WORKSHOP
NEMO - NumErical MOdelling using high performance computing infrastructures

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1) PRESENTATION TITLE:

HIGH PERFORMANCE COMPUTING AND VISUALIZATION: A VIABLE SOLUTION TO BOOST RESEARCH FOR EARTH SCIENCES

2)AUTHORS, AFFILIATION

V.C. Manea[1,2], M. Manea[1,2], M. Pomeran[2], L. Besutiu[2], L. Zlagnean[2]

1 *Computational Geodynamics Laboratory, Centro de Geociencias, Universidad Nacional Autonoma de Mexico, Mexico*
2 *Institute of Geodynamics of the Romanian Academy*

Corresponding author: **Vlad Constantin Manea[1]**, vlad@geociencias.unam.mx

2) ABSTRACT:

The Earth Sciences community has started to move towards implementing high performance computational (HPC) research facilities and is likely to play a key role in defining the requirements of high performance computing (HPC) resources for years to come. However, the large diversity of applications and processing of large data volumes, represent a challenge for high performance computing. One of the key tenants of HPC is performance, and designing a HPC solution tailored to a specific research field as solid earth that represents an optimum price/performance ratio is often a challenge. The HPC system performance strongly depends on the software-hardware interaction, and therefore knowledge on how well specific parallelized software performs on HPC architectures can significantly improved the final design/setup of these parallel machines. Here we present benchmark results preformed with the HPC CyberDyn, a high-end state-of-the-art parallel machine recently implemented at the Institute of Geodynamics of the Romanian Academy. This HPC cluster has a total of 1344 cores with 11.2 TFlops theoretical peak performance, a high-performnce 40 TB Panansas storage system and a dedicated QDR Infiniband network fabric for inter-node communication. The software employed for the benchmark is the open source package CitcomS (www.geodynamics.org), a FEM (Finite Element Code) widely used for a whole range of mantle convection simulations, including thermo and thermo-chemical simulations, performed in regional or full-spherical domains. The benchmark results show continuous performance gain as the number of cores increases (up to 1024 computing cores). Also the benchmark results show that increasing the mesh size and the number of computing cores the HPCC CyberDyn maintains a remarkably good performance.

Additionally, in this presentation we will show other HPCC examples and success stories where obtaining modeling results in as short time as possible is imperative, as lahar predictions and volcanic ash dispersion in active volcanoes.

Since presently we are moving towards multi-scale high-resolution simulations for geodynamic predictions that require the same scale as observations, up-front investment in HPC facilities will strongly boost our knowledge, understanding and lever of awareness for a wide range of disciplines related, but not limited to, with earth sciences.

4) POSITION OF CORRESPONDING AUTHOR:

Student	~~**yes**~~	no
Post-Doctoral	~~yes~~	**no**
Researcher	yes	~~**no**~~