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Time Varying Feature Data

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The infrastructure to gather, store and access information about our environment is improving and growing rapidly. The increasing amount of information allows us to get a better understanding of the current state of our environment, historical processes and to simulate and predict the future state of the environment. Finer grained spatial and temporal data and more reliable communications make it easier to model dynamic states and ephemeral features.

The exchange of information within and across geospatial domains is facilitated through the use of harmonized information models. The Observations & Measurements (O&M) developed through OGC and standardised by ISO is an example of such a cross-domain information model. It is used in many domains, including meteorology, hydrology as well as the emergency management. O&M enables harmonized representation of common metadata that belong to the act of determining the state of a feature property, whether by sensors, simulations or humans. In addition to the resulting feature property value, information such as the result quality but especially the time that the result applies to the feature property can be represented. Temporal metadata is critical to modelling past and future states of a feature.

The features, and the semantics of each property, are defined in domain specific Application Schema using the General Feature Model (GFM) from ISO 19109 and usually encoded following ISO 19136. However, at the moment these standards provide only limited support for the representation and handling of time varying feature data. Features like rivers, wildfires or gas plumes have a defined state - for example geographic extent - at any given point in time. To keep track of changes, a more complex model for example using time-series coverages is required. Furthermore, the representation and management of feature property value changes via the service interfaces defined by OGC and ISO - namely: WFS and WCS - would be rather complex. Keeping track of feature property value corrections or even feature (state change) cancellations for auditing purposes is also not easy to achieve.

The aviation domain has strong requirements to represent and manage the state of aeronautical features through time. Being able to efficiently encode and manage feature state changes, keeping track of all changes for auditing purposes and being able to determine the future state of an aeronautical feature as currently known to the system are vital for aeronautical applications. In order to support these requirements, the Aeronautical Information Exchange Model (AIXM) which has been developed by the aviation domain is based on the so called AIXM Temporality Model (AIXM-TM). The AIXM-TM defines various rules for modeling, representing and handling the state of aeronautical features through time. This is a promising approach that can be incorporated into the GFM so that ultimately the modeling and management of time varying feature data is supported in an interoperable and harmonized way in all geospatial domains. This presentation gives an introduction to the main concepts of the AIXM-TM. It also shows how the GFM can be extended to support time varying feature data. Finally, the relationship of O&M and time varying features is discussed.