

The background of the slide is a deep blue space scene. On the left, a large portion of the Earth is visible, showing blue oceans and white clouds. In the upper center, a bright sun or star is partially obscured by a red, glowing ring, creating a lens flare effect. The overall atmosphere is futuristic and high-tech.

NORTHROP GRUMMAN

DEFINING THE FUTURE

Net-Centric Services for Delivery of Actionable Earth Environmental Data

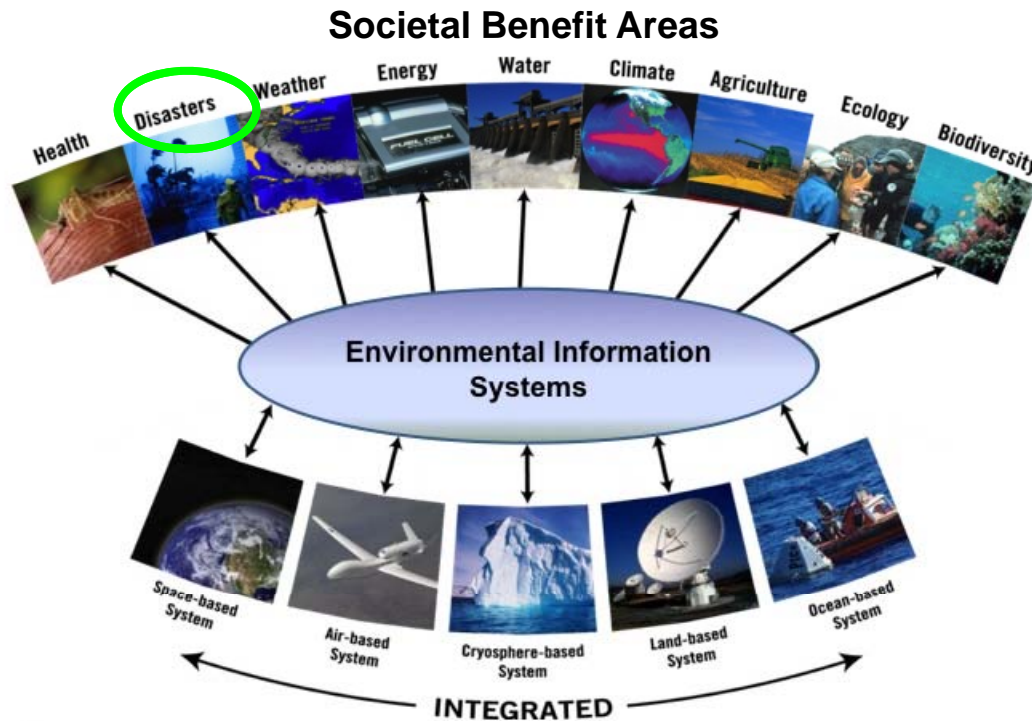
**Ground System Architectures Workshop 2009
Architecture-Centric Evolution (ACE) Working Group**

23 - 26 March 2009

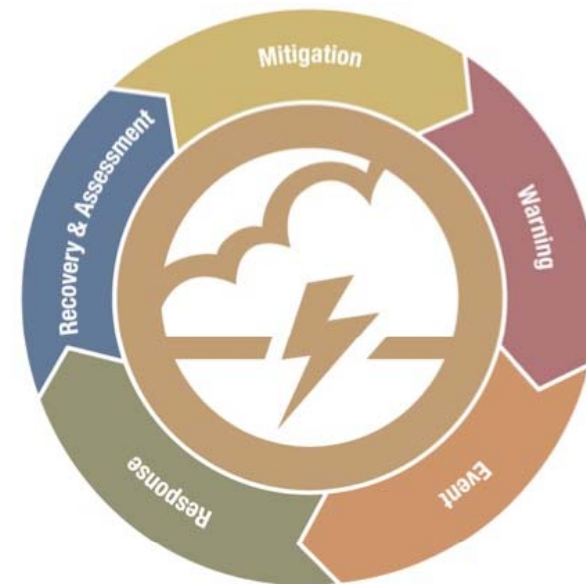
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The Challenge: Connect Users to Environmental Data Providers for Disaster Response



- Environmental sensor systems and their ground segments are not currently integrated
- The system must appear as an integrated enterprise
- The Disaster Cycle is the workflow



Disaster Cycle

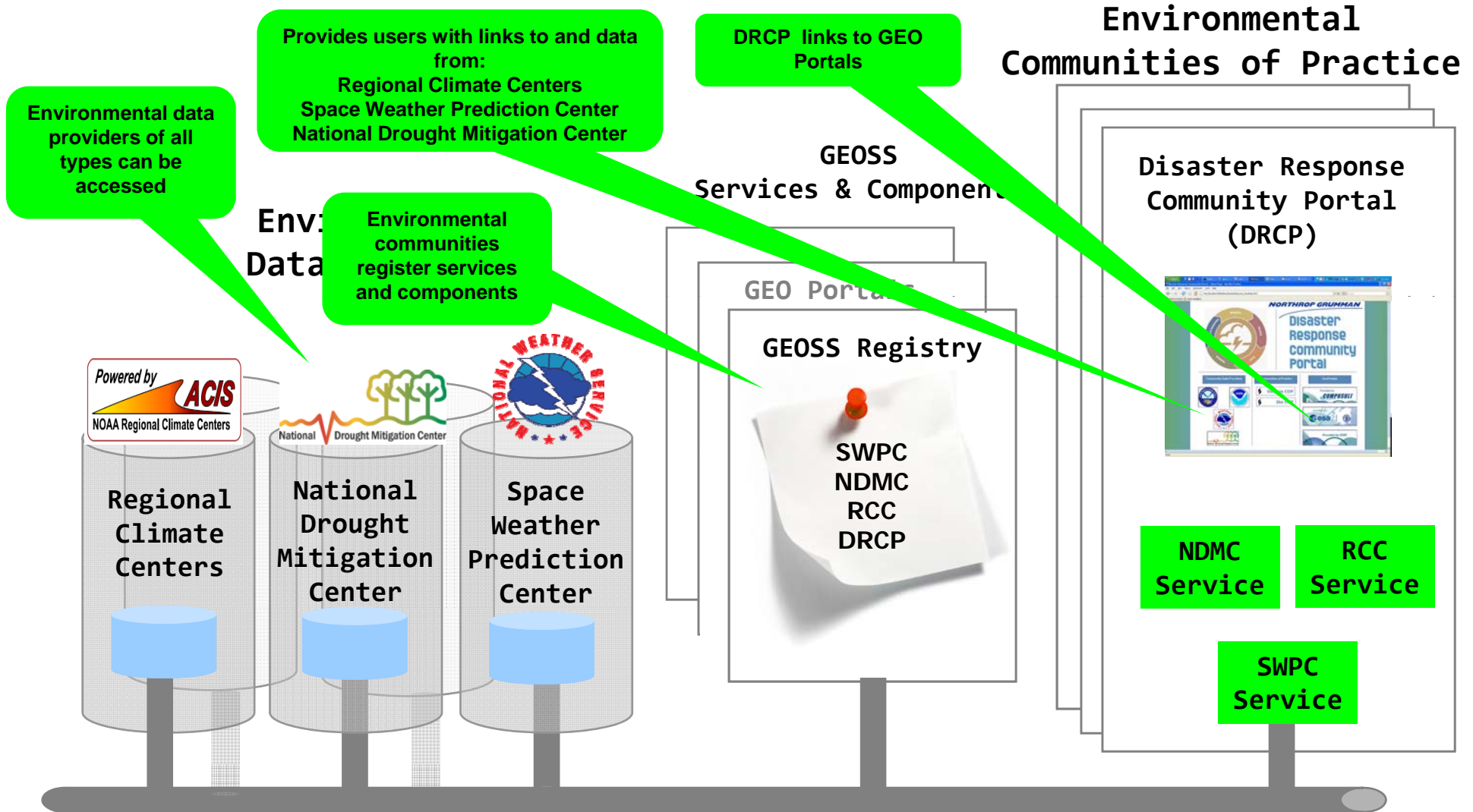
- Global Earth Observation System of System (GEOSS) Implementation Plan has identified nine different user communities, called "Societal Benefit Areas" (SBA), that are responding to the challenges posed by climate and technology change.
 - Each SBA has unique needs and capabilities and shares common services and approaches through a network of community portals.
 - Our focus is on disaster response and management

Figures: Group on Earth Observations, "Architecture Implementation Pilot (AIP) Phase 2: IOC Augmentation Call for Participation (CFP), Annex B – Architecture", June 2008




The Disaster Response Scenario Drives the Selection of Standards and Services

Activity	Scenario Step	User (Primary)	Storyline	Proposed Data and Source(s)	Proposed Service(s)
Mitigation	Community Data Providers investigate and monitor area drought, flooding, and climate conditions	Forecaster	Forecasters at regional and community levels are hard at work laying down the foundation for data that needed from data providers to determine effects of hurricane activity later in the season. We provide some examples of Forecasters extracting current drought and climate information from data currently available. We are especially focused on the Louisiana (LA) and Texan Gulf Coast in this scenario	<ul style="list-style-type: none"> NDMC – Current and forecast conditions products for the gulf coast—TX (e.g., Houston/Harris County, LA) RCC – Current climate data (precipitation totals over last 30-31 days as of the start of hurricane season –1 June; show as a percentage of normal May month) WGRFC – Current flood data LMRFC – Flood Data Harris County – Floodplain data 	<ul style="list-style-type: none"> NDMC & RCC (ACIS) – WMS WGRFC– Tabular data provided via website – WCS
Warning	Forecaster begins tracking storm and posts projected track, watches, and warnings	Forecaster	The Forecaster is monitoring hurricane progress. One of the data points used is IR and visible images taken by space-based sensors. In our example, we show GOES-East images in a loop of 30-minute updates. Certainly, a variety of sources are available including the NHC. Today, we can use NOAAport but certainly, GEONETCast includes GOES-E data that will be available on GEONETCast-Americas in the future.	NHC	AVI
Event: Tasking	Storm gathers strength resulting in an upgrade of storm to a CAT I storm	Forecaster	The Forecaster upgrades the storm category to a CAT I hurricane and issues an alert that alerts the Response COP and the Public that Hurricane Victoria is on a path to land somewhere along the TX, LA Gulf coast.	NHC – Hurricane Alert	RSS
Event: Tracking & Response Preparation	Decision Maker at Regional Decision Support Center (RDSC) engages the Response Team COP including Regional Civil Protector, Forecaster	Decision Maker	The Decision Maker is shown using the Disaster Response Community Portal to share an image of the path of the storm. He is shown using the Portal's chat capability to communicate with the Response Team.	Community Portal	<ul style="list-style-type: none"> WMS WCS CAP
Event: Disaster Prediction & Response Preparation	Decision Maker alerts COP of space weather detection of a solar flare--prediction of wide-area blackouts of HF radio communications	Decision Maker	<ul style="list-style-type: none"> The Decision Maker receives a warning indicating a period of intense solar activity that may impact HF and VHF communications thereby posing a communications issue for emergency responders (245 MHz, 410 MHz). The Decision Maker issues a warning to the Response COP The Decision Maker monitors TEC and frequency 1.4 GHz for potential impact to GPS navigation. 	SWPC	<ul style="list-style-type: none"> WMS WFS
	Evacuation orders were mostly followed but extensive coastal damage and flooding of oil refinery areas occurred as extensive flooding occurs in area	Civil Protector	Civil Protection takes the upper hand during this activity. In this step, the Civil Protector has access to high resolution imagery that shows extensive flooding in oil refinery and storage tank holding areas.	WGRFC – Flood data	WCS
Recovery & Assessment	Forecaster tracks the storm as it passes over the area slowing slightly upon landfall before it heads northward with torrential rains falling in river basins that flow toward the coast	Forecaster	Forecaster tracks where heavy rainfall might still be falling. This greatly affects flooding patterns in the area. The Forecaster keeps monitoring the bayous in the Houston area for signs of cresting. There is a USGS sensor on the Buffalo Bayou that runs through downtown Houston. USGS sensor data is shared with the National Weather Service.	<ul style="list-style-type: none"> RCC NHC WGRFC – Flood data 	WMS, WCS
Mitigation	Post-event analysis of data and products by Community Data Providers	Civil Protector	The storm and aftermath events have passed. We are now back in the Mitigation activity of the Disaster Cycle. The Civil Protector will be reviewing the timeline of events, forecasts, types and timeliness of warnings, issuance and obedience of evacuation orders, etc. to glean lessons learned. Here we see the Civil Protector looking at the timeline of events on the Community Portal.	Community Portal	<ul style="list-style-type: none"> Timeline AVI of storm and flooding

The System View: Services Connect Users to Data Providers



Standards Based Services Enhance Interoperability Among Environmental Communities

Service	Description	Organization	URL
 Common Alert Protocol (CAP)	<ul style="list-style-type: none"> Simple format for exchanging alerts and hazards Currently on version 1.1 	OASIS	http://www.oasis-open.org/home/index.php
 Web Map Service (WMS)	<ul style="list-style-type: none"> Way for client to request a rendered, projected, cartographically styled mp image from a service Returns a static map 	OGC	http://www.opengeospatial.org/
 Web Feature Service (WFS)	<ul style="list-style-type: none"> Interface for data access and manipulation operations on geodata via HTTP Allows web users or services to combine, use, and manage geodata from different sources Returns discrete geospatial features 	OGC	http://www.opengeospatial.org/
Web Coverage Service (WCS)	<ul style="list-style-type: none"> Access to sets of geospatial data in forms that are useful for client side rendering, multi-valued coverages, and input into scientific models and other clients Returns data with its original semantics and therefore may be interpreted, extrapolated, etc. 	OGC	http://www.opengeospatial.org/
Sensor Observing Service (SOS)	<ul style="list-style-type: none"> Requesting, filtering, and retrieving observations and sensor system information Intermediary between client and observation repository or near-real time sensor channel 	OGC	http://www.opengeospatial.org/
Sensor Planning Service (SPS)	<ul style="list-style-type: none"> Requesting user driven acquisitions and observations Intermediary between client and sensor collection management environment 	OGC	http://www.opengeospatial.org/
Sensor Alerting Service (SAS)	<ul style="list-style-type: none"> Publishing and subscribing to alerts from sensors 	OGC	http://www.opengeospatial.org/
Web Notification Service (WNS)	<ul style="list-style-type: none"> Asynchronous delivery of messages and alerts from SAS and SPS web services and other element service workflows E-mail alerts 	OGC	http://www.opengeospatial.org/

✓ Today

✓ Future plans

Summary

- Selecting and developing services is driven by workflow or scenario
- Portals create a marketplace for information sharing and collaboration for effective disaster response
- Use of standards, and registering services eases interoperability, extensibility, reuse
- Interoperability with environmental information silos made transparent to end-users

Thank You



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