EGU2020-6833
https://doi.org/10.5194/egusphere-egu2020-6833
EGU General Assembly 2020
© Author(s) 2021. This work is distributed under
the Creative Commons Attribution 4.0 License.

Assessing and improving focal mechanisms in Switzerland: Towards a comprehensive seismotectonic model of the Central Alps and their foreland

Federica Lanza[1], Tobias Diehl[1], Nicholas Deichmann[1], Frederick Massin[1], John Clinton[1], Marco Herwegh[2], and Stefan Wiemer[1]

[1]Swiss Seismological Service, ETH Zürich, Zürich, Switzerland (federica.lanza@sed.ethz.ch)

[2]University of Bern, Bern, Switzerland

Seismotectonic models that combine all the relevant seismotectonic data (e.g., hypocenter locations and velocity models, focal mechanisms and moment-tensors, faults, geodetic data, and in-situ/regional stress data) constitute a pre-requisite to better understand the interplay between stress, faulting and seismicity of a region. This study is a contribution to the multiannual project SeismoTeCH funded by the Swiss Geophysical Commission (SGPK) and coordinated by the University of Bern to produce an integrative seismotectonic model for the entire territory of Switzerland. In this context, our aim is to provide an up-to-date, high-quality, and consistent catalog of first-motion focal mechanisms computed by the Swiss Seismological Service (SED) since 1976. For this purpose, we developed a quality classification scheme for existing mechanisms based on a priori independent information (mainly applied to the oldest mechanisms in the catalog) combined with statistical methods such as HASH (Hardebeck and Shearer, 2002) and probabilistic source mechanisms scanner algorithms (Massin and Malcom, 2018) to probe the solution space and translate probability density functions to a discrete quality rating.

Tests on selected problematic mechanisms are also carried out in order to assess the sensitivity of the focal mechanisms to the velocity models used to calculate location and take-off angles. In particular, we compare existing solutions using the standard 3D P-wave model of the SED with solutions based on recently derived high-resolution 3D Pg+Sg models. These tests are functional to understand the benefits of developing an updated full crustal velocity model for first-motion focal mechanisms calculations, in particular in relations to the focal depths and the accuracy of take-off angles.

Finally, to improve the completeness of the existing catalog, we explore new methodologies that would incorporate automated (possibly real-time) and semi-automated techniques for expanding the calculation of first-motion focal mechanisms (and moment tensors) to events of smaller magnitude. The Anzere/Sanetschpass sequence of November 2019 is used to assess and develop these new methods. As a preliminary result of these combined efforts, we present here a high-resolution map of strain-based deformation across Switzerland. This work represents a benchmark for future regional-scale stress inversion and sets the basis for the development of a

consistent, fully accessible, and dynamic focal mechanisms database for Switzerland.