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DOIT: a graphic tool for the inversion of deformation data

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DOIT (Data Optimization Integrated Tool) is an ongoing project to develop a tool to perform inversions of deformation data by global optimization running on a commodity supercomputer. Its main task is to facilitate the user about the interpretation of deformation data (GPS, InSAR, leveling, etc.) due to different geophysical sources such as seismic dislocation or volcanic inflation. We have developed a graphic interface assisting the user during the required steps to set-up and solve the inversion problem: data importation, model and parameters space definition, job submission, monitoring and results visualization. The user can import data in some predefined formats or define his own custom format. The forward models embedded in the tool are analytical descriptions of simple sources like isotropic point-source, finite spheroid, or general dislocation. A further feature is the possibility to use as forward model arrays of precomputed solutions based on finite element or other numerical techniques so that it is possible to take into account some realistic features (e.g. topography). The user has the capability to choose from few direct search methods such as Monte Carlo, simulated annealing or the more efficient Neighbourhood Algorithm. In this last case it is possible to perform a bayesian appraisal of the sampled solutions. The main paradigm of the tool is a client-server structure. The client machine submits jobs and retrieves information about the state of the running task; the graphical interface takes care also to link the computing front-end and the client machine itself. Since all the search algorithms are implemented using the MPI library, users can take advantage of parallel runs on cluster machines without knowing details either of MPI codes or the use of a batch queue in a distributed computing environment. The tool is a C++

application running on a dedicated Linux computer and is written using QT4 graphic libraries (the same libraries of the KDE window manager) which offer powerful options. An important feature of the DOIT tool is the communication with clients. When the client, (a piece of software available for almost any OS) asks for the user interface service, DOIT exports its graphical environment to a session on the client itself, using the X-protocol with high compression technology. This limits the needs of a fast connection between the client and the server, maintaining a high interactivity at the same time. Furthermore, the protocol is encapsulated over SSL, facilitating a safe communication with the server. DOIT has an open structure allowing to easily modify the application, adding forward models or implementing new inversion algorithm. We present a test of the DOIT capabilities, running inversions on an IBM P575 with 168 Power5 processors installed at CASPUR.