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Cyberdyn supercomputer - a tool for imaging geodinamic processes

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More and more physical processes developed within the deep interior of our planet, but with significant impact on the Earth's shape and structure, become subject to numerical modelling by using high performance computing facilities. Nowadays, worldwide an increasing number of research centers decide to make use of such powerful and fast computers for simulating complex phenomena involving fluid dynamics and get deeper insight to intricate problems of Earth's evolution.
With the CYBERDYN cybernetic infrastructure (CCI), the Solid Earth Dynamics Department in the Institute of Geodynamics of the Romanian Academy boldly steps into the 21st century by entering the research area of computational geodynamics. The project that made possible this advancement, has been jointly supported by EU and Romanian Government through the Structural and Cohesion Funds. It lasted for about three years, ending October 2013. CCI is basically a modern high performance Beowulf-type supercomputer (HPCC), combined with a high performance visualization cluster (HPVC) and a GeoWall. The infrastructure is mainly structured around 1344 cores and 3 TB of RAM. The high speed interconnect is provided by a Qlogic InfiniBand switch, able to transfer up to 40 Gbps. The CCI storage component is a 40 TB Panasas NAS. The operating system is Linux (CentOS). For control and maintenance, the Bright Cluster Manager package is used. The SGE job scheduler manages the job queues. CCI has been designed for a theoretical peak performance up to 11.2 TFlops. Speed tests showed that a high resolution numerical model ($256 \times 256 \times 128$ FEM elements) could be resolved with a mean computational speed of 1 time step at 30 seconds, by employing only a fraction of the computing power (20%).
After passing the mandatory tests, the CCI has been involved in numerical modelling of various scenarios related to the East Carpathians tectonic and geodynamic evolution, including the Neogene magmatic activity, and the intriguing intermediate-depth seismicity within the so-called Vrancea zone. The CFD code for numerical modelling is CitcomS, a widely employed open source package specifically developed for earth sciences. Several preliminary 3D geodynamic models for simulating an assumed subduction or the effect of a mantle plume will be presented and discussed.