Cyberinfrastructure and Numerics:

Strategic Plan 2013-1017

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Research interests of Cyber WG members present at CSDMS 2.0

- Central scientific application around which our efforts can crystallize: Computational fluid dynamics and sediment transport
- Have available a suite of sophisticated computational codes to cover range of length scales: Grain-scale code (Biegert, Borden and Meiburg), Open Foam including particles (Schmeeckle, Liu, Hsu), TURBINS (Nasr-Azadani and Meiburg), TURBINS-LES (Radhakrishnan and Meiburg), Delft 3D (Jagers), ROMS (Arango).
- Expertise on Cyberinfrastructure: software componentization, coupling, interoperability, standards, semantics, algorithms, databases, social networks, hardware …
- Possible extension to ecology: coupling of fluid dynamics/sediment transport with vegetation, larvae transport, transport of nutrients and pollutants …

Key directions and long-term goals

- Make existing models accessible and useful to the widest possible community
- Create legacy databases that can benefit wide research community
- Develop nested models to address multiscale phenomena
- Help improve capabilities of reduced complexity models
- Uncertainty quantification
- Perform model inter-comparisons
- Develop strong ties with EarthCube (Scott Peckham, Boyana Norris, Anna Kelbert)

Medium term goals

- Perform model inter-comparisons between TURBINS, Open Foam, LES, RANS models for a few canonical sediment transport problems
- Target one or two of the above codes for creating demo examples of computational models and databases that address the needs of the community, such as:
  - Standardized way of accessing models/databases
  - Easy access even from developing countries (outreach)
  - Databases need to be interoperable ("internet of things")
  - Ability to query datasets for various quantities (velocities, sediment concentrations etc.) at arbitrary locations
  - Allow for easy visualization of databases

Medium term goals (cont'd)

- Accommodate large data files (bring model to the data, instead of the other way around?)
- Searchable in automated fashion (semantics)
- Ability to feed real-life data into ongoing simulations (such as updated rainfall statistics)
- Employ social networking tools to build user communities, track user experience, create discussion forums (Google groups)

- Continue to provide Python, MATLAB, Octave clinics, offer Q&A sessions, post on YouTube
- Create systematic infrastructure for performing model comparisons

“Earth-on-a-Chip:”

Advanced modeling concepts in support of the environment, water and energy resources