

Modeling Strategies Group

Current levels of Knowledge (Existing models):

- Conceptual models – coming from other groups
- Numerical models: list of models, what is missing? Defines gaps...

Input parameters:

Get feedback from the other groups?

Grand challenges:

Make (useful) predictions:

what predictions, on what scale in space and time?

Knowledge gaps:

- How do carbonate processes scaling: temporal/spatial, process understanding, how to choose appropriate scale?
- Non-linear dynamics
- Feedbacks between processes, extent and importance
- Heterogeneity: controls at different scales, how to reproduce heterogeneity?
- Biogenic non-stationarity

What is our goal? Where do we want to be?

10 year – STAGE 4

Numerical work-bench for carbonate knowledge generation

that:

- Has a suite of process modules [Deposition, Diagenesis, Structure/fractures]
- Accepts input from other models Ocean/Climate/etc.
- Accept observations from different sources, databases
- Has multiple inversion/verification schemes
- Multiple sensitivity/ response surface, experimental design, uncertainty quantification
- Multiple scales/scalability, nestedness, up- downscaling
- Multiple outputs (eclipse, petrel, modflo etc.)
- Influence observations (eg. Global Ocean Observatory)

Short-term (2 yr) – STAGE 1

- Sort out the responsibilities, who does what in terms of cyberinfrastructure (GUI, protocols, coupling)
- V.simple GUI frontend/backend, visualization
- Module inventory, available worldwide
 - 2 MSc, review papers
- 5-9 modules available
 - production, biogenic, inorganic, ecosystem/community
 - syndepositional processes, diss-reprecip, cementation
 - hydrodynamics (e.g. Delft3D, ROMS, cheap & cheerful)
 - sediment transport (CSDMS, SedFlux, SedFlo)
 - verification on appropriate time scales
 - +
 - +
- Establish at least 1 database for testing

- Identifying potential partners:
 - Global change community
 - Reef health community
 - Hydrology
 - Industry
 - Ecosystems
 - Geochemistry
 - Ocean-Atmosphere
 - Test tank access
- Intellectual property rights, publication policy, spec. publ. *Comp & Geosc.??*
- Start an online journal for modules and code documentation, benchmarks, where editorial board & review involves user community, look at what the CCM crowd is doing on this. Several options, special issues, special section in each issue... Before getting into the practicalities: what is it that we want? Co-authorship ?
- CSDMS: Common format transfer, Coupling
- A PhD or similar project from one of the other workgroups can lead to new data/scales that can feedback on model efforts Note: the learning/knowledge generation in this process

Intermediate term (2-3 PhDs) – STAGE 2

- Involve students from geophysics, applied math, computer science fields.
- Computational issues: grid conversion, interfaces.
- Have stage 1 modules tested, improved
- Documentation to enable informed choice of modules
- Start coupling with climate/ocean/clastic models
- Complete a comparative numerical scheme study
- Complete initial comparative verification/inverse objective cost function study
- Initial sensitivity studies
- 2 international workshops in carbonate computational issues
- Achieve “buy-in” by non-NSF funds for module development
- Ensure HPC access
- Activate partnerships

Longer term (5 postdocs) – STAGE 3

- Reality check, redefine goals
- Usage statistics – what groups – what types of application
- No. of sedimentology courses in US using carb workbench as lab tool ?
 - **Dave Budd using it**
- Publications, citations using workbench modules
- Have modules running efficiently on HPC
- Have made at least 1 useful prediction...?