Applications of CSDMS:

Needs: 2-3 proof-of-concept problems that illustrate the power of coupled models

To get there: We need prototype models that can treat one or more of the following coupled process domains within Earth surface processes:

- Glacial-fluvial transition
- Hillslope-channel transition
- Valley-floor channel-groundwater aquifer transition

Between-discipline couplings:

- Surface-atmosphere (eolian landform evolution models, orographic-erosion models)
- Rock deformation-fluvial system coupling (Willett-style models, CHILD with COULOMB3D)
- Landscape processes and ecology (river morphodynamics and aquatic/riparian ecology)

Conceptual frameworks for getting off the ground:

- Model intercomparison, i.e. pick a test problem and let developers "compete" to get the best results. The goal is not necessarily to solve the science problem but to improve the models that get folks collaborating more.
- Collaborations with CZOs and other data-rich consortia.

Datasets:

- LIDAR/other DEM
- Constraints on surface ages, strat ages, and erosion rates
- Climate, hydro, and atmo data
- Material properties
- Sedimentary basin records

Validation:

- Morphology
- Time series of efflux
- Automatic calibration methods (MCMC)

<u>Example problems:</u>

Glacial-fluvial transition:

- mass balance of sediment over glacial-interglacial cycles, terrace generation etc.

Hillslope-channel transition (w/ veg capability):

- post-fire erosion
- alluvial fan aggradation via Plio-Q climate cycles

Channel-aquifer transition:

- gaining and losing streams, groundwater sources, arroyo cutting in the SW

Lithosphere-fluvial coupling:

- mountain belts (Sierra Nevada, Southern Alps, Himalaya etc.)

Favorites (at least one within-terrestrial and one that reaches out)

- post-fire erosion (rich data along San Gabe front and Front Range 2002? fires) components: hillslope-channel model that does rainfall-runoff-sedflux. Interesting potential for long-term assessment (climate change/pine beetle/erosion/water quality etc.). These models will be highly parameterized because we do not fully understand how fire changes surface properties.
- Terrestrial-to-marine coupling over geologic time scales (Eel River to shelf). e.g. CHILD to SEDFLUX. This sort of coupling can also be done currently with simpler 2D models as a "fall back".
- GCM to landscape evolution model (e.g. impact of future change in mean runoff and variation to erosion, flood potential, etc….) Long term: vegetation, hydro, and dust all feedback to climate. Short term: one way input of GCM to landscape. Could include glacier advance/retreat. Data is a component, so the coupling of GCM model output to a landscape model is, in itself, a technical challenge.

Larger conceptual themes:

- Landscape as a low-pass filter

Action items:

- Provide guidance to integration facility on coupling priorities
- Identify specific data-rich field sites and collect data that can be used to run/validate models in each of these "favorite" themes.