Analogue modeling for science outreach: glacier flows at Antarctic National Museum, Italy

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Comprehension of internal deformation and of ice flow in the Antarctic ice sheet in relation with the bedrock topography and with the thickness variation induced by climatic variations represent an important target for the scientific community.

Analogue modelling technique aims to analyze geological or geomorphological processes through physical models built at a reduced geometrical scale in laboratory and deformed at reasonable scale of times. Corti et al. (2003 and 2008) have shown that this technique could also be used successfully for ice flow dynamic.

Moreover, this technique gives a three-dimensional view of the processes.

The models, that obviously simplify the geometry and rheology of natural processes, represent a geometrically, cinematically, dynamically and rheologically scaled analogue of the natural glacial environment. Following a procedure described in previous papers, proper materials have been selected to simulate the rheological behaviour of ice. In particular, during the experiments a Polydimethilsyloxane (PDMS) has been used to simulate glacial flow. PDMS is a transparent Newtonian silicone with a viscosity of 1.4 104 Pa s and a density of 965 kg m-3 (see material properties in Weijermars, 1986). The scaling of the model to natural conditions let to obtain reliable results for a correct comparison with the glacial processes under investigation.

Models have been built with a with a geometrical scaling ratio of ~1.5 10-5, such that 1 cm in the model represents ~700 m in nature. The physical models have been deformed in terrestrial gravity field by allowing the PDMS to flow inside a Plexiglas box. In particular, the silicone has been poured inside the Plexiglas box and allowed to settle in order to obtain a flat free surface; the box has been then inclined of some degrees in order to allow the silicone to flow. Several boxes illustrating different glacial processes have been realized; each of them could be easily performed in short time and in standard laboratories.

One of the main aims of the Antarctic National Museum in Siena (Italy) is to establish a strategy to deliver results to a broader scientific community. Time and spatial small scale of the experiments lead the analogue modeling technique easy to be shown to non-technical audiences through direct participation during Museum visits.

All these experiments engage both teachers and students from primary and secondary schools and the general public.

References:

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