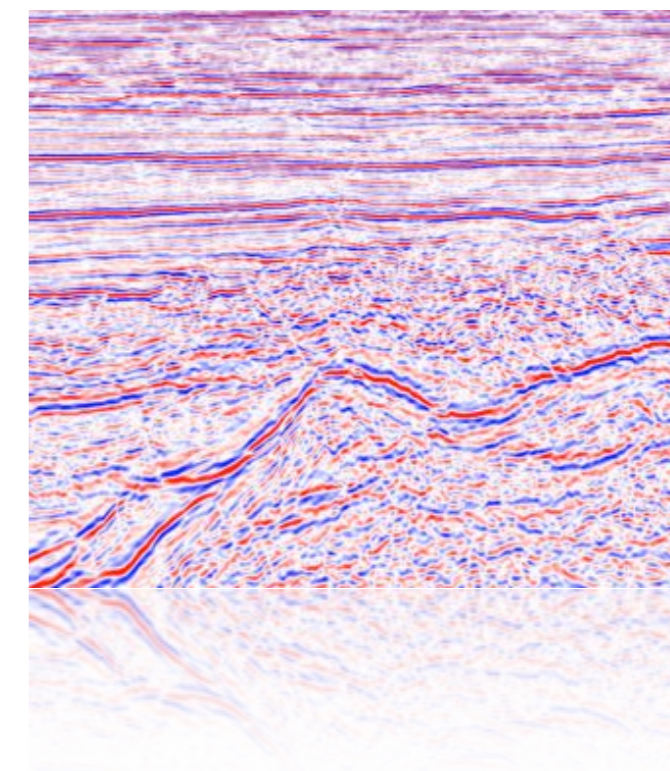# Reproducible research in computational (geo)sciences

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Motivation

- bring *reproducibility* and *peer review* to the field of computational (geo)sciences
  - make research *productive*
  - seamless integration of computational results into publications (report, journal paper, thesis, etc.)

- provide an efficient technology transfer tool
  - from student to student in a research group
 - from research group to its sponsors

Madagascar story

- start in 2003
  - Sergey Fomel, University of Texas at Austin

- release to the general public in June 2006
  - *open-source* (rsf.sourceforge.net)

- schools & workshops
  - Vancouver in August 2006
  - possible future locations include Texas, California, and Europe

- improvements committed on a *daily* basis
  - contributors around the world (including SLIM @ UBC!) and YOU could be one

Cumulative stable release downloads
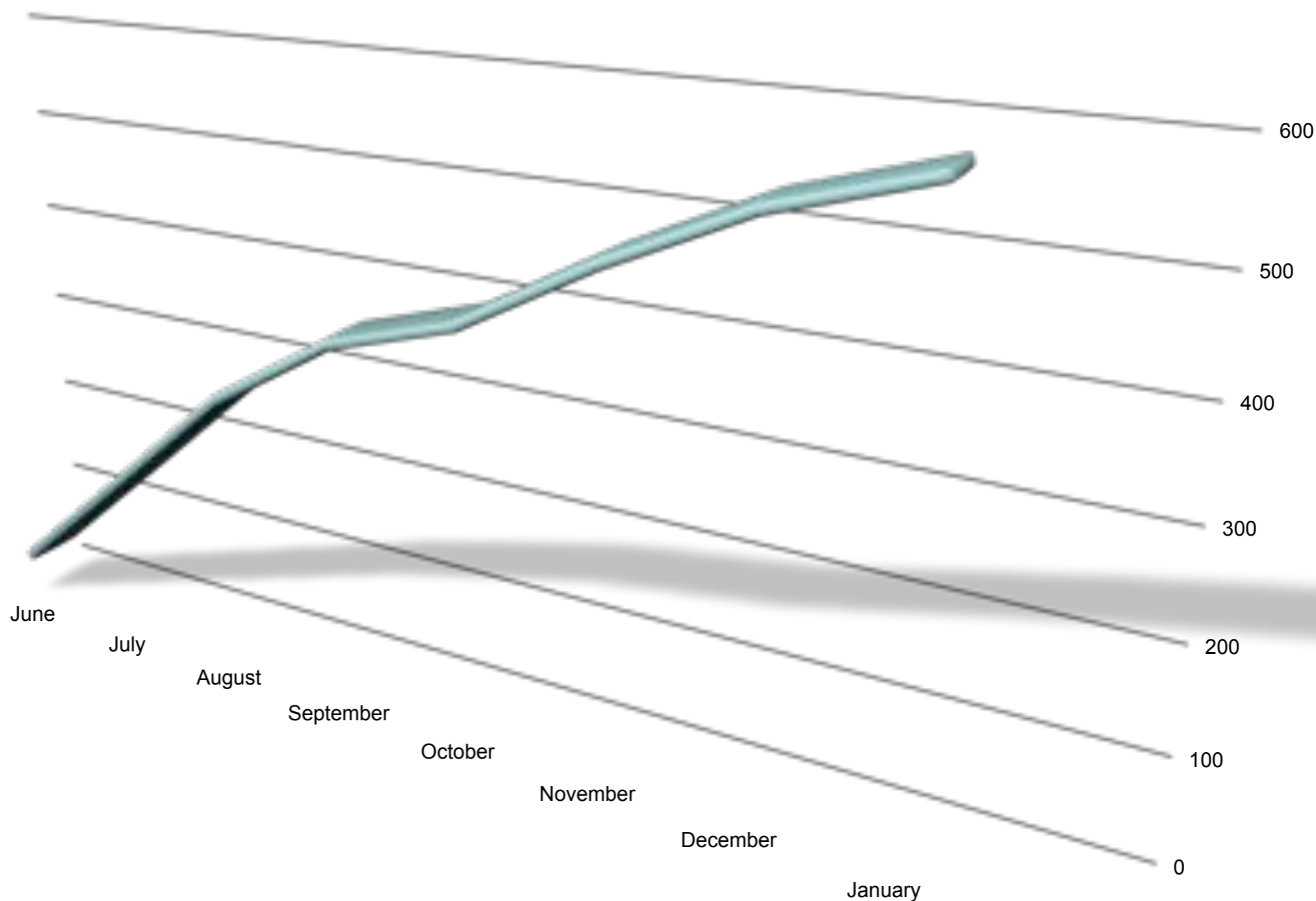
Cumulative developer version access
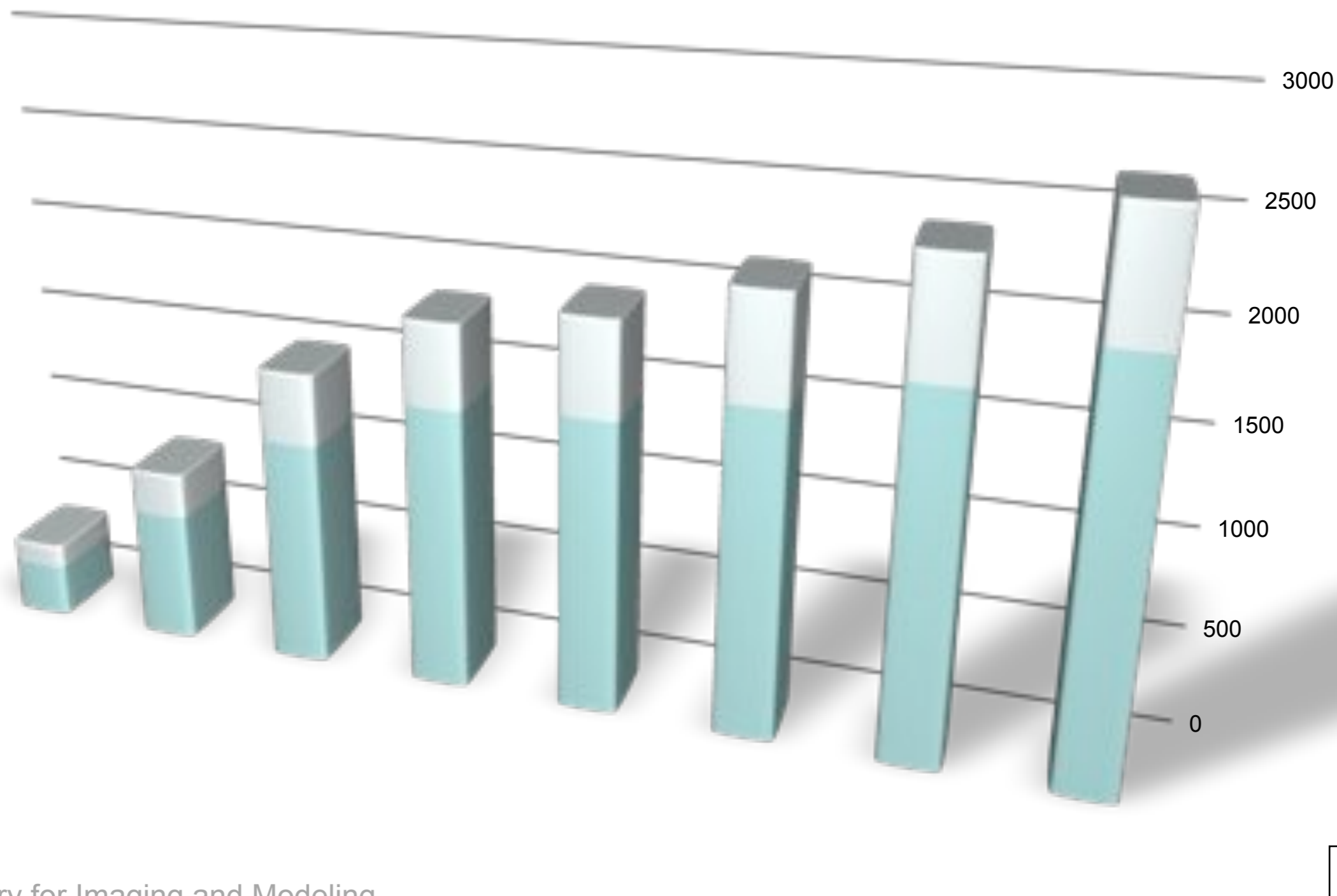
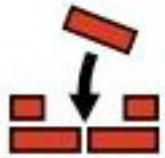# Website access locations (top 100)

Philosophy: 1-week tech transfer

Monday	get an idea
Tuesday	**implement it**
Wednesday	**test it**
Thursday	**communicate it**
Friday	attend graduate seminar...

Madagascar architecture

- 3 main levels
  - **low-level**
    - main programs/functions: typically written in C/C++, Fortran, Python, Matlab, Mathematica

  - **mid-level**
    - processing flows: written using Python and SCons
      - processing flows are numerical recipes
      - experiments become unit tests for Madagascar *test-driven development*

  - **high-level**
   - documentation: written using LaTeX and SCons

Python, SCons & Subversion

- **python** (www.python.org)
  - dynamic object-oriented programming language
  - multi-paradigm language
    - object orientation, structured programming, functional programming, and aspect-oriented programming supported
  - **very clear, readable syntax!!!**
  - cross-platform

- **SCONS** Build your software, better. (www.scons.org)
  - next-generation, cross-platform, build tool (alternative to Make)
  - written in Python
  - reliable, automatic dependency analysis
  - reliable detection of file changes using MD5 signatures (and/or time stamp)

- **SUBVERSION** (subversion.tigris.org) - optional
  - version control system

Madagascar construction

Documention (PDF & HTML)

Processing flows
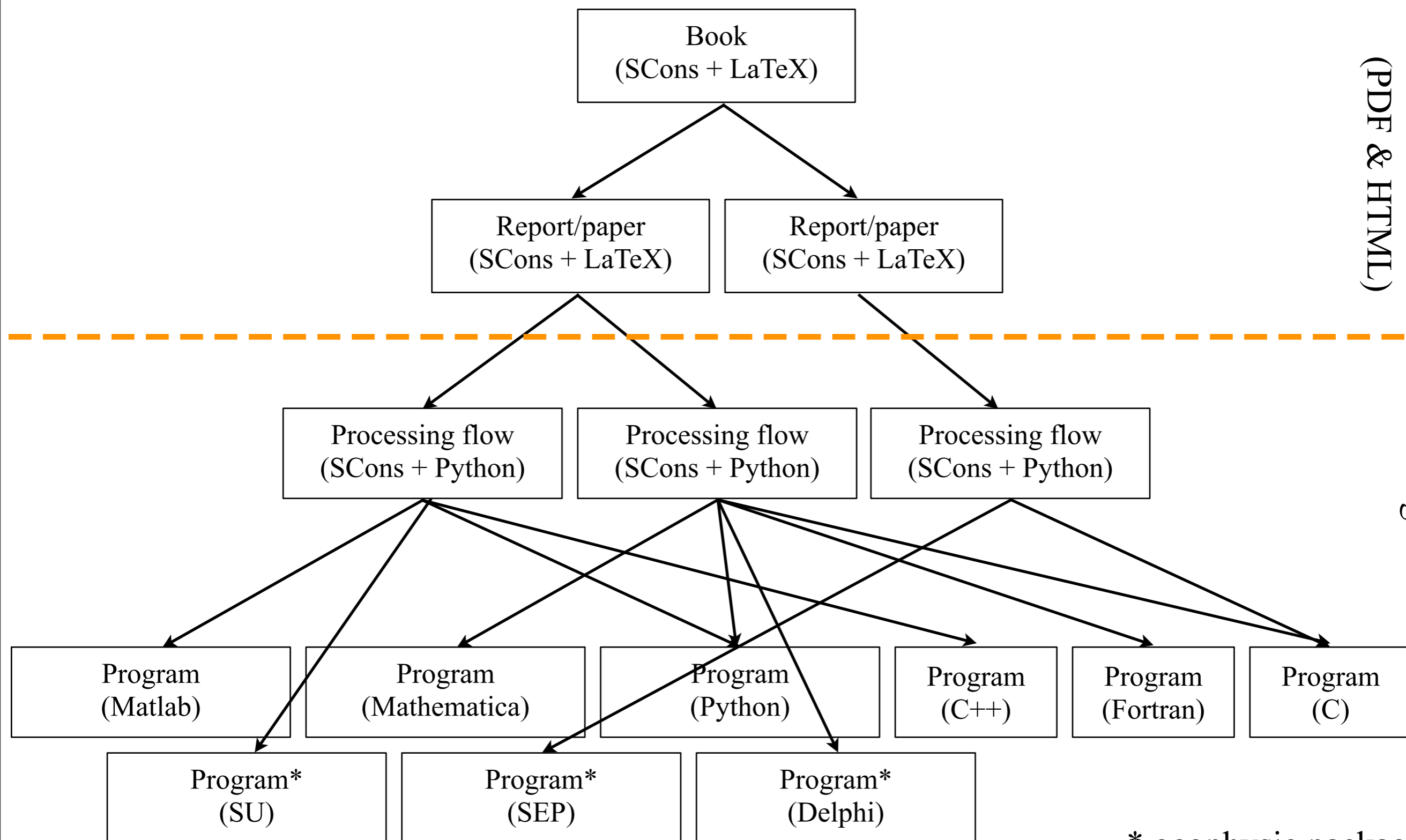
* geophysic packages

Demo...

- $RSFROOT/book/slim/rsf

Conclusions

- Madagascar
  - convenient & powerful environment for reproducible research in computational (geo)sciences

  - convenient technology transfer tool
    - seamless integration of computation results in publications (report, journal paper, thesis, etc.)

  - open-source (rsf.sourceforge.net)