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Advanced visualisation for environmental computing

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Environmental computing – supporting production of actionable knowledge from different environmental data sources and models – tends to produce results that describe the combined effects of several contributing phenomena. Efficient analysis of such amalgams, for example to understand how the event would be developing or to identify relative importance of different factors, requires different visualisation tools and techniques. Comparing different scenarios (and the effect of human responses to them) and developing action plans and policy recommendations requires seamless interdisciplinary (and often inter-sectoral) collaboration, which cannot be efficiently supported by the discipline-specific data sets alone.

In this paper we will present different visualisation approaches and their relative strengths and weaknesses in environmental computing approaches through using on-going initiatives as case studies. At the most straightforward level, simple graphs can already present information in a way that supports decision-making. Perhaps the best example of the power of such a simple visualisation is the impact of the "hockey stick" chart describing the global warming scenarios. However, the controversy surrounding the hockey stick graph also illustrates its limitations: finding the connection between data, models and the output requires some effort and human interpretation. This disconnect between the data and tools made it quite easy to misinterpret and misrepresent the data – accidentally or intentionally. Simply adding more dimensions (2D maps or videos) or resolution cannot overcome this problem on its own. In addition to presenting the results in an intuitive way, visualisation solutions for environmental computing need to cover equally efficiently the data sources as well as the models and workflows used.

As an approach to address this challenge, we present a framework model that supports efficient and intuitive visualisation of all the aspects of the environmental computing, ranging from the characteristics of the individual models and data sources to 3D presentations of the results. The framework components and their characteristics are discussed, ranging from model metadata frameworks to advanced virtual reality (VR) technologies used in environmental computing applications.

Since environmental computing data often consists of simulated or reassured spatial structures describing natural phenomena, VR tends to be an ideal tool visualising these structures. The observer is able to understand the spatial relations in a better way with the help of stereoscopic display and the intuitive change of geometrical perspective through head tracking technology.

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