



Environmental networks for large-scale monitoring of Earth and atmosphere

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Installation and operation of instrument/sensor networks are proven fundamental in the monitoring of the physical environment from local to global scale. The advances in electronics, wireless communications and informatics has led to the development of a huge number of networks at different spatial scales that measure, collect and store a wide range of environmental parameters. These networks have been gradually evolved into integrated information systems that provide real time monitoring, forecasts and different products from the initial collected datasets. Instrument/sensor networks have nowadays become important solutions for environmental monitoring, comprising a basic component of fully automated systems developing worldwide that contribute in the efforts for a sustainable Earth's environment (e.g. Hart et al., 2006, Othman et al., 2012). They are also used as a source of data for models parameterization and as verification tools for accuracy assessment techniques of the satellite imagery. Environmental networks can be incorporated into decision support systems (e.g Rizzi et al., 2012) providing informational background along with data from satellites for decision making, manage problems, suggest solutions and best practices for a sustainable management of the environment.

This is a comparative study aiming to examine and highlight the significant role of existing instrument/sensor networks for large-scale monitoring of environmental issues, especially atmospheric and marine environment as well as weather and climate. We provide characteristic examples of integrated systems based on large scale instrument/sensor networks along with other sources of data (like satellite datasets) as informational background to measure, identify, monitor, analyze and forecast a vast series of atmospheric parameters (like CO₂, O₃, particle matter and solar irradiance), weather, climate and their impacts (e.g., cloud systems, lightnings, rainfall, air and surface temperature, humidity, winds) and marine environment (salinity, water quality, sea surface temperature among others). "ZEUS" lightning detection system (Chronis et al. 2006, Lagouvardos et al. 2009), "UVnet" system that is primarily referred to the UltraViolet solar irradiance (Bais et al. 2006, Kazantzidis et al. 2006) and "GLOBcolour" system for seas monitoring, are some characteristic examples of systems that use networks of instruments/sensors to monitor relative parameters. The chosen examples are focused on the European continent. Basic operating principles of these networks, their usefulness, restrictions and their perspectives in the environmental real time basis monitoring and forecast, are also described.

References

Bais, A.F., Meleti, C. Kazantzidis, A., Topaloglou, C., Zerefos, C.S., Kosmidis, E. 2006. Greek UV Network: Results and perspectives after three years. 8th Conference on Meteorology – Climatology and Atmospheric Physics, 24-25 May, Athens, Greece.

Chronis, T., Anagnostou, E. 2006. Evaluation of a Long-Range Lightning Detection Network with Receivers in Europe and Africa. IEEE Transactions on Geoscience and Remote Sensing, 44, 1504-1510.

Hart, K.J., Martinez, K. 2006. Environmental Sensor Networks: A revolution in the Earth system science? Earth-Science Reviews, 78, 178-19.

Kazantzidis, A., Bais, A.F. Topaloglou, C., Garane, K., Zempila, M., Meleti, C., Zerefos, C.S. 2006. Quality assurance of the Greek UV Network: preliminary results from the pilot phase operation. Proceedings of SPIE Europe Remote Sensing of Clouds and the Atmosphere XI, vol. 6362, 636229-1 – 636229-10, Stockholm, Sweden, 11-14 September.

Lagouvardos, K., Kotroni, V. Betz, D-H., Schmidt, K. 2009. A comparison of lightning data provided by ZEUS and LINET networks over Western Europe. Natural Hazards and Earth Systems Sciences, 9, 1713-1717.

Maritorena, S., D'Andon, O.H.F., Mangin, A., Siegel, D.A., 2010. Merged satellite ocean color data products using bio-optical model: Characteristics, benefits and issues. *Remote Sensing of Environment*, 114, 1791-1804.

Othman, M.F., Shazali K., 2012. Wireless Network Applications: A study in environment monitoring system. *Procedia Engineering*, 41, 1204-1210.

Rizzi, J., Torresan, S., Zabeo, A., Gallina, V., Critto, A., Marcomini, A., 2012. A GIS-based Decision Support System to support the implementation of integrated coastal zone management – preliminary results from the PEGASO project. *Proceedings of the AGILE' 2012 International Conference on Geographical Information Science*, Avignon, April, 24-27.