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Machine actionable information about observed environments

Markus Stocker (1), Stefano Nativi (2), and Jay Pearlman (3)

(1) MARUM, University of Bremen, Bremen, Germany (mstocker@marum.de), (2) Institute of Atmospheric Pollution Research, National Research Council of Italy (CNR-IIA), Florence, Italy (stefano.nativi@cnr.it), (3) J&F Enterprise, Seattle, WA, USA (jay.pearlman@jandfent.com)

Data, information, and knowledge are terms commonly used in earth and environmental sciences, as well as in informatics supporting these sciences. The Lindstrom et al. Framework for Ocean Observing highlights the "challenge of delivering ocean information for societal benefit" and suggests that a key framework concept is to promote the "transformation of observational data organized in [Essential Ocean Variables] into information." A flyer presenting the Integrated Carbon Observation System says "Knowledge through observations." Writing about Oceans 2.0, Ocean Networks Canada highlights that the system is able to mine "data streams to detect trends, classify content and extract features [...] thereby turning raw data into information and setting the stage to allow the information to be transformed into knowledge." At 2016 AGU Fall Meeting, Rebecca Moore presented the vision of monitoring a changing planet and "generating precise, actionable information and knowledge."

Yet, what exactly are these entities in the context of earth sciences and environmental research infrastructures? Can they be defined? To which processes are they input and output? How are they represented and managed? Can we extend Moore's vision to machine actionable information and knowledge?

Information Systems research has for long struggled with defining data, information, and knowledge. Literature on the Data, Information, Knowledge, Wisdom (DIKW) hierarchy underscores the challenge of defining these terms. Some scholars have even suggested that providing general definitions is beyond the scope of the discipline. This may be particularly true at the higher levels, where wisdom should be considered in the context of the societal environment and may not be quantifiable out of context. While reaching consensus is hard, to obtain a better understanding for what the terms mean, how they are applied, and to what processes they are relevant in the context of earth sciences and environmental research infrastructures is arguably worthwhile. This can be done in some situations through the examination of exemplars or use cases, particularly addressing processing for translation of data to knowledge.

In this talk, we will not attempt to define what data, information, and knowledge are in the context of earth sciences and environmental research infrastructures. Rather, in the particular context of a concrete use case in aerosol science - namely for the study of atmospheric new particle formation events on concentration of polydisperse aerosol - we present how observational data on concentration evolve to but are different from information about events, and how these entities are input and output, respectively, to the process of interpretation. The presentation involves technologies that enable the formal representation and management of information. Information about new particle formation events is thus machine actionable.