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Meta-propagation of Uncertainties for Scientific Workflow Quality Management in Interoperable Spatial Data Infrastructures

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Abstract:
Addressing multidisciplinary interoperability, one of the goals of the European FP7 project EuroGEOSS [1] is to facilitate the derivation of new product datasets from existing data and scientific models. A scientific workflow instantiates a scientific model by combining the needed chosen resources within an interoperable environment using OGC standards [2] for (geo)computational processes and data embedded in web services. When using/testing different sources, changing the scale or adpating the scientific model with various scales, the user or the modeller needs some means to evaluate the «fit to purpose» of the workflow instance. Quality assessment provides quantification of the reliability of the workflow in term of the expected uncertainties, and, accumulation of evidence for its usability [3]. This is crucial for decision making and any proper use of the seamless ability to reuse existing workflows along with discovered or retrieved datasets and processes. The knowledge of how the data uncertainties are defined and propagated through the processes within the workflow is of concern. This paper proposes a framework, within existing interoperability/standards settings, that is able to encode quality information, and to assess the quality of an instance of a scientific model at workflow and sub-workflow levels using them directly [4, 5]: meta-propagation. Specific quality metadata for processes that allows simple data uncertainties to be propagated are derived and encoded along with the scientific model within a XPDL [4] file representing the workflow. A WPS (Web Processing Service) profile realising and performing the workflow will be described to allow querying for metadata propagation. This type of WPS could be thought as a WWS (Web Workflow Service) which could reify the use of WPS in a single hard-coded task and leaving the WWS for higher level combination of tasks.

Keywords: scientific workflow, web services, quality, uncertainty, metadata, error propagation
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