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FMC: a one-liner Python program to manage, classify and plot focal mechanisms

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The analysis of earthquake focal mechanisms (or Seismic Moment Tensor, SMT) is a key tool on seismotectonics research. Each focal mechanism is characterized by several location parameters of the earthquake hypocenter, the earthquake size (magnitude and scalar moment tensor) and some geometrical characteristics of the rupture (nodal planes orientations, SMT components and/or SMT main axes orientations). The aim of FMC is to provide a simple but powerful tool to manage focal mechanism data. The data should be input to the program formatted as one of two of the focal mechanisms formatting options of the GMT (Generic Mapping Tools) package (Wessel and Smith, 1998): the Harvard CMT convention and the single nodal plane Aki and Richards (1980) convention. The former is a SMT format that can be downloaded directly from the Global CMT site (http://www.globalcmt.org/), while the later is the simplest way to describe earthquake rupture data. FMC is programmed in Python language, which is distributed as Open Source GPL-compatible, and therefore can be used to develop Free Software. Python runs on almost any machine, and has a wide support and presence in any operative system. The program has been conceived with the modularity and versatility of the classical UNIX-like tools. Is called from the command line and can be easily integrated into shell scripts (*NIX systems) or batch files (DOS/Windows systems). The program input and outputs can be done by means of ASCII files or using standard input (or redirection "<"), standard output (screen or redirection ">") and pipes ("|"). By default FMC will read the input and write the output as a Harvard CMT (psmeca formatted) ASCII file, although other formats can be used. Optionally FMC will produce a classification diagram representing the rupture type of the focal mechanisms processed. In order to count with a detailed classification of the focal mechanisms I decided to classify the focal mechanism in a series of fields that include the oblique slip regimes. This approximation is similar to the Johnston et al. (1994) classification; with 7 classes of earthquakes: 1) Normal; 2) Normal – Strike-slip; 3) Strike-slip - Normal; 4) Strike-slip; 5) Strike-slip - Reverse; 6) Reverse – strike-slip and 7) Reverse. FMC uses by default this classification in the resulting diagram, based on the Kaverina et al. (1996) projection, which improves the Frohlich and Apperson (1992) ternary diagram.