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Abstract

Geocomputing, New Technologies and Historical Analysis: Tools for a Changing Planet †

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Abstract: Understanding the geoenvironment and deciphering its interactions with the anthroposphere is a key element for achieving the United Nations defined Sustainable Development Goals (SDGs). Moreover, the objective and holistic analysis of the geoenvironmental system may suggest to modify existing SGDs or to define new ones. The analysis of geosphere-anthroposphere interlinked dynamics strongly relates with relevant research topics, among which the "Critical Zone" research area and the "Anthropocene" related debates. The issues involved in this context are characterized by high complexity, both from the scientific as well as from the cultural and socio-economical viewpoint. The geosphere-anthroposphere interlinked and reflexive dynamics should be studied taking into consideration demographic and socio-economical factors, inevitably involving anthropological considerations on the ancestral relationships between humankind and the planet Earth.

The advances in geocomputation and technology play a pivotal role in this exciting research context, both in relation to the characteristics of available geo-information, often heterogeneous and affected by uncertainty, as well as in relation to the complexity of studied processes. The wide set of data analysis approaches (e.g., geostatistics, machine learning, etc.) and numerical modelling tools (e.g., ground water models, ocean circulation models, etc.) is fundamental to exploit available geo-information. The developments in technology, software and hardware, amplify our capability to collect geoenvironmental data and furnish an unprecedented computing power at low cost for data analysis and numerical modelling. This is an area of bewildering development, still to be fully exploited, both from the side of available open data repositories as well as from the side of available open and "easy" to use software for data analysis and numerical modelling.

Now more than ever, Earth Scientists need to strengthen their quantitative and mathematical understanding of used methodologies, avoiding to rely blindly into completely automatic software for analysis and modelling. Moreover, now more than ever, domain-specific knowledge is crucial for conducting tasks of data analysis and modelling. From this perspective, the role of quantitative Earth Scientist is growing in relevance, given the inherent capability to integrate expert knowledge related to the natural system with quantitative approaches.

Modern Earth Scientists need also to interact with other disciplines, apparently far from the Earth Sciences and Engineering. Disciplines related to history and philosophy of science are emblematic from this perspective. From one side, the quantitative analysis of information extracted from historical records (documents, maps, paintings, etc.) represents an exciting research topic, requiring a truly holistic approach. On the other side, epistemological and philosophy of science considerations on the relationship between geoscience and society in history are of fundamental importance for understanding past, present and future geosphere-anthroposphere interlinked dynamics.

Keywords: Anthropocene; critical zone; geocomputing

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