A myriad of data acquisition devices is observing every day more variables and generating a vast amount of data in almost every application domain. Environmental observation data is an essential portion of such generated data, whose spatio-temporal nature has posed interesting challenges in the area of Environmental Observation Data Management Systems. Two features are common to all these systems: spatio-temporal observations and heterogeneity. In the context of this Thesis, the Observations and Measurements (O&M) conceptual schema was adopted as the theoretical framework for the definition of the concept of observation. Heterogeneity specifically concerns the data acquisition part of the aforementioned systems, which need to access data produced by heterogeneous sensing following different software/hardware specifications that are accessed through several communication protocols. A major challenge is to provide the required flexibility to enable data acquisition from heterogeneous sensing devices and data dissemination through heterogeneous end-user applications. The system must provide simple and straightforward mechanisms for the incorporation of the following components: 1) new in-situ sensing devices, 2) new data dissemination services, and 3) different persistent data storage technologies. Focusing on observation data management, a system must provide the following general functionalities to effectively manage observation data: 1) management of conventional Entity/Relationship data related to non-observed properties of entities, 2) management of sampled data over temporal, spatial (1D and 2D) and spatio-temporal domains, 3) Support for observation data semantics, and 4) efficient implementation for large scale shared-nothing distributed hardware architectures.