OceanXtremes: Oceanographic Data-Intensive Anomaly Detection and Analysis Portal

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Objective

Develop an anomaly detection system which identifies items, events or observations which do not conform to an expected pattern

- Mature and test domain-specific, multi-scale anomaly and feature detection algorithms
- Identify unexpected correlations between key measured variables

Demonstrate value of technologies in this service:

- Adapted Spark/Map-Reduce data mining
- Algorithm profiling
- Shared discovery and exploration search tools
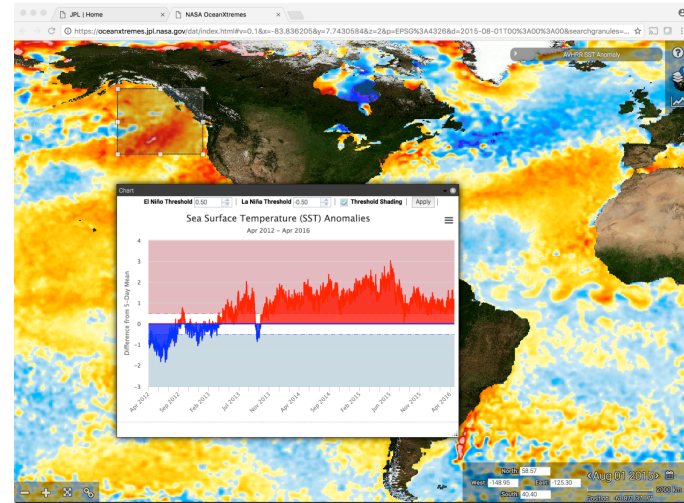- Automatic notification of events of interest

Illustration of OceanXtremes analysis capability showing "The Blob" the name given to a large mass of relatively warm water in the Pacific ocean off the coast of North America from 2013-2015

Graph shows SST above the norm (red) as dynamically analyzed by scientist

Accomplishments

- Demonstrated Portal ability to identify and perform anomaly analyses for a variety of scientific observation cases (i.e., SST Blob, El Niño 3.4 Regional Signal, and Hurricane Katrina)
    - Users can compare different measurements and models; document, browse, and archive shared identified anomalies.
- Demonstrated 2-orders of magnitude performance gain for regional time series generation compared to Giovanni.
- Developed analytic platform to identify and study anomalies in oceanographic datasets using large-scale data analysis
    - Created OceanXtremes as an Open Source and interactive platform.
    - Leveraged cloud computing using the AIST Managed Cloud Environment (AMCE)
    - Developed interactive visualization and analytic workbench (XtremesExplorer) enabling on-the-fly data comparisons and interactions with high performance computing and storage

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