Towards a Community Hydrologic Modeling Platform (CHyMP)

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Overview

- The need for community modeling in hydrology
- Status of the CUAHSI effort
- Specific needs and issues
- Recent activities
- Strategy for moving forward

The Need for Community Modeling in Hydrology

Community modeling: the development, distribution and technical support of common simulation software designed to serve the diverse needs of a community, and to be advanced through contributions from the community.

- Rich tradition in other disciplines, but less so in hydrology
- NCAR example enables a broad range of climate research, across spatial and temporal scales, for a variety of applications, and for *participation in international climate exercises such as the IPCC*
- A similar effort in hydrology will enable major advances in hydrological science that are *simply not possible in its absence*

Example science questions that require a community effort and an integrated hydrologic model

- How is fresh water distributed over and through the land surface, and how will this change over the next century?
- How does the space-time distribution of catchment water storage and flux influence patterns of ecosystem carbon and nutrient cycling
- How can water management best adapt to changes in the hydrologic cycle, and what are the feedbacks across scales?

The CHyMP effort proposes to significantly accelerate the development of advanced hydrological modeling capabilities in order to address complex water issues of the highest priority at the national and international levels

The Need for Community Modeling in Hydrology

- Eliminate repetition: stop ‘recreating the wheel’ and *spend more time on science*
- Enables *integrated modeling and new science* that cannot be done without it
- Can greatly *enhance integrated water management*, policy/ decision support

Without community hydrologic modeling, simulation tools will remain fragmented by and within disciplines or in the proprietary domain of the author.

CHyMP status report

- In the ‘workshop’ and community engagement phase
  - defining ‘what is it’ and determining ‘why we need it’
  - identifying the needs and requirements and soliciting feedback through community engagement
  - articulating science and implementation strategies
- First CHyMP ‘scoping’ workshop, 26-27 March 2008, Washington, DC
- OpenMI Workshop, 7-10 April 2008, Wallingford, England
- CMWR2008 Session, 6-10 July 2008, San Francisco, CA
- STC pre-proposal for National Center for Hydrologic Modeling submitted, 14 October 2008
- AGU Fall Meeting 2008 Community Modeling session, 19 December 2008, San Francisco, CA
- Formation of CSDMS Hydrology Focus Research Group to advise and liaise with CSDMS
  - First meeting 20-21 January 2009, Boulder, CO
- Release of ‘Rationale Report,’ March 2009 (tentative)
- Second CHyMP ‘science’ workshop, 31 March – 1 April 2009, Memphis, TN
- Third CHyMP ‘implementation’ workshop and Science Plan, Implementation Plan to follow

Specific needs and issues

- Ties to and compatibility with other CUAHSI activities
  - Data Federation, HMF, Synthesis, E & O
  - Design for WATERS Network
- Engagement of other community modeling efforts such as CSDMS, NCAR, USGS, NOAA, NASA, DoE, OpenWEB, etc.
- Links to other disciplines, e.g. ecology, climate, biogeochemisty, social sciences
- Portable to HPC/Scalable

Specific needs and issues

CHyMP effort

- Platform of modular components that can be linked together to form integrated water cycle models and implemented across scales

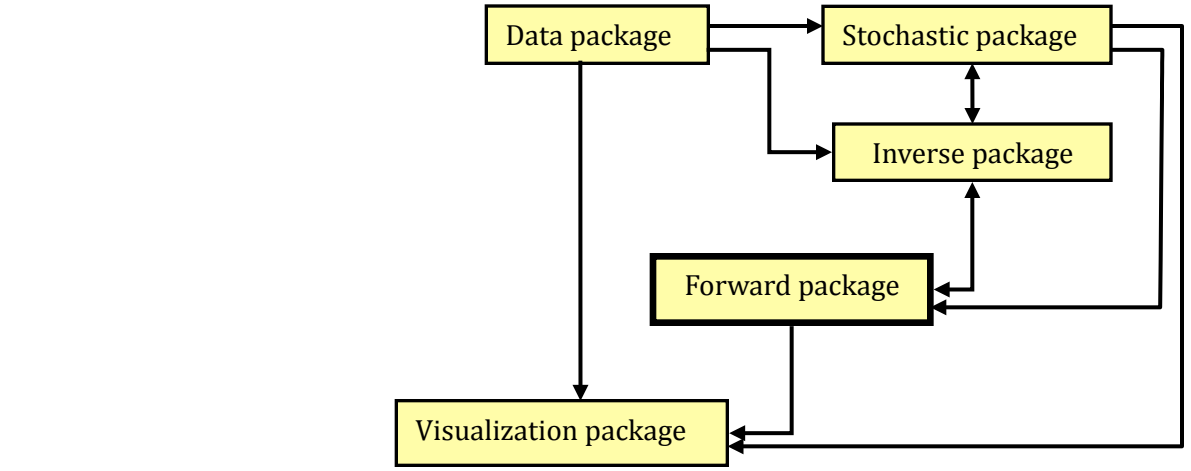
- Regional and National Integrated Water Models

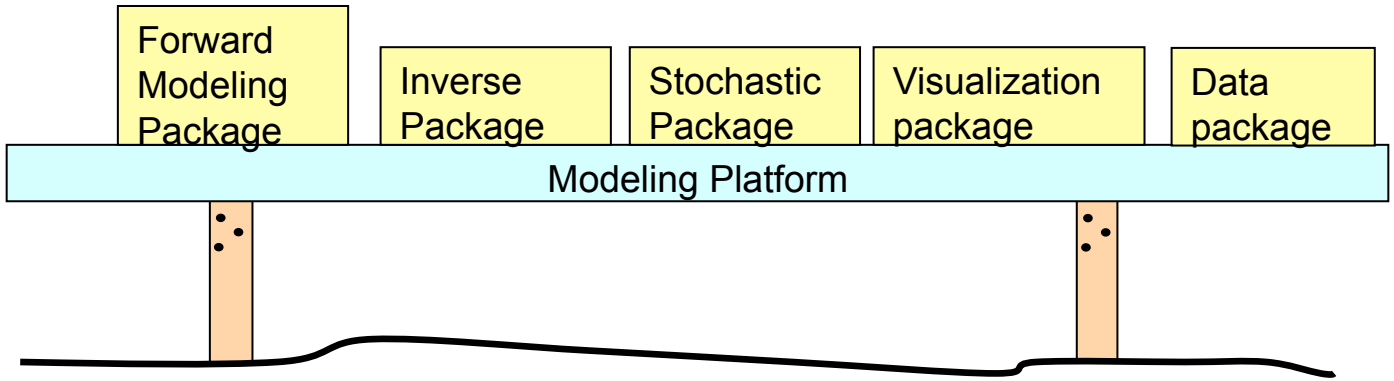
- Community engagement and input through working groups and annual meetings – NCAR model?

Specific needs and issues

1. **Physics: Represent physics associated with all fresh water**
   Ground water, vadose, streams, lakes, estuaries, glaciers, snow, etc.
2. **Other Processes: Flexibility to represent many physical, chemical and biological processes**
   from biology, ecology, environmental engineering, geomorphology, economics, etc.
3. **Scale: Accommodate parameters and physics over a wide range of scales**
   Pores to continents; methods to up-scale and down-scale parameters.
4. **Other Domains: Couple with Ocean and Atmospheric Circulation Models**
   Entire hydrologic cycle
5. **Data: Exchange data with Hydrologic Information System**
   Get data for calibration, store results
6. **Calibration and optimization**
   Model parameters and uncertainty from large data sets, management strategies
7. **Stochastic: Include stochastic processes, data analyses**
   Parameter distributions, transition probabilities, networks, Monte Carlo, geostatistics
8. **HPC: Execute simulations on single, or many parallel processors**
   Middleware for seamless application
9. **Visualization**
   Display data to maximize insights
10. **Interface**
    Easy to use, learn, teach

Specific needs and issues





CHyMP Scoping Workshop

26-27 March, 2008, Washington, DC