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Structured Multi-level Data Fusion and Modelling of Heterogeneous Environmental Data for Future Internet Applications

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The rapid increase in environmental observations which are conducted by Small to Medium Enterprise communities and volunteers using affordable in situ sensors at various scales, in addition to the more established observatories set up by environmental and space agencies using airborne and space-borne sensing technologies is generating serious amounts of BIG data at ever increasing speeds. Furthermore, the emergence of Future Internet technologies and the urgent requirements for the deployment of specific enablers for the delivery of processed environmental knowledge in real-time with advanced situation awareness to citizens has reached paramount importance. Specifically, it has become highly critical now to build and provide services which automate the aggregation of data from various sources, while surmounting the semantic gaps, conflicts and heterogeneity in data sources. The early stage aggregation of data will enable the pre-processing of data from multiple sources while reconciling the temporal gaps in measurement time series, and aligning their respective a-synchronicities. This low level type of data fusion process needs to be automated and chained to more advanced level of data fusion services specialising in observation forecasts at spaces where sensing is not deployed; or at time slices where sensing has not taken place yet. As a result, multi-level fusion services are required among the families of specific enablers for monitoring environments and spaces in the Future Internet. These have been intially deployed and piloted in the ongoing ENVIROFI project of the FI-PPP programme [1]. Automated fusion and modelling of in situ and remote sensing data has been set up and the experimentation successfully conducted using RBF networks for the spatial fusion of water quality parameters measurements from satellite and stationary buoys in the Irish Sea. The RBF networks method scales for the spatial data fusion of multiple types of observation sources. This important approach provides a strong basis for the delivery of environmental observations at desired spatial and temporal scales to multiple users with various needs of spatial and temporal resolutions. It has also led to building robust future internet specific enablers on data fusion, which can indeed be used for multiple usage areas above and beyond the environmental domains of the Future Internet. In this paper, data and processing workflow scenarios shall be described. The fucntionalities of the multi-level fusion services shall be demonstrated and made accessible to the wider communities of the Fututre Internet.

[1] The Environmental Observation Web and its Service Applications within the Future Internet. ENVIROFI IP. FP7-2011-ICT-IF Pr.No: 284898
http://www.envirofi.eu/