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The U.S. NSF Ocean Observatories Initiative: A Modern Virtual Observatory

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The NSF Ocean Observatories Initiative (OOI) began a five-year construction period in October 2009. The Consortium on Ocean Leadership (COL) manages the overall program with Implementing Organizations for Coastal/Global Scale Nodes (CGSN) at Woods Hole, Oregon State and Scripps; the Regional Cabled Network (RCN) at U of Washington and Cyberinfrastructure (CI) at UCSD and more than ten subcontractors. The NSF has made a commitment to support the observatory operations and maintenance for a 30-year period; a minimal period of time to measure physical, chemical and biological data over a length of time possibly sufficient to measure secular changes associated with climate and geodesy. The CI component is a substantial departure from previous approaches to data distribution and management. These innovations include the availability of data in near-real-time with latencies of seconds, open access to all data, analysis of the data stream for detection and modeling, use of the derived knowledge to modify the network with minimal or no human interaction and maintenance of data provenance through time as new versions of the data are created through QA/QC processes. The network architecture is designed to be scalable so that addition of new sensors is straightforward and inexpensive with costs increasing linearly at worst. Rather than building new computer infrastructure (disk farms and computer clusters), we are presently exploiting Amazon's Extensible Computing Cloud (EC2) and Simple Storage System (S3) to reduce long-term commitments to hardware and maintenance in order to minimize operations and maintenance costs. The OOI CI is actively partnering with other organizations (e.g. NOAA's IOOS) to integrate existing data systems using many of the same technologies to improve broad access to existing and planned observing systems, including those that provide critical climate data. Because seasonal and annual variability of most measureable parameters is so large, the measurement of small secular variations requires sensors with little or no drift over many annual cycles as well as absolute timing between globally distributed sensors that exceeds current practice by orders of magnitude.