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# Generic Sensor Data Fusion Services for Web-enabled Environmental Risk Management and Decision-Support Systems

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The advancement of smart sensor technology in the last few years has led to an increase in the deployment of affordable sensors for monitoring the environment around Europe. This is generating large amounts of sensor observation information and inevitably leading to problems about how to manage large volumes of data as well as making sense out the data for decision-making.

In addition, the various European Directives (Water Framework Diectives, Bathing Water Directives, Habitat Directives, etc.. ) which regulate human activities in the environment and the INSPIRE Directive on spatial information management regulations have implicitely led the designated European Member States environment agencies and authorities to put in place new sensor monitoring infrastructure and share information about environmental regions under their statutory responsibilities. They will need to work cross border and collectively reach environmental quality standards. They will also need to regularly report to the EC on the quality of the environments of which they are responsible and make such information accessible to the members of the public.

In recent years, early pioneering work on the design of service oriented architecture using sensor networks has been achieved. Information web-services infrastructure using existing data catalogues and web-GIS map services can now be enriched with the deployment of new sensor observation and data fusion and modelling services using OGC standards. The deployment of the new services which describe sensor observations and intelligent data-processing using data fusion techniques can now be implemented and provide added value information with spatial-temporal uncertainties to the next generation of decision support service systems. The new decision support service systems have become key to implement across Europe in order to comply with EU environmental regulations and INSPIRE.

In this paper, data fusion services using OGC standards with sensor observation data streams are described in context of a geo-distributed service infrastructure specialising in multiple environmental risk management and decision-support. The sensor data fusion services are deployed and validated in two use cases. These are respectively concerned with: 1) Microbial risks forecast in bathing waters; and 2) Geohazards in urban zones during underground tunneling activities. This research was initiated in the SANY Integrated Project(www.sany-ip.org) and funded by the European Commission under the 6th Framework Programme.