De complexitate mundi – What a complexful world

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Bare twenty years into the XXI century – and what a treat. Damaging earthquakes with regional impact, climate extremes disrupting weather cycles, water shortages in high-income regions, scarcer (and costlier) energy and mineral resources, rising population. Add a slice of global geopolitical instabilities – even where one would never expect to report them from. And, well, why not: a novel pathogen, so little yet so commanding that the world is still vying with it.

Natural hazards and anthropogenic factors interact in multiple ways and across various scales, close or afar, in time and space. They interweave a web of complexities that can appear deceitful, capricious, or otherwise overwhelming to the citizens of contemporary societies – even in statistically affluent and educated ones. There comes the role of geosciences, from paleontology to high-atmosphere physics, from energy to oceanography, from the solid to the not so solid earth. There comes their transformative, instrumental task – as new and as pressing as ever.

Geosciences are not (and will not) what they used to be, bound as they are to glean lessons learned from the past to provide insight into the future. Geoscientists were once thought to study ancient rocks, fiddle with very slow-moving tectonic plates, and bantering about invisible earth's features, too large, or too deep, or too far away to even imagine for us earthlings. But this is no longer the case – and maybe never has been. At the core of geosciences' interests lies Nature, for what it is – with all its grand size, seemingly slow processes that unveil sudden effects, complex interactions among forces and bodies across distances and time. These prove to be paramount tools to probe a world perceived as inscrutable, increasingly richer in risks and poorer in resources.

Therefore, tools of yesterday's intellectual quests prove instrumental to decipher tomorrow's societal issues, such as:

- The long records of natural events (hazards);
- Far-flung origins (our solar system and the universe);
- Far-reaching effects (feedback, periodicity, and recurrence times);
- Need to forecast (or at least account for) the irregular behaviors of modern phenomena (not always known or detectable by current means).

The knowledge of compounded risks of natural origin provides an outlook on where and what to call for enduring communities. This applies also to risks resulting from interaction among natural events and anthropogenic components. Since natural phenomena embed complexities due to
multiple variables and intrinsic feedback, interaction among natural and non-natural ones brings novel issues, requiring a remarkably broad outlook – global and beyond. The natural consequence is then to envision natural risks against population distribution, spatial extents of natural resources, size, and time window of induced effects.

Picking a selection of examples, this talk thus tries to put into perspective:

- Hazards stemming from multiple, at times unpredictable sources;
- The precious role of geosciences to decipher them – and to forecast them;
- The complexity of natural hazards, the flexibility of human planning;
- Modern issues challenging societies and economies – today, tomorrow, and thereafter.