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A model for the AgES (Agricultural Ecosystems Services): Concepts of simplicity versus complexity in representing spatially explicit soil-water-plant processes

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A model for the AgES (Agricultural Ecosystems Services): Concepts of simplicity versus complexity in representing spatially explicit soil-water-plant processes

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Abstract: Despite the availability of interchangeable components in flexible modeling frameworks, we tend to avoid developing multiple customized models due to human limitations of managing multiple code bases, documenting different but similar models, deploying custom user interfaces, and institutional constraints on model maintenance and deployment. Thus, models grow larger and more complex as features are added for new applications. The objective of this project is to develop and deploy an adaptable model to simulate agro-ecosystems in a range of environments, while balancing simplicity versus complexity. Two facets of this balance are: 1) making process computations as simple and efficient as possible to capture environmental responses, and 2) providing appropriate complexity of the model parameters and process simulations to capture the desired features in space and time. Simplicity of use is desired even when the underlying model is very complex. The Agricultural Ecosystems Services (AgES) distributed watershed model was developed as a component-based model. Here, we demonstrate a few applications of AgES to watershed studies in semi-arid Colorado, sub-humid Iowa and tropical Brazil. AgES is used to simulate space-time patterns of soil moisture and infrequent runoff events in Colorado, tile drainage contributing to high nitrate loads in Iowa, and to assess reforestation scenarios in Minas Gerais, Brazil. These watersheds (56 ha to 581 km²) provide comparative studies to address model parameter complexity across various scales with different types of data and levels of spatial information. Other presentations will address aspects of AgES deployment as an internet service, advances in crop model development, and web tools for watershed delineation and data provisioning.

(259 words)

Keywords: Watershed modeling; Ecosystems services; Landuse; Model complexity; Streamflow; Surface runoff; Soil moisture; Nitrate loads.