and NDVI and respective model complexities are then investigated. We hypothesize that complexities of basin specific SAC-SMA models correspond to aforementioned hydrologic characteristics, thereby suggesting that model complexity, in the context presented here, may have a physical interpretation.