CSDMS

COMMUNITY SURFACE DYNAMICS MODELING SYSTEM

Organizing Pop-ups and Breakout Groups

TERRESTRIAL WORKING GROUP GOALS
2008 Strategic Plan

Year 2+ (2008/09+) goals:

- **Evaluate the state-of the-art** in understanding sediment-transport processes that fall within the terrestrial domain … identifying existing models, research needs, and areas where models (and perhaps also data and process understanding) are missing …
- Develop a set of **criteria for proof-of-concept applications** ...
- Identify potential **proof-of-concept applications and data sets**.
- **Stimulate proposals** from the community for projects that will address important science questions while completing steps necessary for realizing the overall goals of CSDMS … encourage proposals for integration of at least two different landscape-scale models within the CSDMS framework … comparison of models within a unified framework should analyze and explicate different model predictions in the context of existing data sets.
- Create a **prioritized list of computational infrastructure needs** as relates to terrestrial process modeling and interface with coastal and marine environments ...
- Stimulate the beginnings of **self-organizing collaborative teams** …
- Define and prioritize **educational needs training** in … CSDMS framework.

Proposed breakout groups

1. **Scoping** the state of the art and identifying key ingredients of first-generation model
2. **Model development:** identifying major design issues and developing strategies to address them
3. **Applications**: identifying criteria and data sets for model testing and proof-of-concept

SCOPING

model ingredients & state of the art

- What should a first-generation terrestrial model look like?
- What are the key processes that should be included in a basic/generic model?
- What is the state of knowledge, and where are the gaps?
- What existing models can be adapted?

	In the dark	Faint flame	Lighthouse	Sunshine	Enlightenment
Quantitative framework	None	A few straw-man expressions based on intuition	Multiple competing hypotheses based on observations and measurements	Widely accepted, mechanistic theory has emerged	Solved problem. Universally accepted physical principles
Calibration/validation efforts	None	Initial efforts to calibrate expressions are underway, but no real tests have been performed.	Several calibration exercises have been performed. Initial efforts to test predictions against field or laboratory data are underway.	Parameters calibrated for many scenarios. Predictions tested against multiple lab & field data by independent groups.	Moot, except for efforts to measure parameter values for specific sites
Human effort	We know it's important, but almost nobody is working on it	A handful of groups are working on it	Every other group is working on it	A few groups are working to refine the details	No need to work on it. Everyone uses it.
Existing code	None	A few in-house efforts	Many different in-house versions, a few longer-term development efforts, some distributed packages	Community models, widely available commercial packages	Shipped with textbooks
Examples [and names of existing codes/developers, if applicable]	> hillslope grain size production & comminution > large-scale development of bedrock landscapes	> debris flow incision and routing > landscape-scale glacial erosion > long-term overland flow erosion > deep-seated landsliding > chemical denudation > long-term ice sheet dynamics	> bedload transport > bedrock river incision > structural development of orogens > soil production > local (cm to m-scale) glacial erosion > river meandering > hydraulic geometry: fluvial channel width and depth > shallow landsliding > debris flow dynamics > hillslope sediment transport > fluvial sorting and patch dynamics > delta formation	> Catchment-scale groundwater flow [MODFLOW] > free-surface/open-channel flow [Delft3D, MD-SWMS] > suspended sediment transport > short-term (years) ice dynamics	> Lithospheric flexure > small-scale (meters) Darcy flow

"State of the art" table by Taylor Perron, based on discussions at Berkeley meeting

TASK =>
White paper and possibly published paper

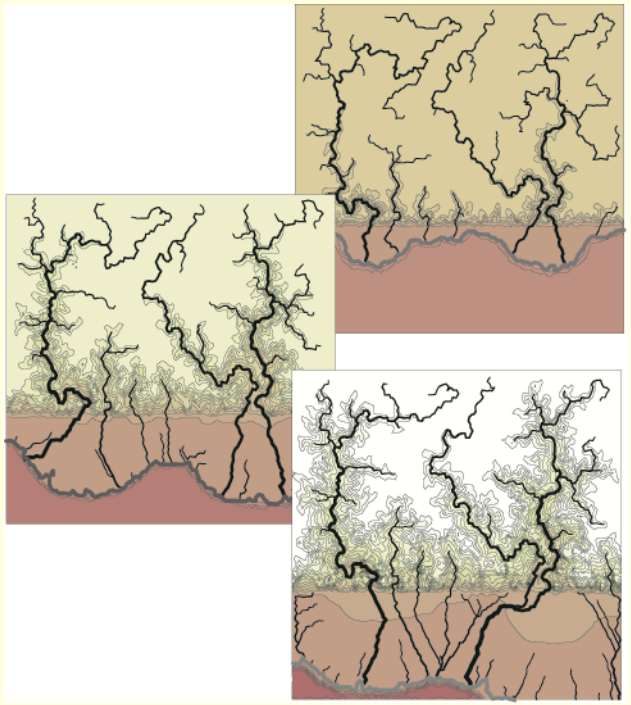
MODEL DEVELOPMENT

software design issues

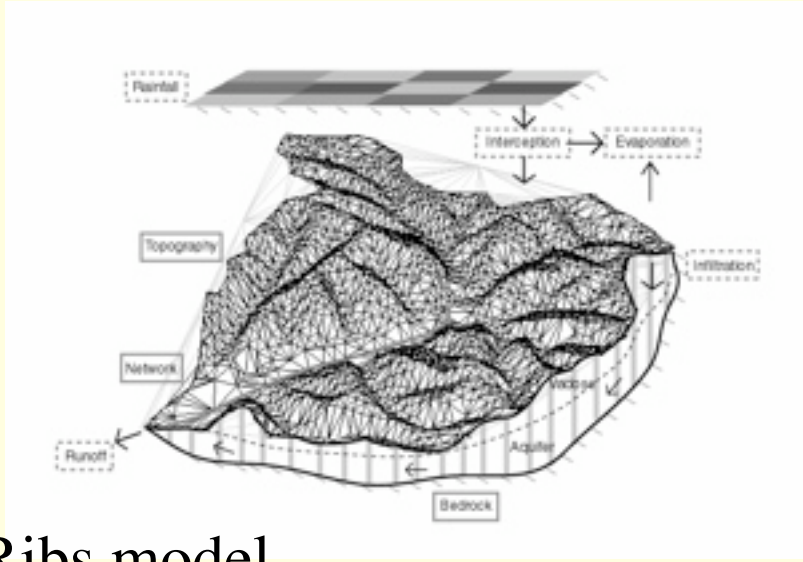
- What are key software design issues and potential barriers?
- Moving boundaries
- Terrain representation
- Stratigraphy
- Wish list & feedback for Integration Facility

Moving Boundaries

- Examples: shorelines, ice margins, mountain fronts, flood extent



Terrain Surface Grids as Generic Components



tRibs model
(Vivoni et al., 2005)

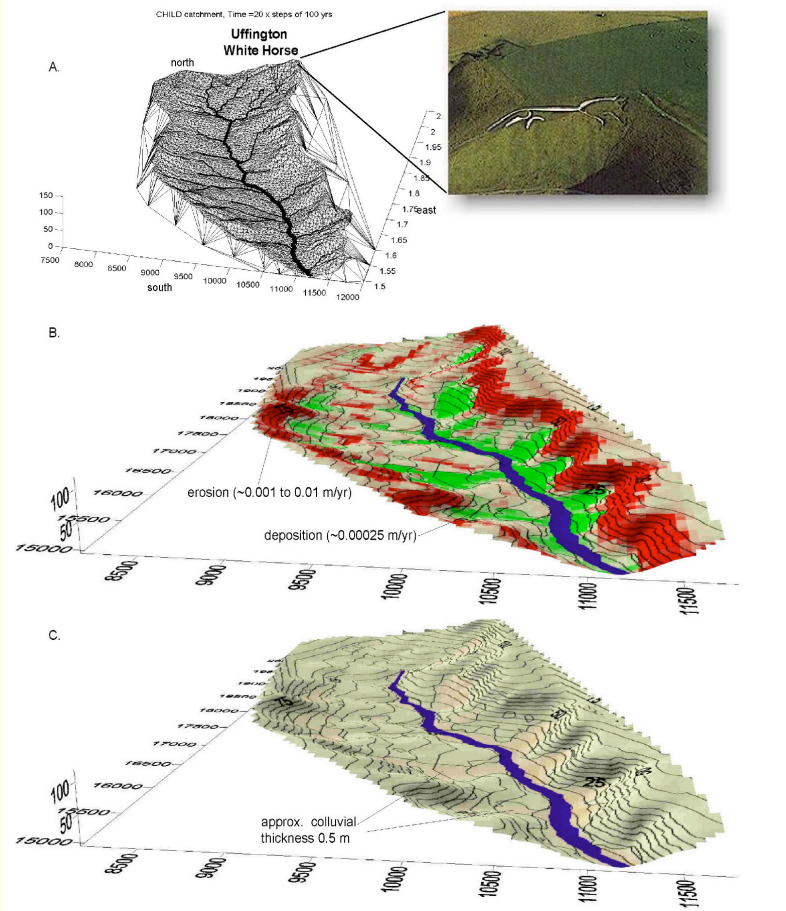
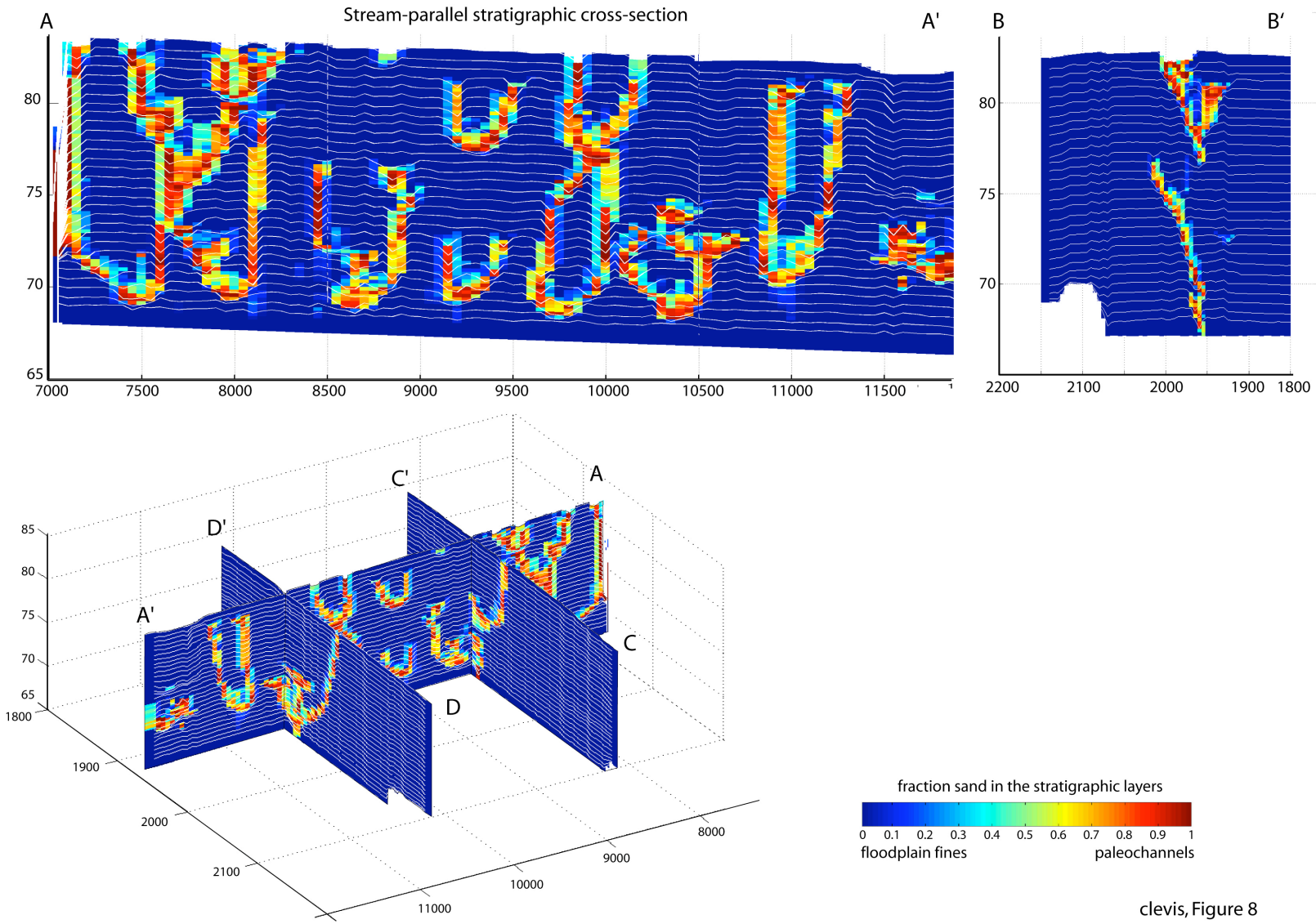


Figure 2. Examples of simulation of land clearance-induced erosion in the Weathercock/ Maddle Farm valley in the Berkshire downs. A) Computational mesh used by the model B) Erosion and depostion pattern, note that most of the eroded material is transported out of the modelled valley towards downstream floodplains. C) Accummulated alluvium in the valley after 2000 yrs of erosion.

CHILD model
(Tucker et al., 2001)

Stratigraphy



clevis, Figure 8

APPLICATIONS

data sets for testing models

- What different types of proof-of-concept application are needed?
- What are the criteria for a proof-of-concept application?
- What data sets are already available?
- What data sets are needed?
- “Grand Challenge” vs. “Proof of Concept”

CSDMS Challenge Problems
(from 2004 Science Plan)

1. Predicting the Transport and Fate of Fine Sediments and Carbon from Source to Sink
2. Sediment Dynamics in the Anthropocene
3. Tracking surface dynamics through Pleistocene glacial cycles

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