ESS 524 Class #19

Highlights from last Monday –Erich
Today's highlights report when we meet next week – Shashank

Today

- Homework questions?
- Validation and Verification

- Next Week

Project oral reports (AGU style, ~10 minutes)

- Thursday June 11, 2:30

Project written reports (*GRL* or *Geology* style & length)

- Friday June 12.

Coming up

- Today – Daniel, Class #2

Reading for discussion next Wednesday (See READING tab)

- Oreskes (1994) *Science,* and comments
- Roache (1997)
- Versteeg and Malalasekara – Chapter 10, Section 10.5, *Verification and Validation*

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Higher-order schemes, colocated grids

Many general codes now use quadratic interpolation in order to evaluate velocities and pressures at the same nodes in unstructured grids, while avoiding the checkerboard patterns the arise with linear schemes.

See these papers under READING tab

- Peric et al. (1988)
- Tinnaluri and Devanuri (2015)

The paper on a structured curvilinear boundary-fitted scheme by

- Price et al. (2007)

is also posted there.

Also see Versteeg & Malalasekera, Chapter 5.9, QUICK scheme

Activities Today

Discussion topics, roughly following developments in the 2 papers.

1. What is “verification” and what is “validation”? - Shashank
https://docs.google.com/presentation/d/1G0TVr--UaK32W3raM5xvpJjbWzhWdMoVF4wFQF4pw0s/edit?usp=sharing

2. Can modeling teach us (or policymakers) anything useful, and is Oreskes guilty of Roache’s charge of “worthless semantics and effete philosophizing”? - Erich
https://docs.google.com/presentation/d/1i1HuyaqVvoA3eP6REmNf9FlusyxNbkkPpNk6Tzu6-YY/edit?usp=sharing

3. What are some practical approaches to model testing? - David
See following slides

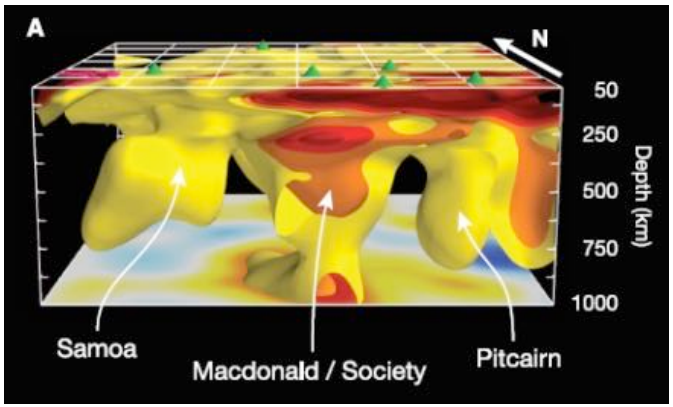
Everyone -What uncertainties are there with your project model, and what will you do to assess them?

What are some practical approaches to model testing?

- Ideally, model results would be compared to real-world results:
  - Predict it rains => it rains
  - Predict an earthquake => earthquake happens
  - Predict landslides => landslides happen
  - Predict ice flow speeds => match measured speeds
  - Predict the size of an impact crater => crater size matches
- Difficulties:
  - Getting statistically meaningful data set
  - Getting full set of data

David Moerdyk

Use scale model?



Glycerin models to model mantle plumes?

HOTSPOTS, MANTLE PLUMES, FLOOD BASALTS, AND TRUE POLAR WANDER

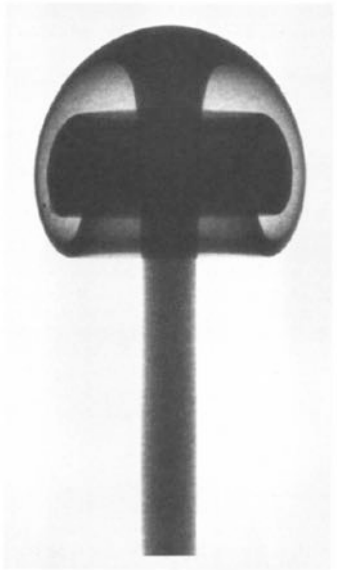


Figure 13*b*. Photograph of a starting thermal plume formed by injection of hot, dyed glucose into a tank of cooler, clear glucose [from *Griffiths and Campbell*, 1990].

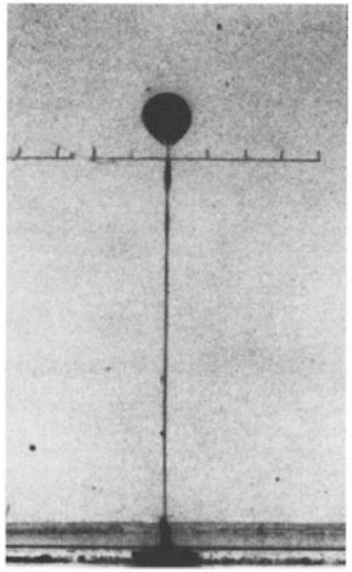


Figure 13*a*. Photograph of a plume head followed by a trailing conduit. The plume is formed by injection of water (colored with red dye) at a constant rate into the bottom of a large tank of glucose.

Pulsating dynamics of thermal plumes and its implications for multiple eruption events in the Deccan Traps, India

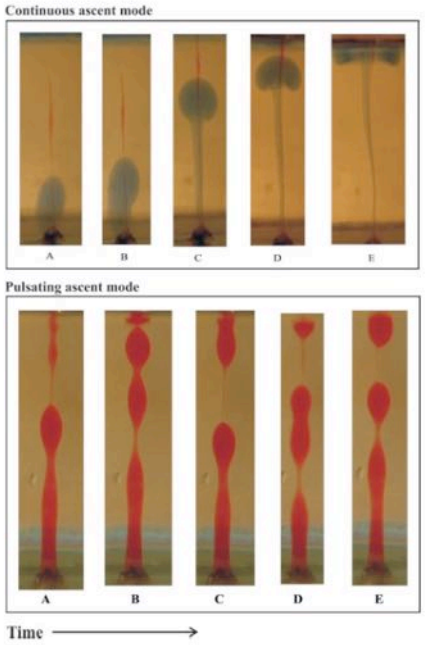


Figure 1: Development of thermal plume in analogue models - continuous (top) and pulsating (bottom) ascent dynamics. A-E denote progressive stages in each case.

Lacking Real World Validation

- Ensure material properties match tested properties.
- Review assumptions, simplifications.
- Test a wide variety of conditions
- Use real dimensions and parameters.