Statistical Seismology Science Gateway

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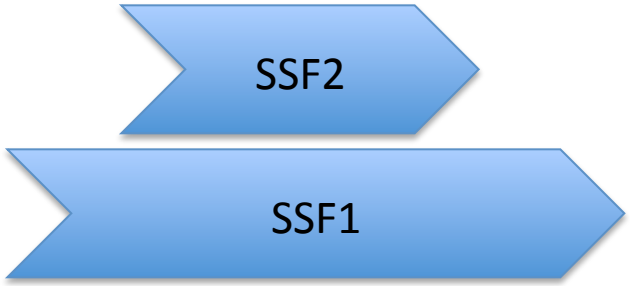
Motivation

- A complete and advanced solution for statistical seismology
- To provide, in the field of seismology, robust and effective statistical methods in order to
  - obtain more precise estimates,
  - reduce uncertainties and
  - conduct more reliable seismic hazard analysis.

Statistical Seismology Functions

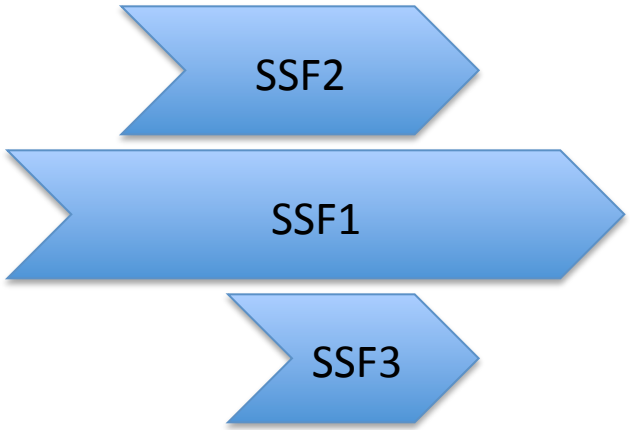
SSF1: Integration of multi-source data for increased reliability and quality

Statistical Seismology Functions



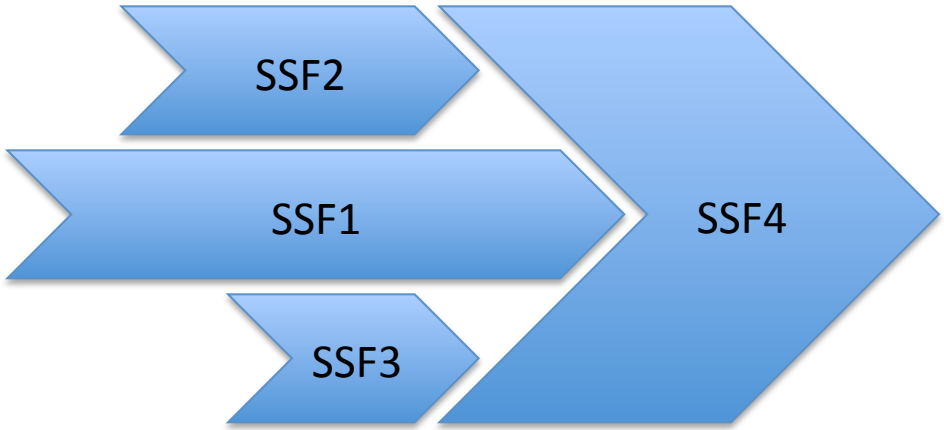
SSF2: Determination of probability distributions and their input parameters

Statistical Seismology Functions



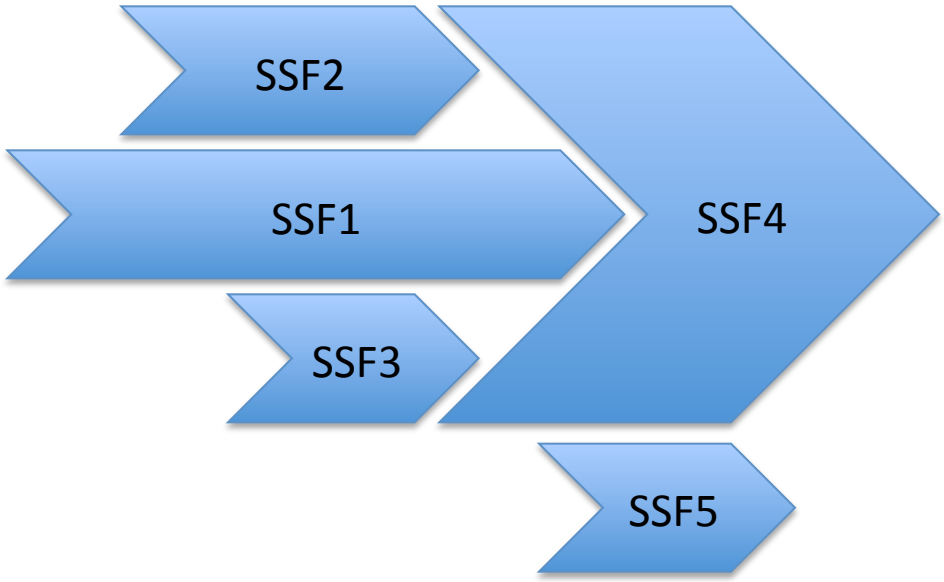
SSF3: Robust techniques for the parameter estimation in models/relations

Statistical Seismology Functions



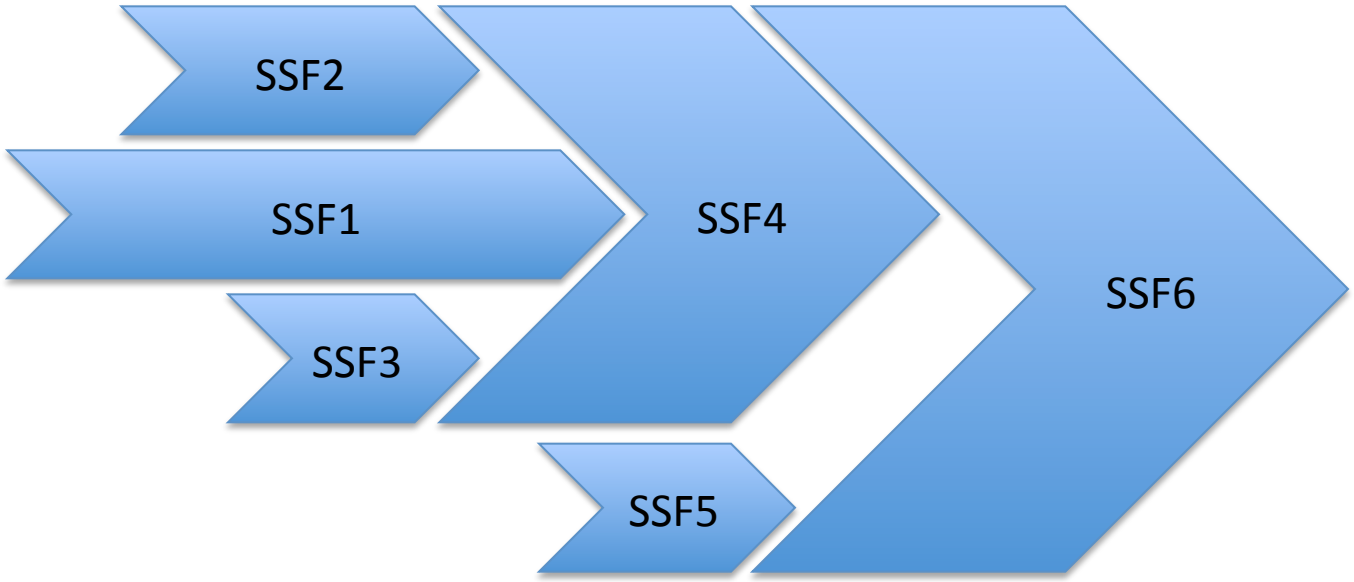
SSF4: Complex predictive modeling of earthquake phenomena in time and/or space domains

Statistical Seismology Functions



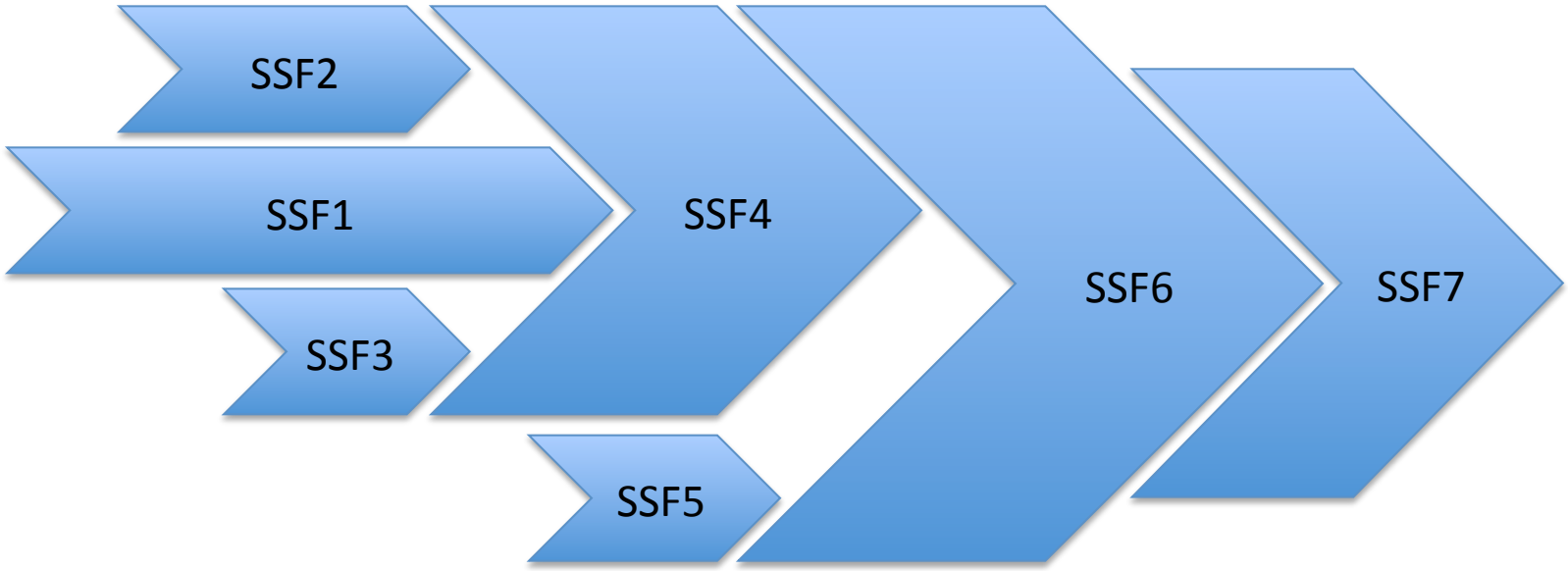
SSF5: Ground motion prediction equations

Statistical Seismology Functions



SSF6: Complex logic-tree and sensitivity analysis in probabilistic SHA

Statistical Seismology Functions



SSF7: Statistical calculations for seismic risk

Status

- A user can run any of these SSFs on a cluster or grid
  - easily through the GUI provided;
  - by calling from her/his models in FORTRAN or C/C++;
  - by embedding in her/his own workflow.

- First release is available…
  → International seismology research community is welcome to use and comment on it.
- Next release, with improvements and new features, is under development.

SSF1: Integration of multi-source data

- Integration of multi-source data for increased reliability and quality
  - Combining multiple earthquake catalogs
    - Provided by different sources (USGS, ISC, …)
    - Uploaded by the user
  - Unifying data for equivalent events with
    - Time and space windows
    - Magnitude conversion
  - Also providing information regarding the completeness of the integrated catalog
  - May apply foreshock/aftershock elimination

SSF2: Determination of PDFs and their input parameters

- Enables the users to obtain estimates for input parameters of models/relations using
  - Least squares estimation technique
  - Maximum likelihood estimation technique

SSF2 Demo

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STATISTICAL SEISMOLOGY SCIENCE GATEWAY

Welcome | Simple Use | Storage | Security | Statistics | Discussion | Help

SSS-Gateway › Welcome

STATISTICAL SEISMOLOGY SCIENCE GATEWAY

The SCI-BUS project creates a generic-purpose gateway technology that provides seamless access to major European distributed computing infrastructures including clusters, supercomputers, grids and clouds. SCI-BUS also elaborates an application-specific gateway building technology and a customisation methodology based on which user communities can easily develop their customised gateways. The gateway technology will be applied also to create application-specific gateways customised for various types of user communities ranging from astrophysics to business process modelling.

One of these application-specific gateways is the Statistical Seismology Science Gateway to provide robust and effective statistical methods in order to obtain more precise estimates, reduce uncertainties and conduct more reliable seismic hazard analysis. Hence, this science gateway aims to implement the following foremost statistical seismology functions (SSFs), reflecting the latest advances in the literature, for the international seismology community:

SSF1: Integration of multi-source data for increased reliability and quality
SSF2: Determination of probability distributions and their input parameters
SSF3: Robust techniques for the parameter estimation in models and relations
SSF4: Complex predictive modeling of earthquake phenomena in time-space domains
SSF5: Ground motion prediction equations
SSF6: Complex logic-tree and sensitivity analysis in probabilistic seismic hazard assessment
SSF7: Statistical calculations for seismic risk

These statistical seismology functions are designed to be provided on a web-based science gateway for ease of access and use, offering a choice of service levels for its users:

Simple: A user can run and get the result of any of statistical seismology functions for her/his data and parameters easily through the GUI provided.
Advanced: A user can code her/his models in a programming language (such as FORTRAN, MATLAB, Octave) calling any combination of statistical seismology functions.
Expert: A user can design and use her/his own improved workflow embedding statistical seismology functions.

The most distinctive aspect of this gateway is that all these services are made usable directly on the web, benefitting from the high computational capacity of the European infrastructures connected, in such a way that users are not required to download, install, compile or run anything on their local computers.

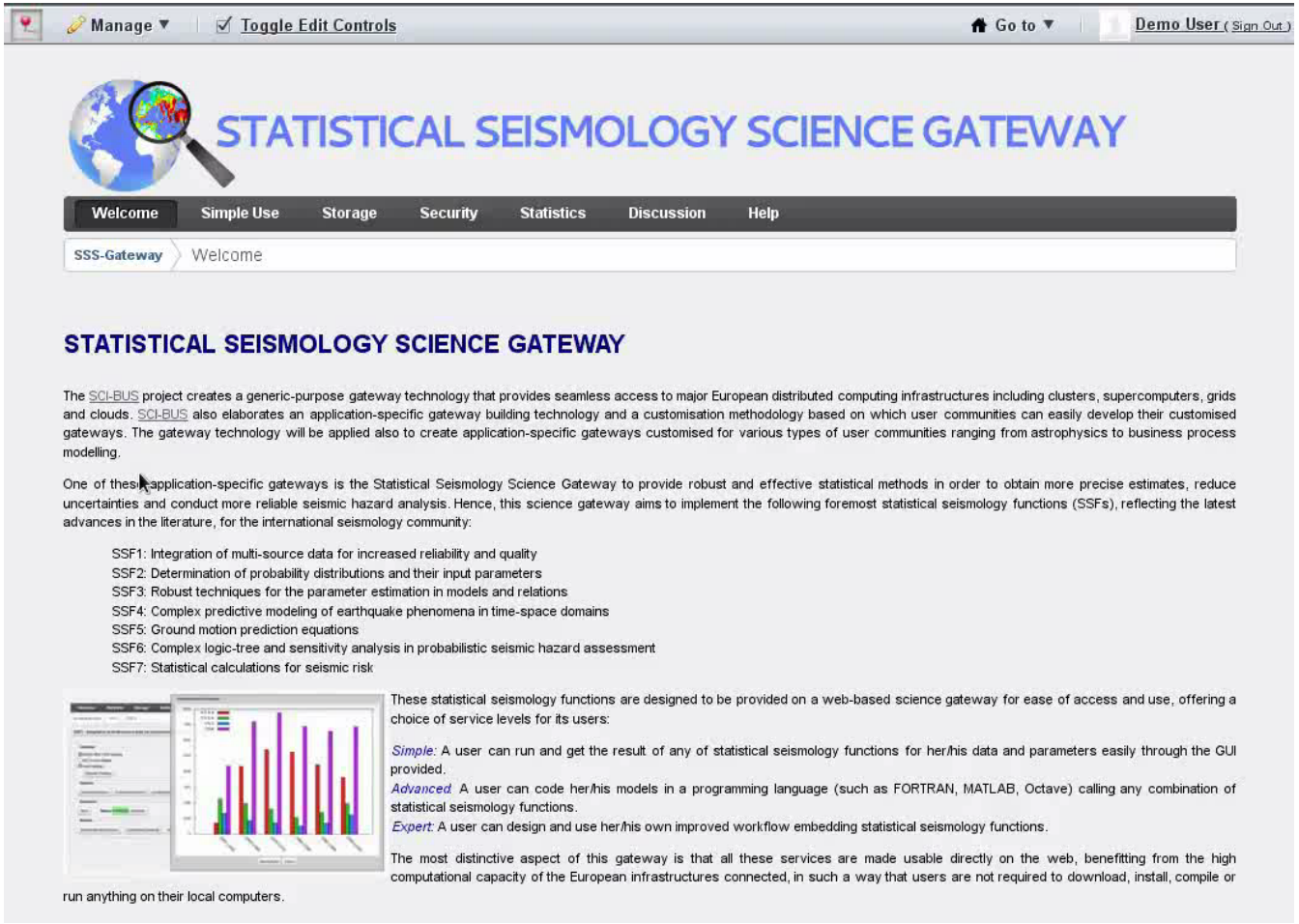
SSF3: Robust techniques for parameter estimation

- Enables the users to obtain estimates for input parameters models/relations using robust techniques, e.g. modified maximum likelihood estimation technique

SSF4: Complex predictive modeling of earthquakes

- Enables users to perform probabilistic seismic hazard analysis for a site region of interest using variety of models such as temporal (time-dependent) and time-independent earthquake occurrence models
  - Memory-less Poisson Model
  - Models with memory (Renewal model and Renewal-hybrid model)

SSF4 Demo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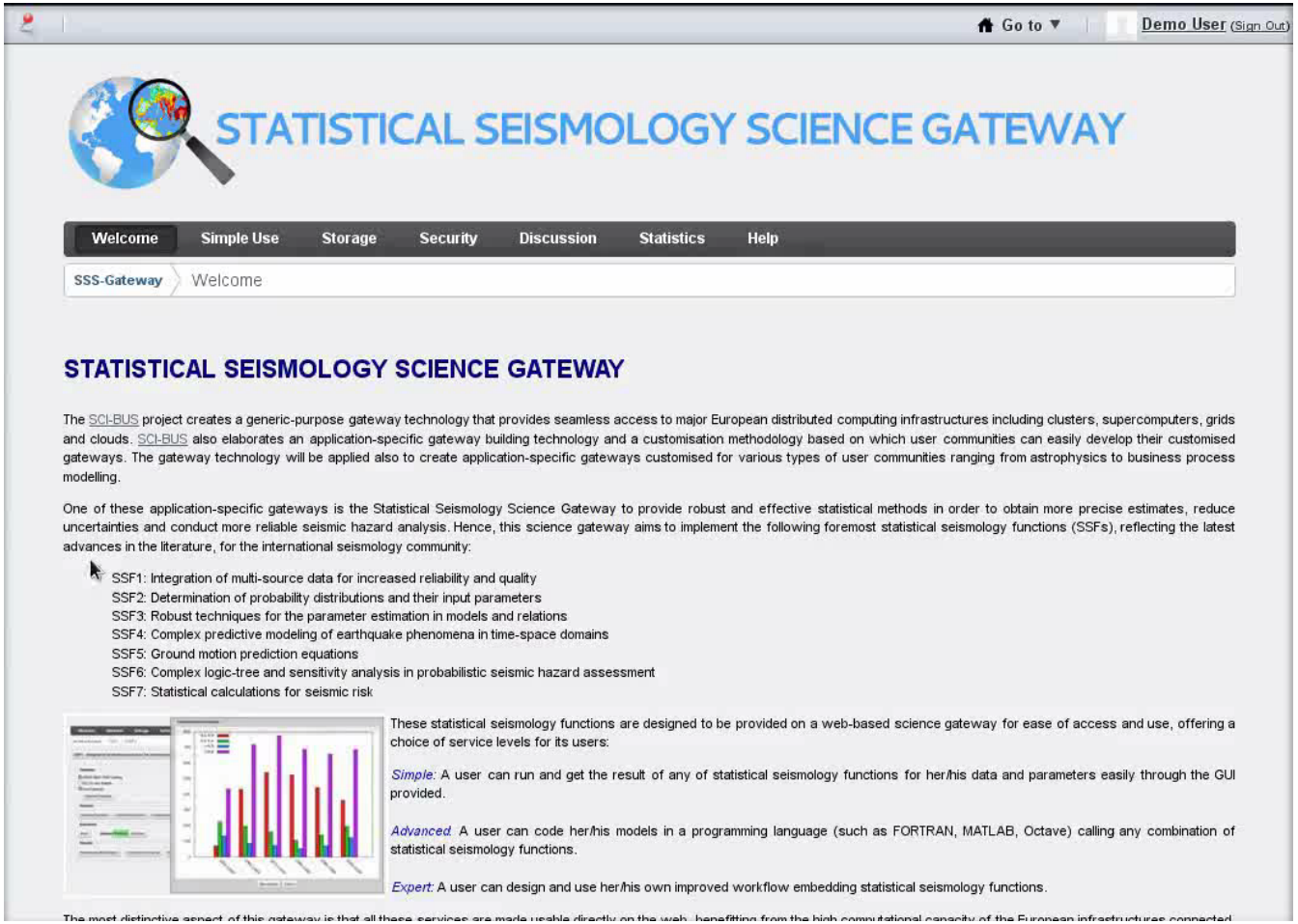
SSF5: Ground motion prediction equations

- When an earthquake occurs, seismic waves and consequently ground motion will propagate and attenuate.
- In SHA, ground motion prediction equations (GMPE) are used to estimate the ground motion parameters of a site located at a distance from the source of an earthquake.
- The effect of a GMPE enters SHA calculations as the annual probability of ground motion parameter Y (measured as PGA, SA etc) exceeding a specified level y, i.e., P(Y>y).
- This function enables users, for a ground motion level, to calculate and plot this annual probability for obtaining a hazard curve.

SSF5 Demo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Advanced-use Portlet

- Enables users to run users' programs (in FORTRAN, C, C++ etc) that contain calls to any SSFs

QUESTIONS?

Contact:

sss-gateway@sci-bus.eu

http://www.sci-bus.eu/seismology http://seismo.ceng.metu.edu.tr