EXTRA – Examples of OGC standards in support of health applications

Some prior / existing initiatives using OGC Standards

• EU INSPIRE (health and safety working group)

• GEOSS AIP, EO2Heaven project: EO2HEAVEN (Earth Observation and Environmental Modelling for the Mitigation of Health Risks) is a research project co-funded by the European Commission as part of the 7th Framework Programme (FP7) Environmental theme. It started on 1st February 2010. EO2HEAVEN contributes to a better understanding of the complex relationships between environmental changes and their impact on human health.

• Medical Biology / Neuroscience, University of San Diego

• Prior GeoConnections funded projects (25+)

• Other OGC DWGs (cross-pollination)
Health Case Studies for GEOSS

Environmental effects on allergies and cardiovascular diseases in Dresden and the Free State of Saxony, Germany

Environmental challenges to health in South Durban, South Africa, due to human exposure on atmospheric pollution

Investigating the impact of environmental and climatic variables on the cholera outbreaks in Uganda
GEOSS connects Observations to Decisions

Nine Societal Benefit Areas

- Climate
- Disasters
- Weather
- Water
- Energy
- Health
- Agriculture
- Ecosystems
- Biodiversity

.registries:
- Services
- Standards
- Best Practices
- Requirements

Web Portal

Clearing-house

GEOSS Common Infrastructure

Data
Models
Metadata
Applications
Services
Products

Earth Observations
GEOSS AIP Architecture

Community Objectives

Enterprise Viewpoint
- GEOSS Vision and Targets
- Societal Benefit Areas
- System of Systems/Interoperability

Optimized Design/Development

GEOSS Vision and Targets
- System of Systems/Interoperability

Information Framework
- Earth Observations
- Geographic Features
- Spatial Metadata and Quality
- GEOSS Data-CORE

Detailed Viewpoints
- Information Viewpoint
- Computational Viewpoint
- Technology Viewpoint

Abstract/Best Practices
- RM-ODP Viewpoints

Services
- Catalog/Registry
- Access and Order
- Processing Services
- Sensor Web
- User Identity

Use Cases
- Discover Resources
- Visualize and Access
- Process and Automate
- Maintain and Support SoS
- Publish Resources

Component Types
- GEOSS Common Infrastructure
- Registered Community Resources
- Main GEO Web Site
- Geo Web Portal
- Discovery Brokers
- GEOSS Catalogues
- Test Facility
- User Management
- Processing Servers
- Access Brokers

Tutorials
Satellite Programming

Telemetry (Data)

Satellite Scheduling

Satellite Tasking One Stop

User Interface

http://140.134.48.12:443/quasiST/login

AIP: Disaster Management
SensorWeb High Level Architecture

Sensors, Algorithms and Models Wrapped in Web Services Provide Easy Access to Sensor Data and Sensor Data Products

Sensor Data Products

Get satellite images

OpenID 2.0

Design new algorithms and load into cloud

Task satellites to provide images

Data Processing Web Services Node

Level 0 and Level 1 processing

Geolocation, Orthorec, Coregistration, atmospheric correction

Level 2 algorithms (e.g. flood extent)

Internet

Sensor Data Products

Web Coverage Processing Service (WCPS)

GeoBPMS

Workflows

RSS Feeds

SWE Node

In-situ Sensor Data Node

UAV Sensor Data Node

Web Notification Service (WNS)

Sensor Planning Service (SPS)

Sensor Observation Service (SOS)

Satellite Data Node

floods, fires, volcanoes etc

AIP: Disaster Management
AIP: Biodiversity models on Web

- Observations plus modeling systems to predict pika distributions change with climate
- Interoperability to determine predictors for the impact of climate change on biodiversity
AIP-6: Hydrology on the web

Watersheds

Global to Local

Maps

Models

Observations

World Water Online – Univ Texas Austin. Leadership in AIP-6 along with many participants
Integrating digital atlases of the brain: atlas services with WPS

Ilya Zaslavsky
San Diego Supercomputer Center, UCSD

Lead of the INCF Digital Atlasing Infrastructure Task Force
What is an atlas?

- A collection of 2D images or a 3D volume, possibly with anatomic feature delineations and a set of additional annotations

What we need is more than an atlas:

- A gateway to large distributed databases of images, volumes, segmentations, gene expression data, electrophysiology, behavioral, connectivity, other spatially-registered data
- Ability to ask questions such as “which atlases have images for this part of the brain”, “what genes are expressed here in atlas A”, “compare spatial patterns of protein distribution across atlases”, etc.
- Collection of atlases organized as spatial data sources
- Collection of spatial data registries, service APIs and workflows:
  - image registration, segmentation, spatial selection, spatial analysis, integration of spatial data
- Collection of viewers, integration and annotation tools
Digital Brain Atlasing

Digital brain atlases are essential tools in neuroscience research. They function as references and analytical tools, and provide stable integration frameworks as a basis for investigations of normal and abnormal brain structure and function. Web-accessible brain atlases and spatial indices promise to evolve into powerful tools for dynamic, multidimensional modes of scientific interaction. The key aim of this INCF program is to coordinate and improve the impact of atlasing projects, with a focus on the recent brain.

Reference Data - Waxholm Space

Waxholm Space is a coordinate-based reference space for the mapping and registration of neuroanatomical data in the mouse brain. Image volumes representing the canonical Waxholm Space (WHS) mouse brain can be downloaded from the INCF Software Center. Servers hosting the Waxholm Space translation services, which will enable scientists to register their own mouse data to the standard Waxholm Space coordinates as well as provide translations among other mouse brain atlases, have been established at the Royal Institute of Technology’s Supercomputer Center in Stockholm.

Oversight Committee Chair
- Ilya Zaslavsky
- Project coordinator

Contact Details
- Jannis Breeze
  - jannis.breeze@incf.org

Digital Atlassing Infrastructure Task Force
- Mike Noworych
- Jifi Rolnick

Selected Resources
- EEG.PL
  - EEG.PL is an open repository for software, publications and datasets related to the analysis of brain potentials: electroencephalogram (EEG), local field potentials (LFP), etc.
  - Learn more
  - Go to website
Purpose of this INCF program: To enhance the interoperability, accessibility, and sharing of spatial data sets in neuroscience: INCF-sponsored standards
Accessing atlases from the Whole Brain Catalog

AGEA response to GetCorrelationMapByPOI

GetGenesByPOI returns gene information from AGEA

The 3D atlas integration client

Get2DImageByPOI returns related images from UCSD hub

GetGenesByStructureName returns gene information from EMAGE

Get2DImageByPOI returns images from AGEA
The Integration Problem: Whose standard?
The Central Role of Waxholm Space
Different types of transformations

- **ABAvoxel to WHS**
  - Large volumes for transforms in both directions, between 3D and 3D of different dimensions
  - Then simple lookup in the transformation volume

- **ABAvoxel to ABAreference**
  - Collection of conversion formulas for individual slices

- **ABAvoxel to AGEA**
  - Simple scaling

- **WHS to Paxinos Mouse Atlas**
  - Warping appropriate WHS cuts to match with Paxinos slices; translations per slice and brain region
Standardization of atlas services

The services use OGC Web Processing Service (WPS)

Waxholm Markup Language (WaxML):
XML schema that provides standard constructs for atlas services
Different types of transformations

• ABAvoxel to WHS
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ListTransformations
GetTransformationChain
DescribeTransformation
TransformPOI