## Lesson 1–1: Introduction to SAC

- i. What is SAC
- ii. History and development
- iii. Alternatives to SAC
- iv. SAC variants
- v. Requirements and installation

#### What is SAC?

- Literally, the Seismic Analysis Code
- Command line oriented tool for basic operations on time series data (usually seismic)
- Graphical interface for viewing and picking waveforms
- Graphical operations for annotating waveform plots
- QC of field oriented data: SEG-Y, MSEED, GCF

#### What (else) is SAC?

- Reads data formats used for nuclear test monitoring research (CSS and GSE)
- Provides simple scripting facility for repeating operations on different time series
- Provides interactive platform to build complex, custom-purpose analysis methods or prototyping analysis procedures

## History and development

- Developed by Los Alamos and Livermore national laboratories for nuclear testing in early 1980s; developers led by W. C. Tapley
- Fortran source code distributed to academics in ~1985 without restrictions (or support); collegial agreement to send bug fixes/improvements to developers
- In 1992 development taken over by Livermore; access increasingly restricted through distribution agreements; releases up through 10.6f
- Converted from Fortran (10.6f) to C using automatic conversion tool (f2c) in 1993-5
- Development of SAC2000 from C conversion with view to commercial sales

# History and development (contd.)

- ~1998 IRIS Consortium alarmed that access to SAC would become unaffordable for wide community use
- Negotiation with Livermore to recognize two development strands of SAC2000, with/without database for tracking all changes made to time series; intent to sell database-enabled version
- No community interest in commercial release; in Livermore support for SAC2000 withdrawn
- 2005 IRIS takes up support and development of SAC2000 (without database features)
- Fortran-based 10.6f development parallels SAC2000 to maintain feature compatibility and fix bugs in 10.6f source code (still in SAC2000)

## SAC alternatives

- gSAC rewritten version of subset of SAC commands for instructional use for time series analysis (Bob Hermann, St. Louis Univ.)
- Seismic Handler system for processing seismic array data (Klaus Stammler, formerly SZGRF Erlangen)
- AH Unix-inspired set of basic seismic operations (reading, filtering, decimation, etc.) on input stream to transform data delivered on an output stream; pipe based (T. Witte, U. Cal. Berkeley)

## SAC alternatives

- SU / Seismic Unix Unix-based program collection using pipes to link together steps for processing exploration industry data (Stockwell & Cohen, Col. School of Mines)
- SEISAN Integrated system for local and global earthquake analysis, including storage and logging of real-time telemetered data (Ottemoller, Voss & Havskov, U. Bergen Geophysics Dept.)
- MATLAB time series toolbox
- R time series library (GNU/Free software
- DIY tools in C, Fortran, Python

#### SAC variants

#### • SAC2000

- 101.4 current release; obtain source code from IRIS web site and compile
- Fortran SAC / MacSAC
  - Downloadable from G. Helffrich web site at U.
    Bristol Earth Sciences:

http://www1.gly.bris.ac.uk/~george/sac-bugs.html

 Historical releases for MacOS 10.2–10.6 available; current release (grh–106) is MacOS 10.6 only

# SAC requirements

- MacSAC Apple Mac (with or without X11)
  - download disk image and install precompiled system with MacOS installer
- SAC2000
  - Linux or FreeBSD system with X11 installed
  - Windows system with Cygwin and X11 installed
  - C compiler
  - Talent to troubleshoot compilation problems; limited help available on IRIS 'sac-help' mailing list