

A Semantic Web-based Methodology for Building Conceptual Models of Scientific Information (IN53A-0950)

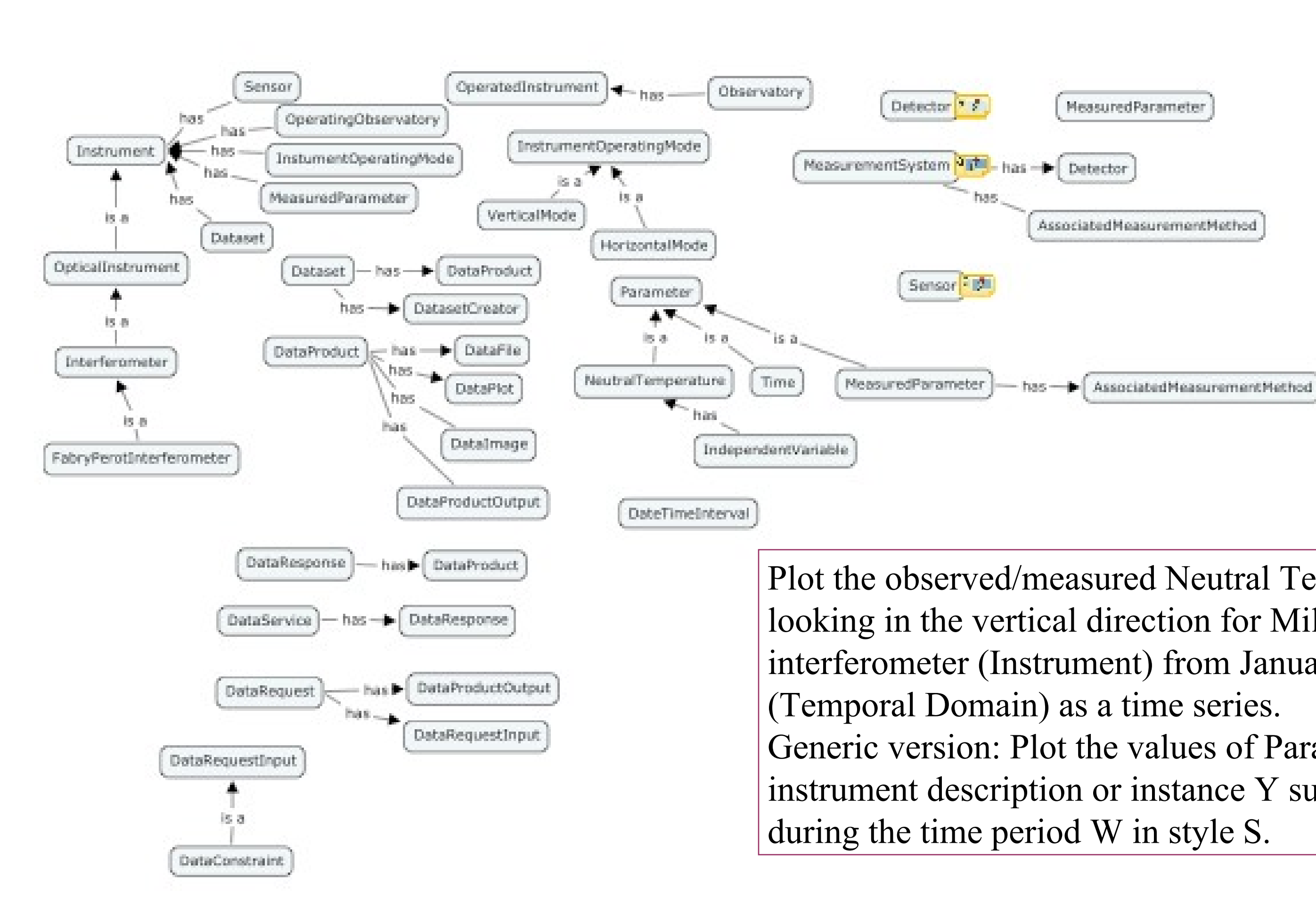
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Abstract

We have designed, developed, and deployed a number of applications that leverage ontologies in interdisciplinary scientific applications. As our work has evolved, we have developed a methodology for leveraging semantic technologies as kind of methodology for building and deploying semantically-enhanced science community applications. We will present our semantic web methodology that has been used in science applications covering Solar Terrestrial Physics, Atmospheric Research, Volcanology, and Plate Tectonics applications, among others. The methodology includes use case generation, carefully chosen mixed skill-set teams, use case analysis, development of a conceptual model, semantic tool usage, expert review and iteration, leveraging of technological infrastructure, rapid prototyping, and open world evolution, iteration, redesign, and redeployment. In this presentation, we will show how the methodology has been used in our projects and highlight benefits including quick deployment and rapid community buy-in.



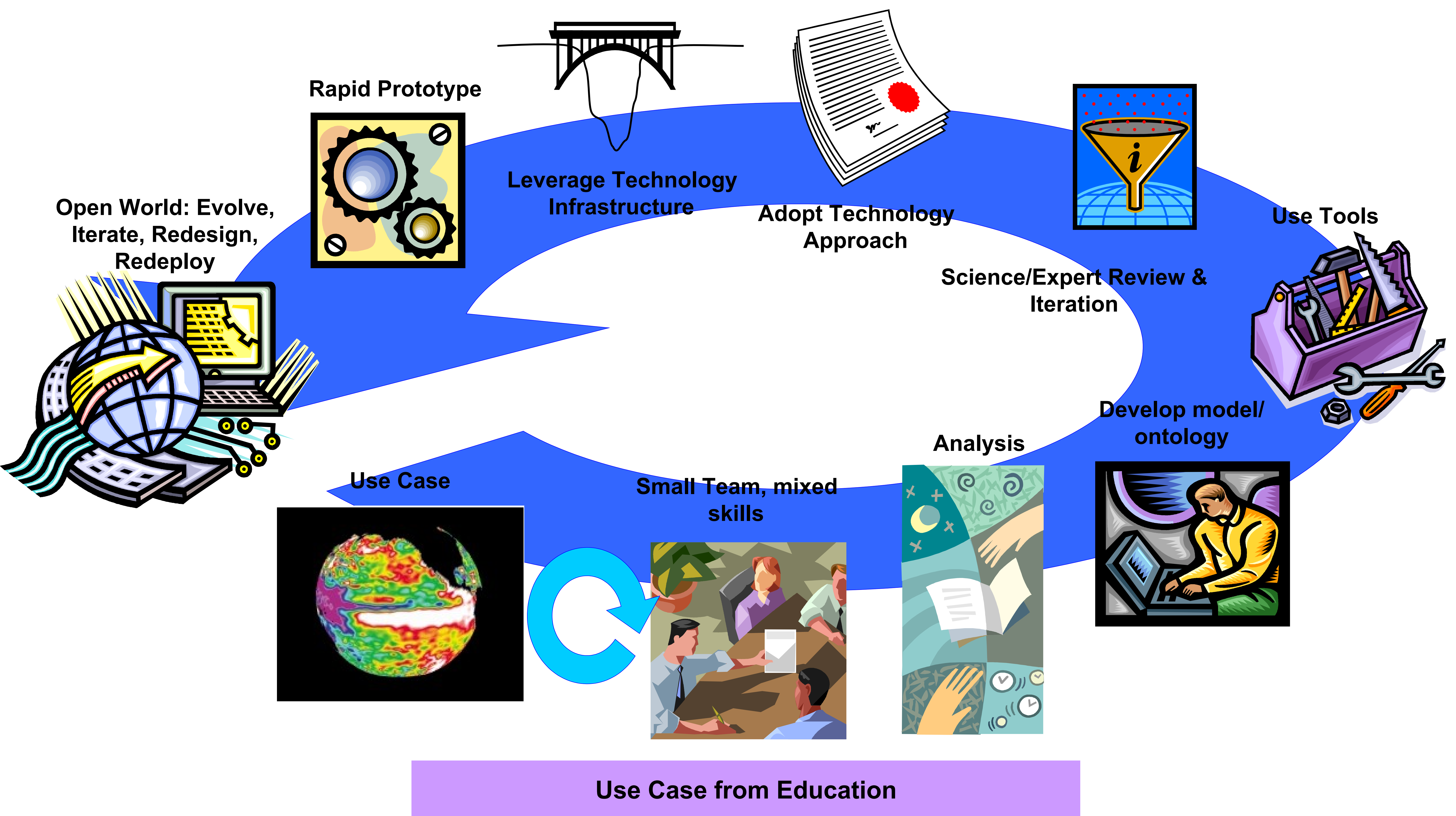
Use Case from Solar Terrestrial Physics



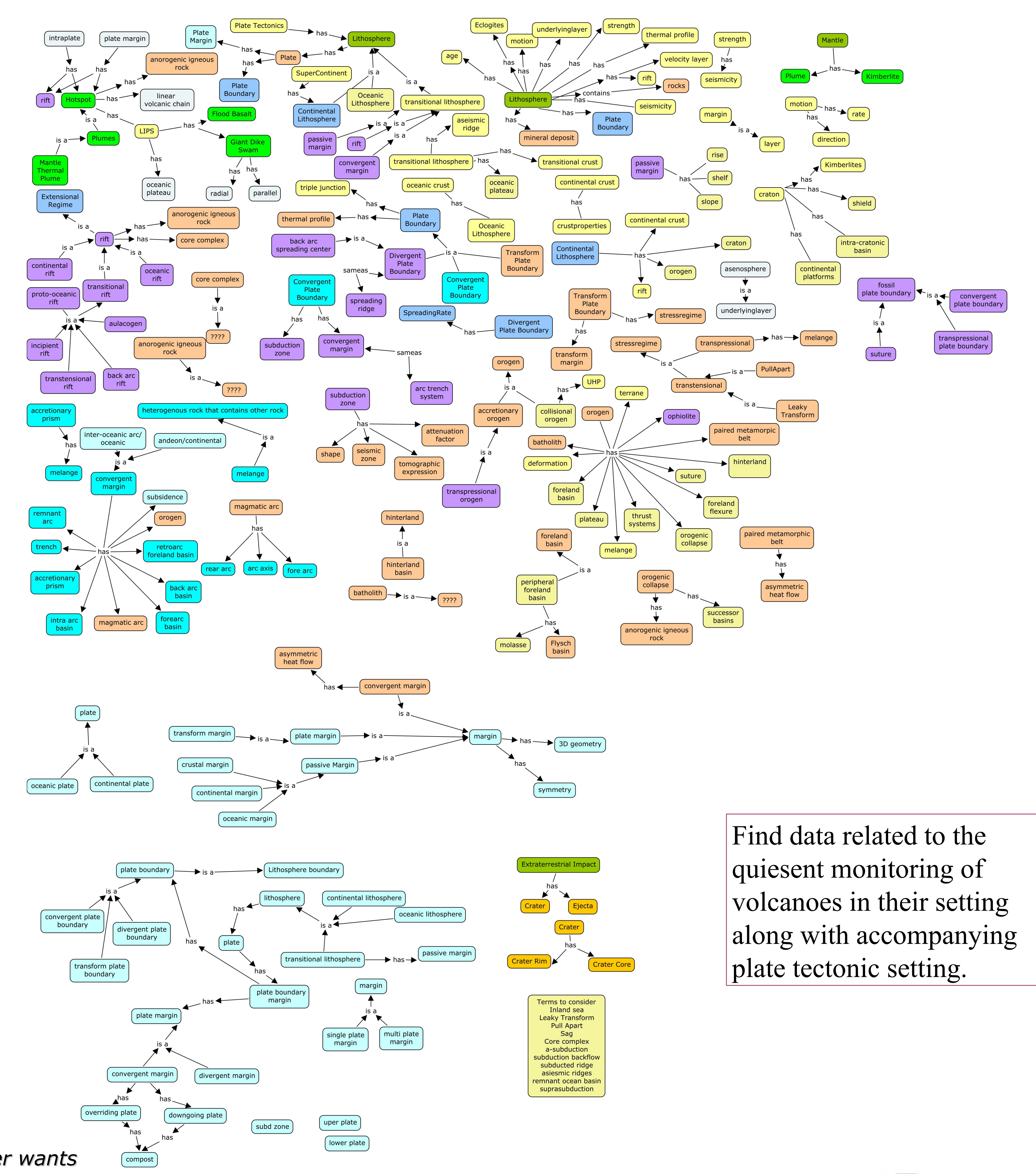
Plot the observed/measured Neutral Temperature (Parameter) looking in the vertical direction for Millstone Hill Fabry-Perot interferometer (Instrument) from January 2000 to August 2000 (Temporal Domain) as a time series. Generic version: Plot the values of Parameter X as taken by instrument description or instance Y subject to constraint Z during the time period W in style S.

Semantic Web Methodology and Technology Development Process

Establish and improve a well-defined methodology vision for Semantic Technology based application development
Leverage any existing vocabularies



Use Case from Volcano-Climata Data Integration - Plate Tectonics



Find data related to the quiescent monitoring of volcanoes in their setting along with accompanying plate tectonic setting.

A 9th grade teacher is preparing a lesson plan aimed at getting students to learn more about the 'northern lights', addressing NSES content standards in earth science. The teacher wants the students to learn the scientific terminology, where the phenomena occurs and retrieve some data or graphics for a recent occurrence. The goal of the lesson plan is to engage students, using authentic data from the aurora, as part of an inquiry-based program.

Goal: translate the teacher's requirements into a search for, and to find a specific dataset appropriate to the education task from a Virtual Observatory. Data would need to be provided in a usable format, as well as in a graphically accessible way. At present, in order for a teacher to access data, he would need to know the appropriate scientific vocabulary, the types of data available, spatial locations and directional operating modes of instruments (also models and indices) to be able to locate, retrieve and use the data from them. This use-case will demonstrate how ontologies, and semantically enabled interfaces can bridge the current gap in terminology and significantly reduce the level of detail that a person has to know about the data.

- 1. Goal**
To develop an interface that allows teachers to access types of data, graphic representations and background information that can be used in standards-based, inquiry-based lesson plans.
- 2. Main Actors**
Teacher. The teacher is an individual with college education and knows in general terms what to search for and what hints a student may need to complete the assignment.
Student. The student is an individual or part of a group at U.S. grade level 9 in the state of Colorado.
Educational portal. This portal allows teachers to access the most common kinds of requested data. (and can actually guess what those would be, build access to data and graphics that address specific NSES standards, and use a built-in evaluation tool to confirm).
Other actors: services to locate the data, retrieve the data and possibly re-package it in a suitable form, and graphically represent the data (backend data extraction and plotting application - located on a separate host from the educational portal and perhaps even via a specialized portal).
- 3. Preconditions**
Teacher does not need any special permission, access requirements or additional resources to meet the goal. Students and teacher must be able to access all data, images, etc. over the internet over relatively low-speed connections. They must be able to interact with the data and other products using computer platforms that are not state-of-the-art. All portals are freely accessible, and all have authorized to access required services. **Note:** the selection process always leads to a data product.
- 4. Characteristics**
 - ✓ Each selection made by the teacher acts as a constraint for the presentation of selections on the next screen. For example, by selecting a particular phenomenon the teacher is presented with both more specific and related information.
 - ✓ The teacher is guaranteed, through the selections made, to obtain data, images and supporting information that are directly related to the topic area of interest (i.e. are not spurious).

Educational use case activity/actor diagram

