

Group 5: National Water Model

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Key Features and Capabilities/Differences from currently available models

- National scale prediction of GW stores (soil to bedrock) surface storage in rivers, lakes, wetlands and reservoirs (in addition to soil moisture storage), glacier water storage and melt. (Get water balance/stores right)
- Groundwater, surface water and soil fluxes (everywhere). Need surface/groundwater interactions. Lateral communication between grid cells essential.
- Water quality constituents/sediments in GW, SW, soil water.
- Need active, physically based vegetation component (veg/surface energetics).
- Incorporate built environment and human demand/extraction of water (water management).
- Direct and indirect coupling with atmospheric and ocean models.
- Multi-scale framework. Up-scaling and down-scaling water balance from scale where can validate/observe to smaller and larger scales. Major need for nested models for hydrology.
- Incorporate data assimilation (remote sensing and in situ data). Use for short-term prediction and/or model diagnostics. Also for parameter estimation for retrospective analyses.
- Scale: continental US and adjoining watersheds
- Major difference with existing modeling efforts is consistency across the nation.

Application: Understanding hydrologic variability and change at a national level

- Provide info to IPCC scenarios and assessments. E.g. Impacts on national soil moisture stores, groundwater stores, river and reservoir stores, ice packs, freshwater storage in the great lakes, river flows, coastal inundation, salt water intrusion into coastal rivers and aquifers, gulf hypoxia... national scale water availability for drinking water, agriculture, ecosystems.
- Drought prediction, reconstruction; Impacts of land use change, climate change, water management on regional hydrology (e.g. large scale floods).
- Water Quality/sediment transport... needed at national scale.
- Evaluate national scale impacts of national water policy.
- Need to decide.. are we modeling for knowledge, education, policy. Are we looking to examine sensitivities to forcings, parameters etc., or to build a predictive model... unresolved.
- How does it pertain to the guy on the street? Have to be able to sell.

Regional model development.

- Need top down and bottom up integration. Use nesting techniques that represent processes consistently at different scales so that can use BC at larger scales for smaller scales and water balance is maintained across scales. Tricky because parameters may be scale dependent.
- Models should be applicable globally/nationally but perhaps alright to use different physics in different regions where dominant processes differ. However should be consistent and is should be possible to apply same physics everywhere.
- Think about what processes we really need to coupled at the national scale (ecology, human behavior/policy models)
- Should test and verify national predictions using regional predictions.
- Discussion... do we need a model, a suite of models, or a modeling framework... unresolved.

Data Needed

- Parameters: Soils, geology, hydrostratigraphy, topo, vegetation.
- Geology/hydrostratigraphy is the biggest barrier at this time. Dynamic vegetation needed. Lake bathymetry needed. Better description of river networks and flood plains.
- Forcing data: climate/weather (precip, temp); energy fluxes (radiation); coastal/ocean BC. Radiation biggest barrier at this time
- States: soil moisture, groundwater levels, surface water levels streamflows.
- Data for parameterization and calibration will be a constraint.

Barriers

- Inertia. Inability to agree on starting point.
- Data at necessary scale.
- Complexity of models, long term code maintenance, user support, management of system.
- Lack of precedence for large groups building community models.
- Lack of precedence for academia, agencies, and private sector working together.

Recommendations for Implementation

- Start with level 0, perhaps NLDAS. Establish formal versioning structure
- Scale: continental US and adjoining watersheds
- Form working groups to take to the next version level.
 - Governance/Integration/computing group (overarching)
 - Data working group (both data inputs and data extraction/visualization)
 - Vegetation and surface energetics
 - Soils/infiltration
 - Surface/Groundwater interaction, lateral movement and transport. How to couple, different discretizations for different domains?
 - Calibration (how much physics? How much fitting?)
 - Water management/policy group
 - Data assimilation, parameter estimation, model diagnostics