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Uncertainty visualisation in the Model Web

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Visualisation of geospatial data as maps is a common way to communicate spatially distributed information. If temporal and furthermore uncertainty information are included in the data, efficient visualisation methods are required. For uncertain spatial and spatio-temporal data, numerous visualisation methods have been developed and proposed, but only few tools for visualisation of data in a standardised way exist. Furthermore, usually they are realised as thick clients, and lack functionality of handling data coming from web services as it is envisaged in the Model Web.

We present an interactive web tool for visualisation of uncertain spatio-temporal data developed in the UncertWeb project. The client is based on the OpenLayers JavaScript library. OpenLayers provides standard map windows and navigation tools, i.e. pan, zoom in/out, to allow interactive control for the user. Further interactive methods are implemented using jStat, a JavaScript library for statistics plots developed in UncertWeb, and flot. To integrate the uncertainty information into existing standards for geospatial data, the Uncertainty Markup Language (UncertML) was applied in combination with OGC Observations&Measurements 2.0 and JavaScript Object Notation (JSON) encodings for vector and NetCDF for raster data.

The client offers methods to visualise uncertain vector and raster data with temporal information. Uncertainty information considered for the tool are probabilistic and quantified attribute uncertainties which can be provided as realisations or samples, full probability distributions functions and statistics. Visualisation is supported for uncertain continuous and categorical data.

In the client, the visualisation is realised using a combination of different methods. Based on previously conducted usability studies, a differentiation between expert (in statistics or mapping) and non-expert users has been indicated as useful. Therefore, two different modes are realised together in the tool: (i) adjacent maps showing data and uncertainty separately, and (ii) multidimensional mapping providing different visualisation methods in combination to explore the spatial, temporal and uncertainty distribution of the data. Adjacent maps allow a simpler visualisation by separating value and uncertainty maps for non-experts and a first overview. The multidimensional approach allows a more complex exploration of the data for experts by browsing through the different dimensions. It offers the visualisation of maps, statistic plots and time series in different windows and sliders to interactively move through time, space and uncertainty (thresholds).