Report on the GEOSS Interoperability Process Pilot Project

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IEEE Committee on Earth Observations

Outline

- **Background**: Origin and purpose of the IP3
- **Context**: The GEOSS Interoperability Process
- **Description**: The IP3 scenarios
- **Summary**: Progress and conclusions

Origins of the IP3

- In 2006 GEO Architecture Task 06-01 produced a draft document outlining the GEOSS "Process for reaching interoperability arrangements".
- The "Interoperability Process Pilot Project" was conceived to begin implementing the GEOSS infrastructure and testing the GEOSS interoperability process.
- GEO TASK AR-06-01 was asked to develop a series of projects involving several initially identified GEOSS components, with the aim of producing a suite of demonstrations for the GEO Summit in November.

A Services Oriented Architecture Approach

- Any component of GEOSS can expose service interfaces intended to provide opportunities for other GEOSS components to “interoperate”
- The exposure of a component interface within GEOSS must be accomplished through a registered service interface that references a GEOSS-registered standard or a GEOSS Interoperability “Special Arrangement”.

"Interoperability Arrangements"

- When two GEOSS components conform to the same data description and transport standards, and are well-defined within the GEOSS registries, interoperability should be achievable with minimal effort
- Where two GEOSS components do not share common standards, or where the service definitions are not adequate, interoperability "Special Arrangements" will need to be made.
- This will be managed by the GEO "Standards and Interoperability Forum."

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Differential Interoperability

- In GEOSS interoperability is not a goal unto itself
  - Different domains within GEOSS should pursue attainable improvements in interoperability on whatever time scale is appropriate to their separate needs and available resources
- Only a few functions (e.g, the Clearinghouse supporting searchable catalogs of services and data holdings) are required to encompass all parts of GEOSS

IP3 Development Phases

- Phase 1 – Populating the Component, Services and Interoperability Registers
- Phase 2 – Develop Cross-System Interoperability Scenarios, invoke SIF
- Phase 3 – Create Demonstrations
- Phase 4 – Work on Higher Levels of Interoperability
- Repeat process with new components and scenarios to address other SBAs

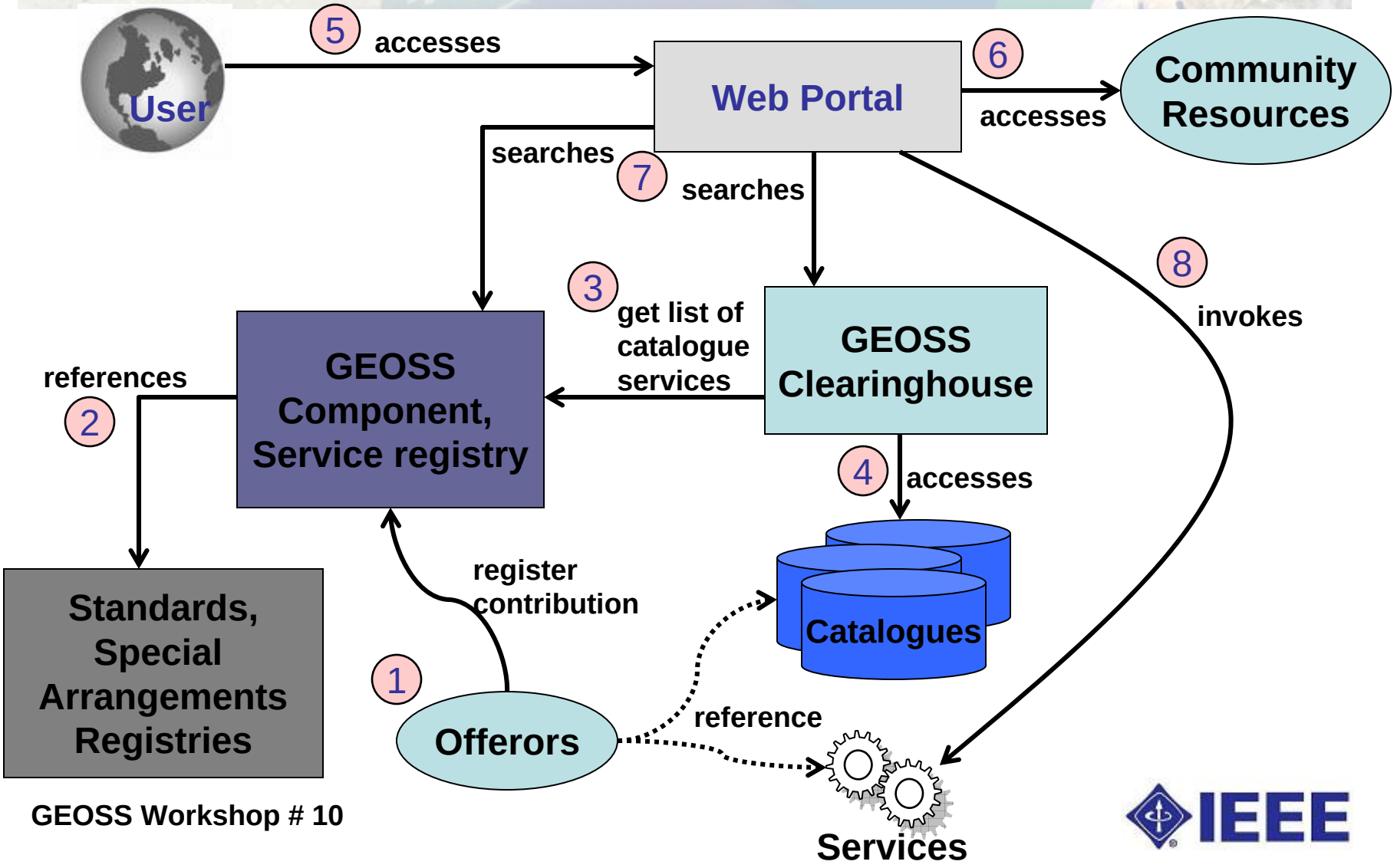
Participating Systems and Principals

- Biodiversity
  - Hannu Saarenmaa & Éamonn O Tuama (GBIF), Stefano Nativi (Italian National Research Council & Univ. of Florence)
- Seismology/Landslides
  - Tim Ahern (FDSN, IRIS), Monica Osuchowski & Rob Atkinson (Geoscience Australia)
- WTF-CEOP
  - Ryosuke Shibasaki & Ben Burford
- WMO Information System - WIS
  - David Thomas (WMO)

Phase 1 – Populating the Registers

- Populate the GEOSS registers
  - Identify the standards, interface protocols and interoperability agreements in use
  - Provide information to the Clearinghouse as it is brought online
- Analyze successful data integration projects, showing
  - why and how interoperability arrangements were made and maintained
  - how the interoperability arrangements worked under the computer and network environment of the time
  - what the impacts were of these arrangements

Registries Context



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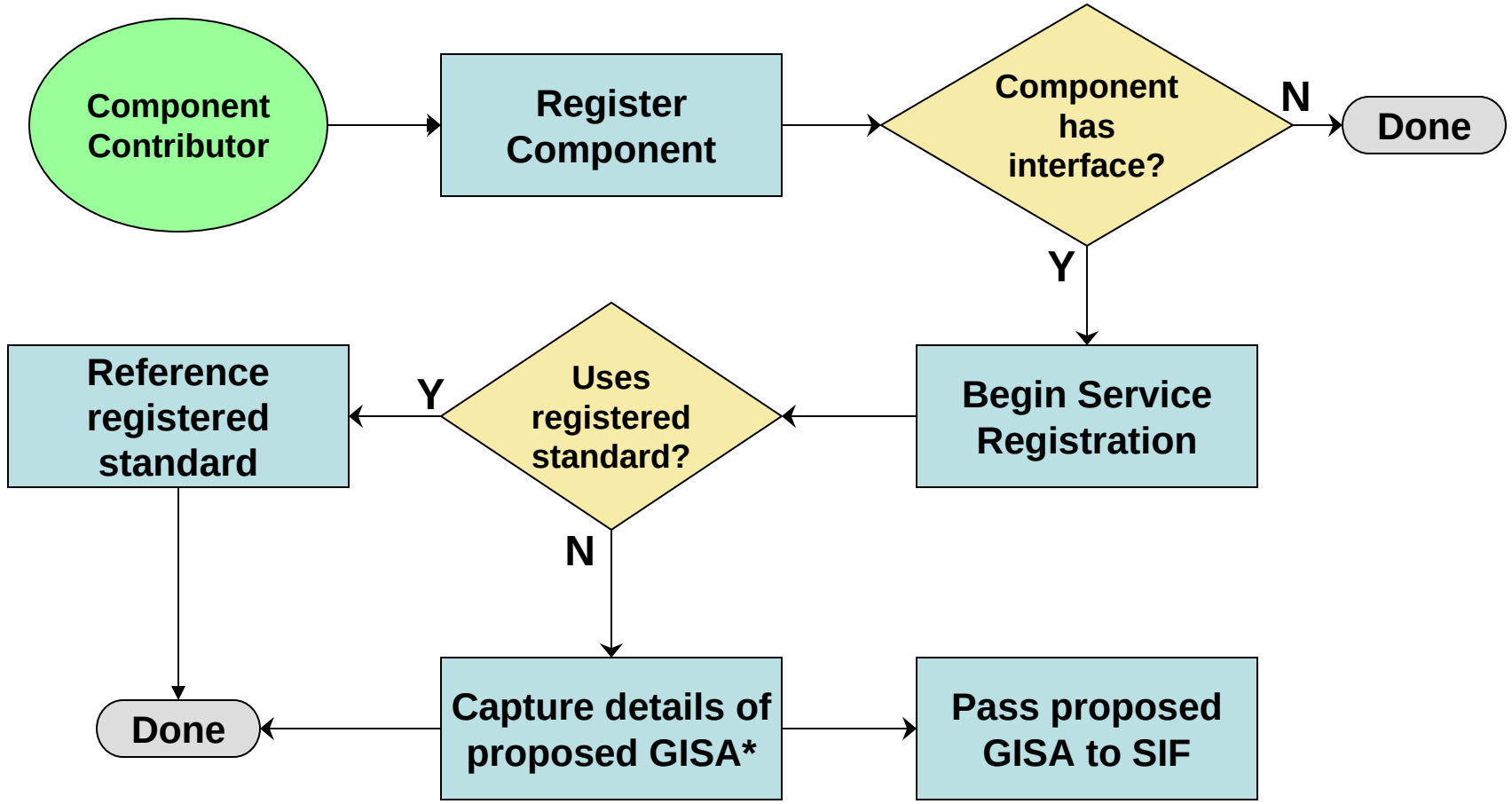
GEOSS Interoperability Process



*GEOSS Interoperability Special Arrangement

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The Standards and Interoperability Forum

- A Standards and Interoperability Forum (SIF) is being formed to carry out impartial review of GEOSS interoperability issues and to recommend solutions (organizational meeting this Friday).
- Initiating the SIF and refining its protocols and procedures is one of the key objectives of the IP3.

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SIF Role in Phase 1 of IP3

- During Service Registration, if the service does not use an existing "GEOSS Registered Standard" (GRS) the contributor will enter details on proposed "GEOSS Interoperability Special Arrangements" (GISA).
- This information will be passed to the SIF, which will manage entries into the "Special Arrangements" register hosted by the IEEE.

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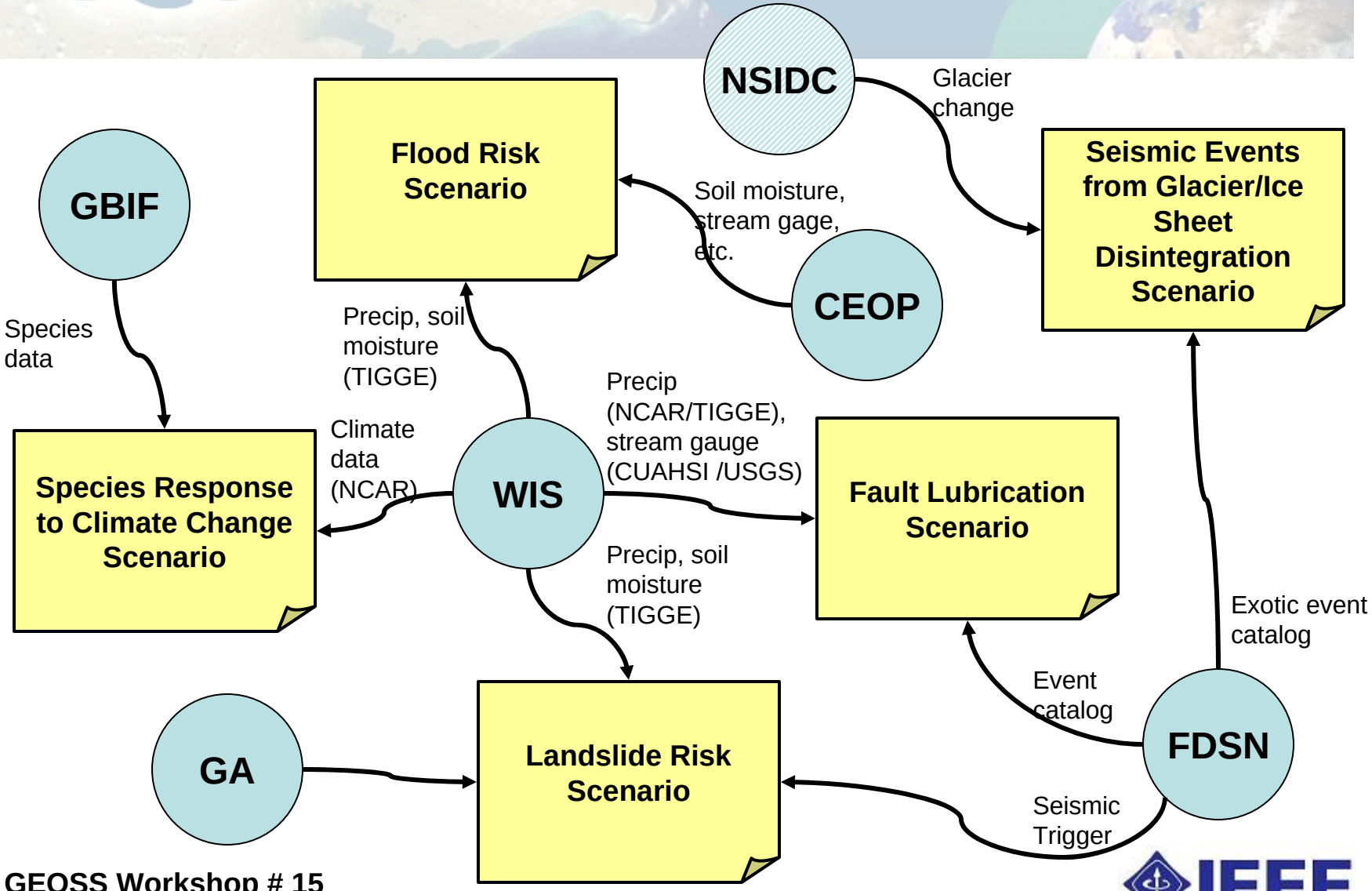
Phase 2 – Cross-System Interoperability Scenarios

- Develop scenarios that require the exchange of data and information between disparate systems which have not yet established a mechanism for such an exchange.
  - Address needs identified in one or more of the Societal Benefit Areas
  - Ensure relevancy and realism
- Demonstrate how the GEOSS architecture, data, and services have made it possible to realize benefits that would not have been easily achieved otherwise

IP3 Scenarios and Data Flows



GBIF IP3 Working Group

- GBIF Secretariat
  - Éamonn O Tuama, Tim Robertson, Dave Martin, Donald Hobern
- IEEE & University of Colorado
  - Siri Jodha Khalsa
- Italian National Research Council (CNR-IMAA) & Univ. of Florence
  - Stefano Nativi, Paolo Mazzetti, Lorenzo Bigagli, Enrico Boldrini, Valerio Angelini, Ugo Mattia
- University of Ottawa
  - Jeremy Kerr
- University of Helsinki
  - Hannu Saarenmaa
- University of Tokyo
  - Motomi Ito
- WMO
  - David Thomas

GBIF Interoperability Scenario

- Scenarios for interoperability between Biodiversity and Climate Change SBAs
- Relevancy
  - Climate change threatens to commit 15-37% of species to extinction by 2050.
  - Widespread land use changes are accelerating the mass extinction.
  - The theme for the International Day for Biological Diversity (IBD) in 2007
  - Report of the Intergovernmental Panel on Climate Change

Species Response to Climate Change

- Ecological Niche Modeling is applied to study the adaptation of butterflies in Canada and Alaska to various climate change scenarios.
  - The scientific approach for using primary biodiversity data for studying adaptation to various climate change scenarios has been created by Peterson & al. (2001, 2002).
- Requires interoperability between the GBIF (Global Biodiversity Information Facility) and components of the WIS (World Meteorological Organization Information System).

GBIF and Open Modeller

- GBIF has been promoting this approach
  - GBIF has integrated 118 million primary biodiversity records from about 1000 databases,
  - GBIF has opened prototype web services to access them through a one stop shop
- The modelling tools for ENM are being made available through the Open Modeller project
  - An open framework
  - A set of web services

Adopted solutions

- Write a formal and expanded use scenario
- Use GBIF portal web services to access and retrieve the biodiversity data
- Access and retrieve NCAR Climate Change data via OGC WCS
- Interoperability with GBIF and Climate registries using GI-go/GI-cat federated catalog and Mediation Server (mapping to ISO19115 core metadata)
- Use the Open Modeller ENM framework through its SOAP functionalities
- Put together an AJAX based demonstrator user interface

Interoperability with GBIF and climatological registries

- Mediation Metadata Model: ISO 19115 core profile

Processing on Distributed OpenModeller Compute Servers

Access

Discovery

Access

GI-cat/GI-go

GBIF Registry

In-situ Biodiversity Records

WCS Registry

Climatological and Environmental Data

GLOBAL BIODIVERSITY INFORMATION FACILITY

NCAR

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Demonstrator user interface

- D
M

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Flood Risk Scenario

- A distributed surface run-off model provides data for flood warning and dam operation systems.
- Requires interoperability between CEOP (Coordinated Enhanced Observation Period) systems and components of the WIS.

Landslide Risk

- Analysis to determine whether rainfall and seismic data be used to predict locations where hillsides are susceptible to collapse.
- The key issue/lesson is need to develop common mechanisms for linking domain models (e.g. landslides and geological context, landslip events and hydrological/meteorological contexts, landslide impacts and risk/hazard assessment models etc.)
- Requires interoperability between the FDSN (International Federation of Digital Seismographic Networks), the WIS, and an interoperable landslide database network in Australia.

Fault Lubrication

- Analysis to determine whether high rainfall rates or excess groundwater produce increased earthquake activity in areas of known faults. Requires interoperability between FDSN and WIS components.

Seismic Events from Glacier/Ice Sheet Disintegration

- Analysis of seismic signals and a combination of remote sensing and in situ data for selected glaciers to determine whether global seismic networks can be used to monitor ice sheets and glacial activity and thus remotely sense effects of warming on a global scale.
- Requires interoperability between FDSN and databases at the National Snow and Ice Data Center.

Scenario End Points

- Two of the scenarios (Species Response and Flood Risk) have substantial resources backing them
  - Schedule/critical path for these being worked
  - End point is live demo plus video or narrated slide show
- The scenarios involving FDSN may not evolve past conceptual stage due to limited resources
  - End point is 2-page write up
- At least two of the scenarios will require “special arrangements” to be registered, thus ensuring involvement of the SIF.

Phase 3 – Demonstrations

- Present results of Phase 2 to the Architecture and Data Committee and then with all GEO Members and Contributing Organizations
  - Prepare a briefing on the process
  - Include live demonstration of those infrastructure components that have been implemented
    - The Interoperability Register and Registry
    - Data and information exchange via the defined arrangements
- Two kinds of demonstrations
  - A demonstration detailing technical implementation
  - A social benefit demo for policy makers and senior managers
- A report on GEOSS interoperability process and its benefits

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Phase 4 – Higher Levels of Interoperability

- Develop higher levels of interoperability
  - Exercise more completely the capabilities of the protocols and interfaces identified
  - Address semantic interoperability
    - Ensure the meaning of the data and information exchanged through the interfaces are intelligible to the recipient systems

Schedule

Milestone	Delivery Date
Component registration forms completed	Feb '07
Draft scenarios delivered	Feb '07
Standards Registry Availability Announced	May 18
SIF Call for Participation Released	June 19
First Organizational Meeting of SIF	July 27
Demonstration to ADC	Sept '07
Delivery of IP3 documents	Nov '07

Summary

- The Interoperability Process Pilot Projects are contributing to the development of the GEOSS architecture by exercising core GEOSS components and processes.
- The scenarios under development are fully compliant with, and representative of, the GEOSS process for reaching interoperability.