Position Paper on "Specialist Meeting on Volunteered Geographic Information"

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The satellite data and derived products, together with available geophysical data products, could be shared within a decision support system or any GIS based information systems by utilizing advancements in Internet based technologies. We believe that we can see and quantify events and changes that normally can't be seen through a conventional way by developing a common system architecture and ontology to allow sharing information freely. However, in order to take the current level of information sharing into a next level, it requires not only technology break-through but also cultural change. We would need to identify a gap between science products and application products, to develop technology and architecture to fill the gap, and to provide an collaborative environment that is reliable and secure. The key aspects of technical challenges include normalizing various types of data products, handling and summarizing a large volume of data, effective visualization techniques for 3D/4D GIS, and data integration of sensor web including remote sensing data. On the other hand, the key aspects of cultural challenges include valuing benefits of sharing (a new business market), security, workflow, and acknowledgement of data contributions. Our science community is not mature to assimilate heterogeneous information products in systematic ways.

A proof of these concepts has been demonstrated through the following cases at JPL with data from satellite, models, and GIS based information:

1. **Messages:** Air quality implications; we have the capability to characterize the atmospheric environment as a precursor to fire. AIRS CO can be used to complement TES CO: TES has the vertical, while AIRS has better spatial coverage. The wind vectors should help explain the CO distribution as the CO gets transported. <u>Visualization techniques in 3D/4D were the key challenge.</u>
2. **Messages:** Fishing implications from upwelling; damage control from oil seeps; we have the capability to characterize the physical environment, and predict the consequences of various incidents. Data are provided by actual or modeled SST, chlorophyll, and winds from MODIS, AMSRE-SST, SAR, and ASTER, and the SCB SST and MM5 models. An upwelling incident can be shown, and an overlay of wind vector fields shows their causative effect on the upwelling. An oil seep can also be traced. <u>Real time runs of large models on demand were a challenge.</u>
3. **Messages:** INSAR and ASTER have many practical applications for land use planning and monitoring of various types of changes. Data focus is on ASTER (natural-looking images, mineral map, vegetation map) and INSAR. It shows records of aquifer discharge and recharge as shown by rising and falling of land surface, revealed by INSAR. Subsidence can lead to house damage, infrastructure damage, etc. <u>Large volume of data transfer was a challenge.</u>

In order to promote these concepts and to allow the public and domain experts to contribute, there needs a change in the current mode of operations for spaceborne remote sensing and sensor web approaches.

1. Vigorously pursue the diminishing opportunities afforded under classical Government sponsorship
   - Mobilize to make key contributions towards next decade's science achievements (we don't have all the right scientists)
   - Prepare for contraction of science workforce (need to outsource algorithm development with application developers)
2. Create demand within broader "flat" world market for space-based Earth observations
   - Identify emerging markets and develop commercial connections
   - Recruit key science leaders/flat world entrepreneurs
3. Develop products of value to the "flat" world market
   - Affordable observations for sustained or operational use
   - Relevant, easily accessible data products

Some of the critical technology needs are the followings:

1. Ways for information to be presented with increasing depth and complexity
   a. General Public > Decision Makers > Scientists
2. Information categories refer to data types
   a. Data is found via intelligent search or expert input
   b. Associated with each data type is a set of processes which transform the data for visualization
      i. Similar to processing and caching PDF to HTML for viewing
   c. Time series data processed into animations or summarized
3. Attribution for all Data and Other Materials (i.e., metadata) is tracked and displayed for the end user

At this workshop, I will discuss the followings:

1. Ways to identify information gaps between science and application world
2. Key technologies to fill the gap to address information generation and search
3. Key technologies to summarize information and to address security and data credits
4. OSSE (Observing System Simulation Experiment) - a simulation environment to increase resolution and sensitivity of information based on Sensor Web.

QuickTime™ and a
TIFF (LZW) decompressor
are needed to see this picture.

Ontology representation of Volcano Sensor Web