Group 3 – Hydrology and Sedimentology

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What types of hydrology/sedimentology applications need petascale computing resources?

- **Fast turn around end-to-end prediction**

  - For example, flash flood forecasting that combines ensemble weather/hydrologic forecasting at high resolution
- **Long simulation**

  - Earth system simulations, water/carbon budgets, sediment simulations
- **High resolution**

  - What is the role of high resolution land surface processes in global cloud resolving model? Is it needed for improved simulation of convection?

  - Need high resolution simulations to understand cross scale issues and develop subgrid parameterizations
- **High complexity**

  - Water, carbon, and chemical budget for major river basins including surface/groundwater, carbon, biogeochemistry

  - Coupling of earth system components including atmosphere, dynamic vegetation, biogeochemistry, and coastal zone to improve earth system predictions at seasonal to decadal time scales

  - Simulate fluids in crustal region; sediment transport into delta regions
- **Data assimilation and data manipulation**

  - Assimilation of remote sensing data and other heterogeneous datasets to produce an accurate estimate of land surface states at high spatial resolution

What does the hydrology/sedimentology community need to do to take advantage of the PCG?

- Science drivers for many hydrologic applications are there, but some models (e.g., sediments) are not quite ready
- Hydrologic processes require accurate inputs such as precipitation, which may not be readily provided with sufficient accuracy spatially/temporally, or with sufficiently long historical records
- The hydrologic community has not embraced the concept of community models. Individual group efforts need to be consolidated to take advantage of PCG
- Diverse and large datasets need to be tapped to advance modeling and data assimilation
- Current data assimilation and modeling may not require petascale computing. The community needs to better define science drivers and visions, and provide compelling examples/justifications
- Need more interactions with other communities to define needs and requirements and foster collaborations (e.g., coastal zone modelers, marine geologists, oil/energy industry)

1. How to structure a coordinated geoscience enterprise to address your needs

- The hydrologic community can make better use of Track 2 and Track 3 resources currently and in the next 3 years
- Need leadership/coordination to develop vision and take advantage of petascale computing in 5 years

2. What are the key attributes of the collaboratory infrastructure systems?

- Community models
- Community datasets
- Need to include not just domain scientists and computer scientists, but also users, stakeholders, and social scientists, as human dimension (e.g., land and water management) is a very important driver. Cohesion among people is as important as hardware
- Develop interactions with CUAHSI to broaden the vision – currently CUAHSI has focused more on infrastructure of the Hydrologic Information System (data archival, access)
- Infrastructure to handle very high resolution data (e.g., GIS data, Lidar topographic data), heterogeneous datasets across different locations – need TERAGRID