

Le partage de données environnementales

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EnviroSPACE – <http://www.unige.ch/envirospace>

UNIVERSITÉ DE GENÈVE

ENVIROSPACE LAB. - SPATIAL PREDICTIONS AND ANALYSES IN COMPLEX ENVIRONMENTS

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Welcome

Research projects

Teaching

Publications

Conferences

Collaborators

TIGERS

enviroMATICS

The **enviroSPACE** laboratory is dedicated to **spatial analyses** within the Institute for Environmental Sciences at the University of Geneva, as part of the Forel Institute, and in close collaboration with the Climatic Change and Climate Impacts group, the Ecology group, as well as the InfoGEO at the Geography department. These groups collaborate at the University of Geneva to promote GIS through a common web platform. We also work under a unique and long lasting agreement with UNEP/GRID-Geneva and the Federal Office for the Environment.

We have coordinated the FP7 **enviroGRIDS** project in the Black Sea catchment, and are presently coordinating the FP7 **EOPOWER** project. We are also participating to the IASON, ACQWA, PEGASO, AfroMaison and EcoArm2ERA FP7 projects. We are also coordinating the SNSF SCOPES ARPEGO project, and the CRUS/SCIEX **enviroPAD** project.

We also contribute to the **TIGERS** academic activities to promote **Technology and Information for Geographic and Environmental Research and Services** and to the **enviroMATICS** hub at ISE.

- Our aim is to promote **interdisciplinary research based on spatially explicit information and indicators** on the past, present and future **state of changing and complex environment**. We are building several **Spatial Data Infrastructures (SDI)** to improve data sharing and processing.
- Our challenge is clearly to **fill the gap between scientific information on one hand and decision making on the other hand**, in order to improve the sustainable management of our unique and fragile environment.
- Our toolbox is composed of traditional GIS, **remote sensing, relational data bases and statistical analyses**, as well as **dedicated modeling tools** in Ecology, Hydrology, Demography, Climate, Risks or Land Cover analyses.

These geoprocessing tools are producing spatially explicit outputs at various scales. Methods for **downscaling and upscaling** geographic information are used to integrate them in order to **asses for instance the vulnerability, sustainability or services of ecosystems**.

These geoprocessing tools are also requesting more and more computing power to manage **complex workflows on large datasets**. We are therefore exploring ways to **run these geoprocesses on the Internet and on distributed computing solutions** (clusters, grids and clouds).

Our expertise is being taught at the University of Geneva by our active contributions to the cursus of the **Master of Environmental Sciences** and the **Certificate of Geomatics**.

TIGERS RSS

TIGERS-TALK 6: 04.04.16 - Barbara Ryan - Director - Group on Earth Observation
April 4th
Building a Global Earth Observation System of Systems (GEOS) and the Importance of Broad, Open Data Policies...

TIGERS-TALK 5: 07.03.16 - Prof. Adrienne Grêt-Regamey, ETH
March 7th
Towards implementing the ecosystem services concept ...

TIGERS-TALK 4: 01.02.16 - Prof. Andrew Skidmore, ITC, Netherlands
February 1st
Illegal logging – the extent of the problem...

TIGERS-TALK 3: 07.12.15 - Prof. Michael E. Schaepman, University of Zurich
December 7th
From photon to policy...

TIGERS-TALK 2: 02.11.15 - Prof. Čedo Maksimović, Imperial College London
November 2nd
Blue-green dream project...

TIGERS-TALK 1: 05.10.15 - Pierluigi Cau, CRS4, Sardinia
October 5th
Modeling tools and web based information systems for the management of GIS data...

TIGERS-TALKS
October 5th
TIGERS-TALKS starting on October 5, 2015. First Mondays of each month at noon...

UNEP/GRID Geneva 30 years anniversary
September 3rd
UNEP/GRID Geneva 30 years anniversary. Chateau de Penthe, September 3, 2015...

Tweets by @TigersUnige

TIGERS Retweeted

UNEP/GRID-Geneva @GRIDgva
#ecosystemservices book role of Ecosystems for Disaster Risk Reduction now free access: tinyurl.com/zxoy2uo

TIGERS @TigersUnige
Data Carpentry is teaching researchers basic concepts, skills and tools for working more effectively with data datacarpentry.org

TIGERS @TigersUnige

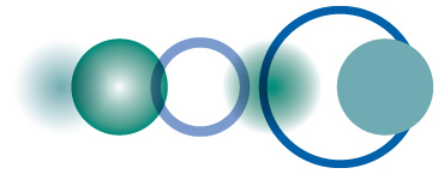
Join TIGERS on:

The story of data on the environment (long)

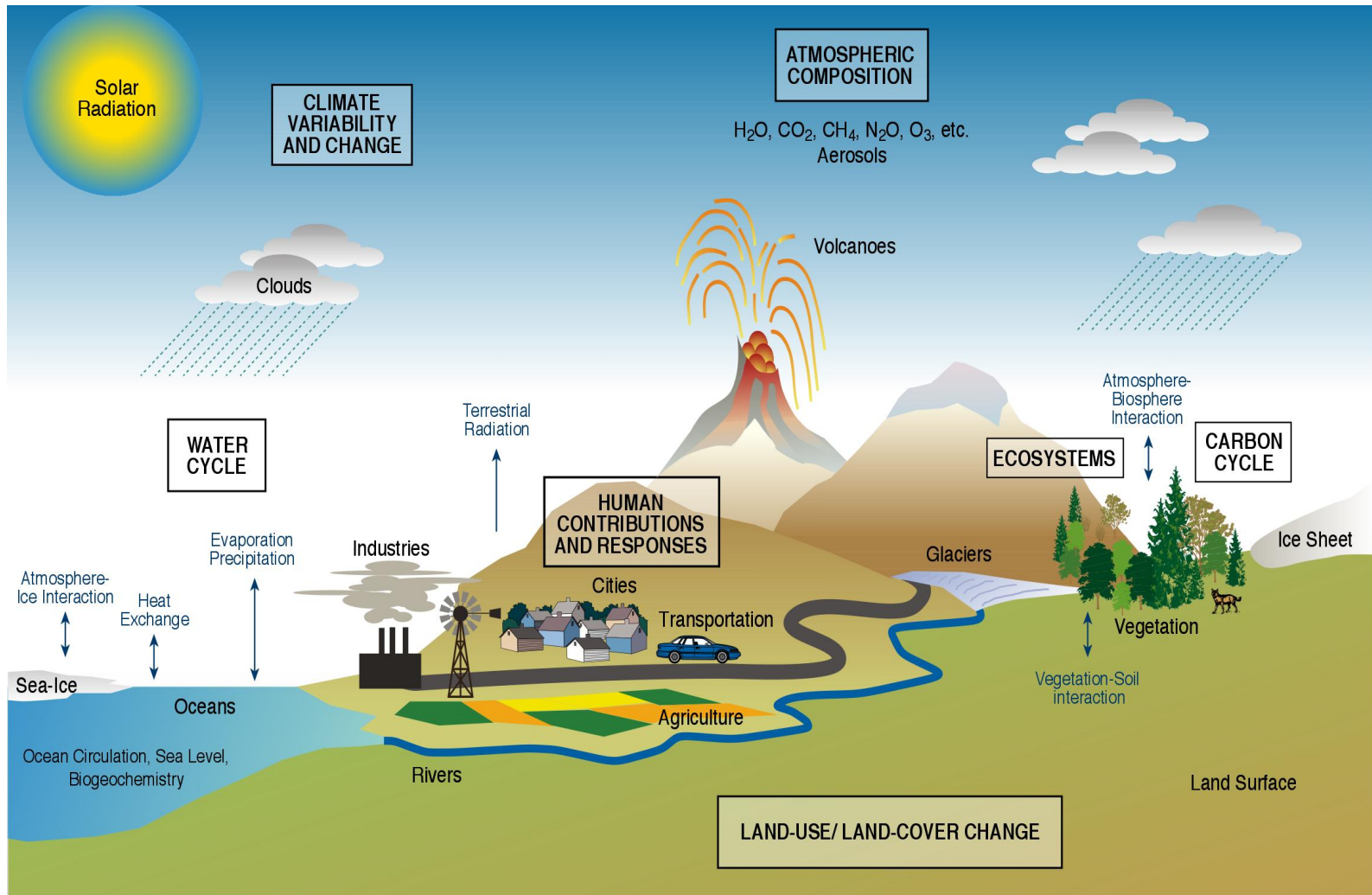
to integrated scientifically based decision processes.



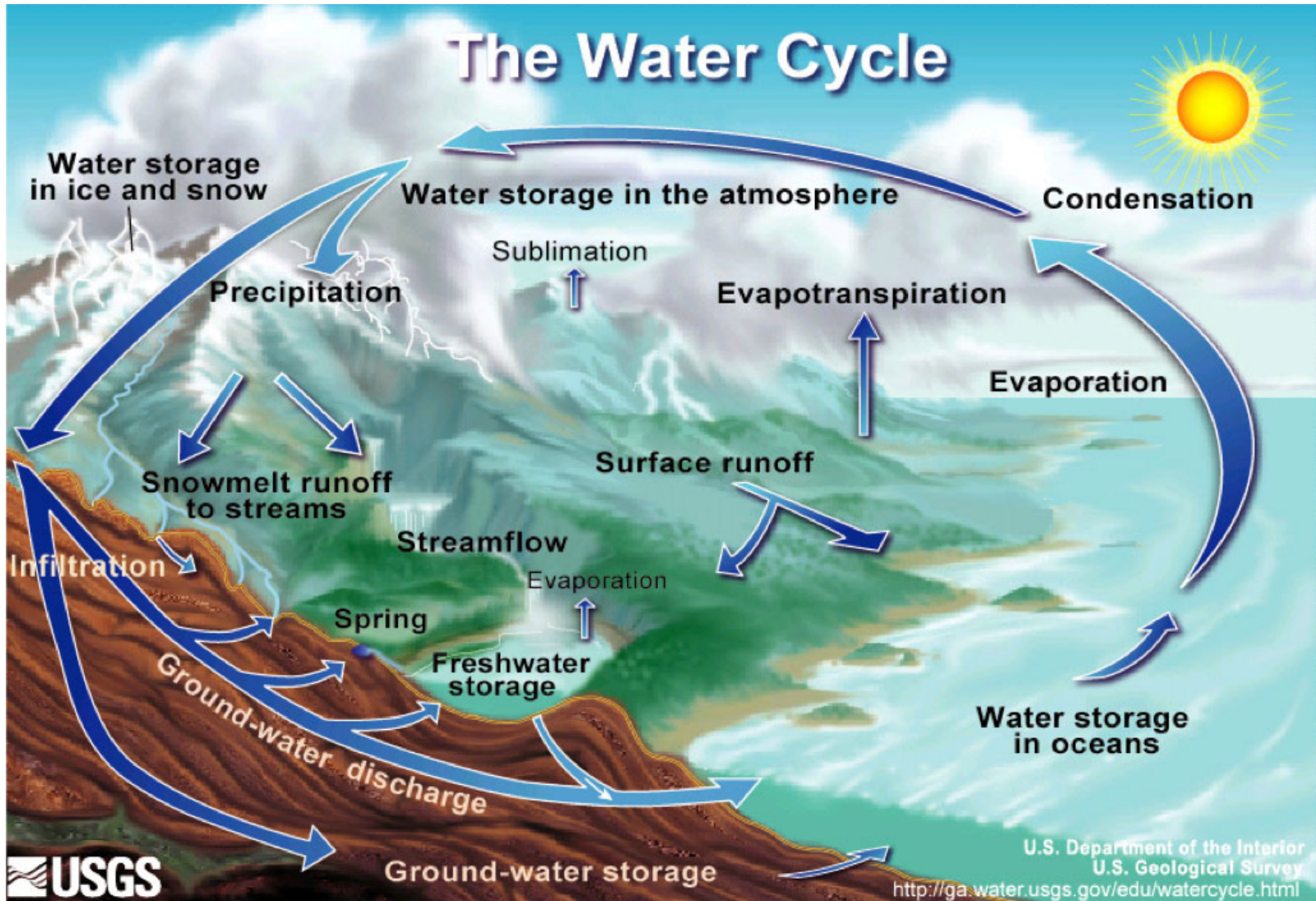




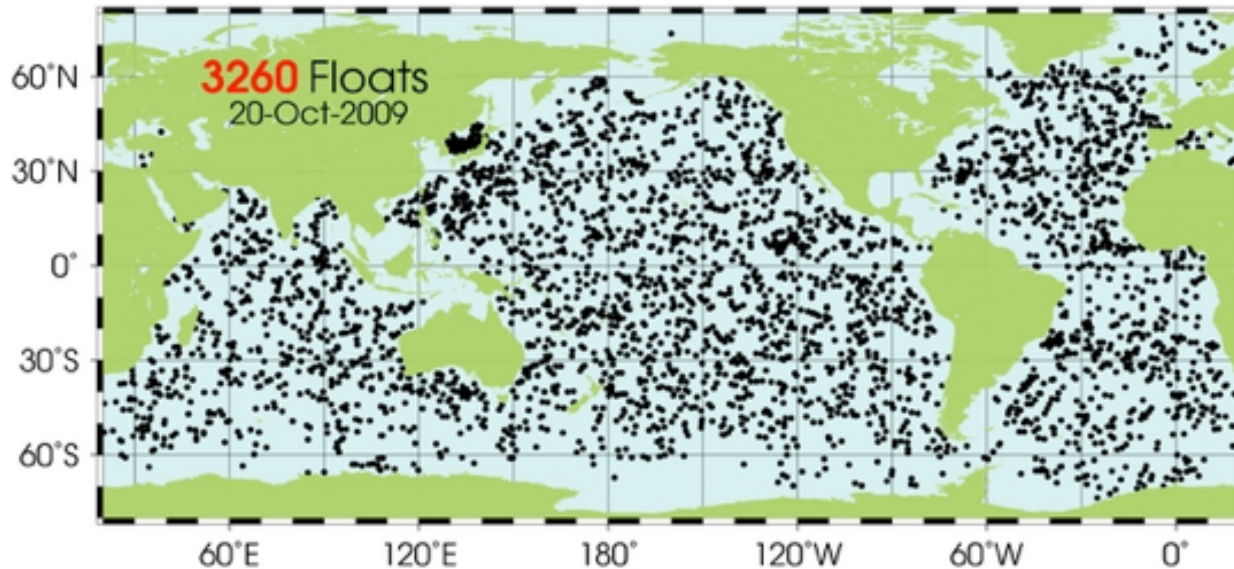
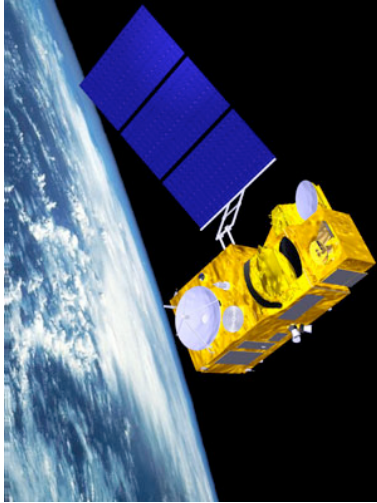
The Earth is a complex system of systems



Water Cycle



Data acquisition



Observe - Share - Inform



OBSERVE



SHARE



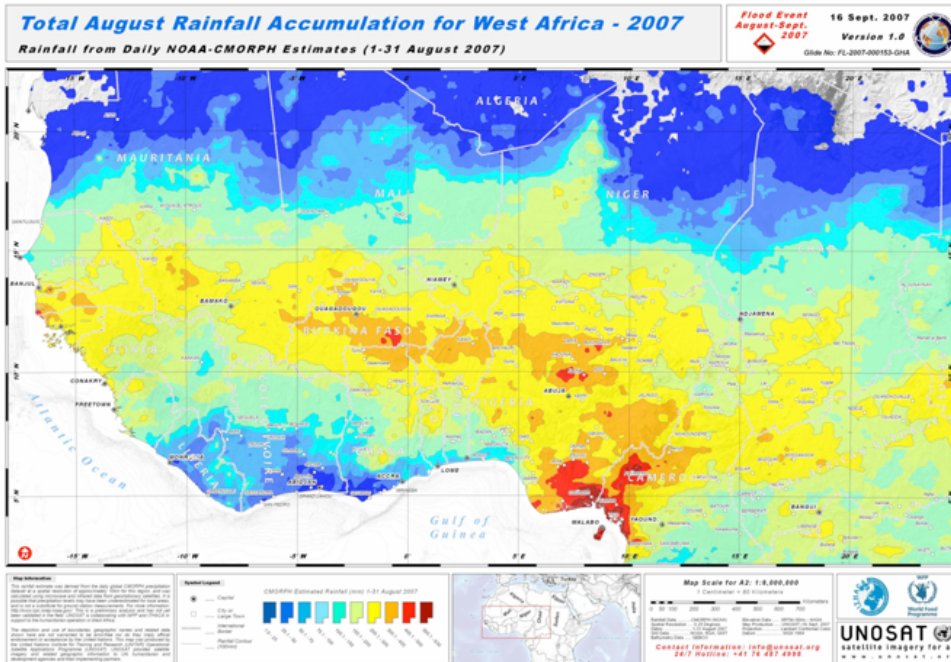
INFORM

One dataset for many users...

...many datasets for one user



One dataset for many users



Climatologists,
 Hydrologists,
 Geologists,
 Biologists,
 Ecologists, ...



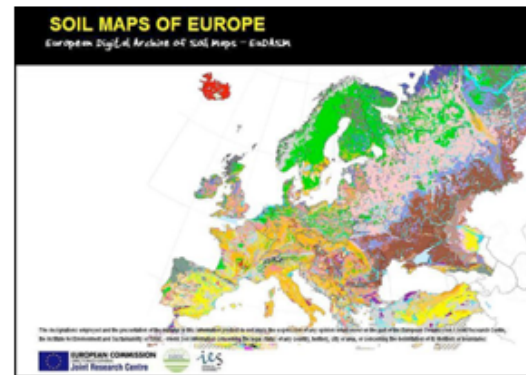
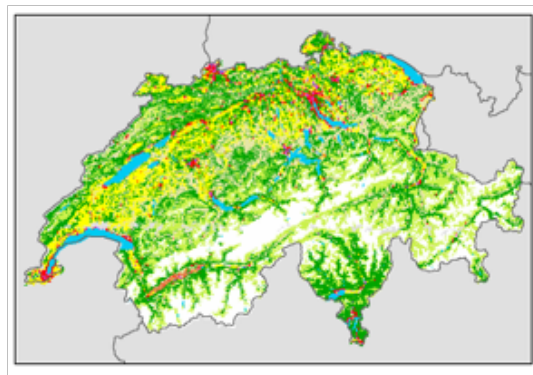
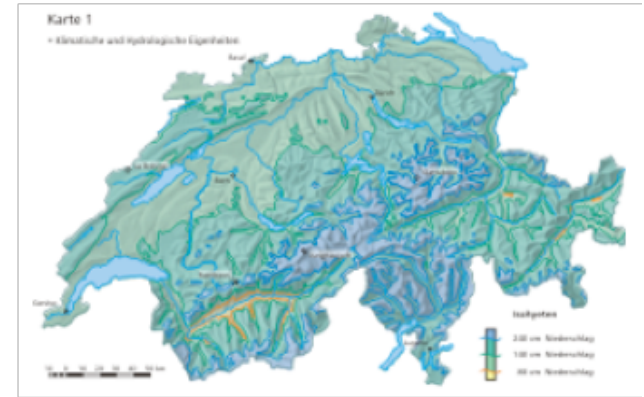
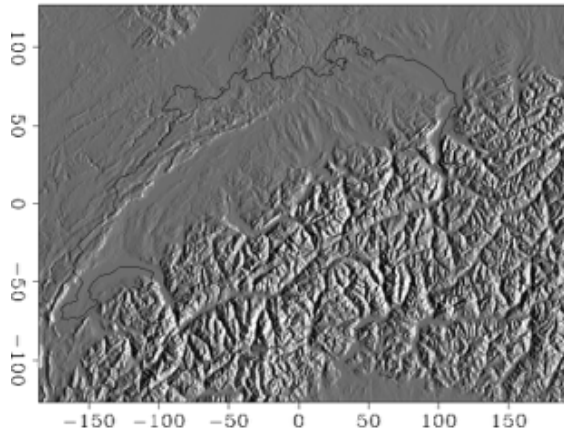
Many datasets for one user

Digital Elevation Model

Temperatures

Precipitations

Elevation

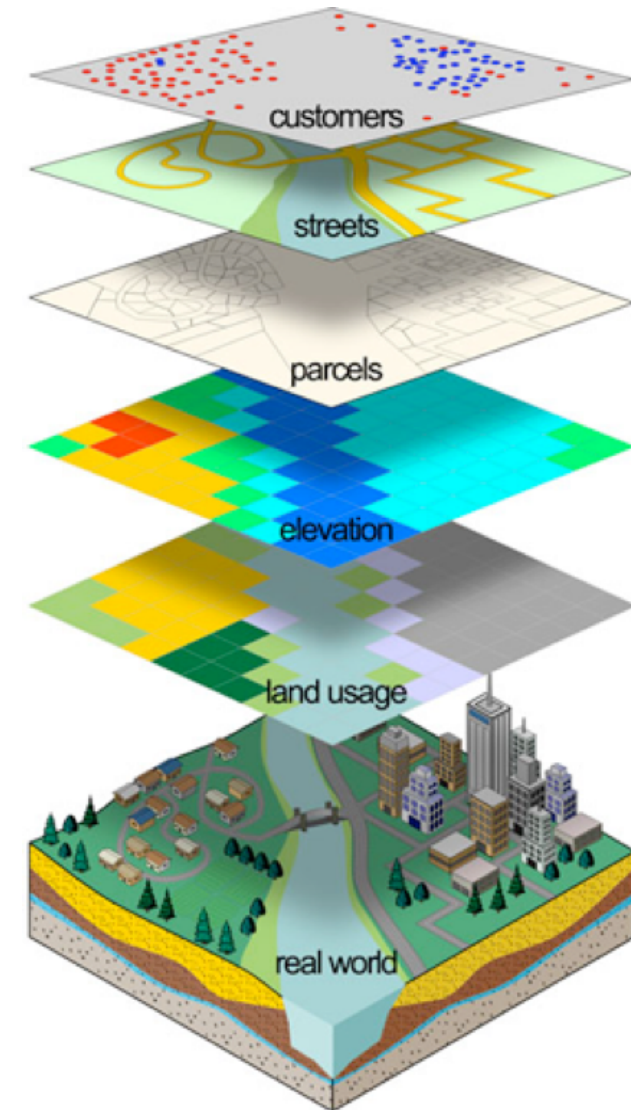


Land Cover

Soils

Environmental data

- physical, chemical, biological and socio-economical data.
- geolocation & attributes
- Integrated into GIS



Internet as a data media



Digital data

- 94% of data are stored in digital form
- In 2007, 65 exabytes of data exchanged (6 newspapers/day/person)
- We reached the point where we collect more data than we are physically able to store!

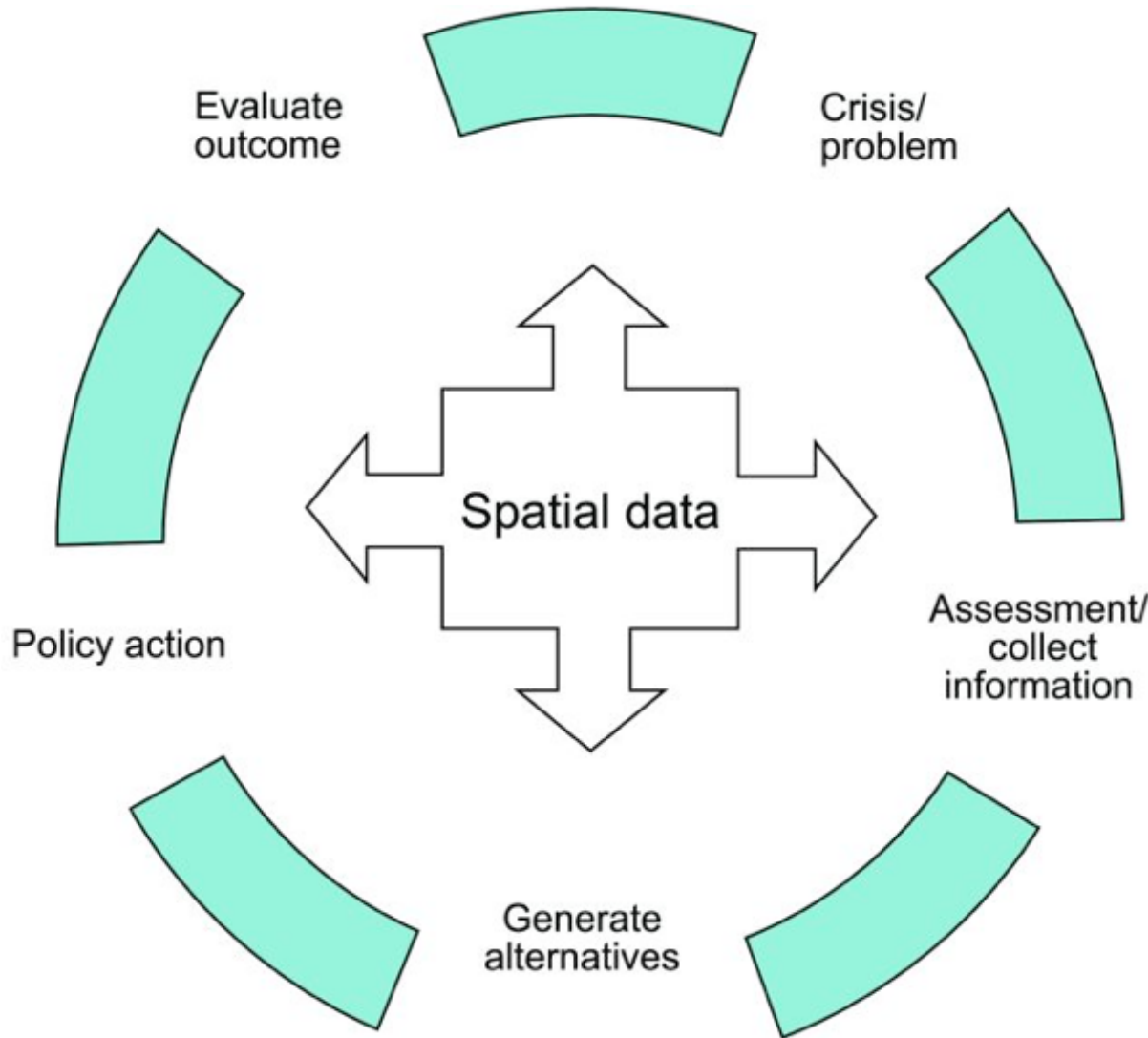


Data is the fuel...

- ... for scientific analysis and decision-making



Geoinformation affects 80% of decisions



CartoDB
@cartoDB

"80% percent of data has a location component" said @jatorre in this @forbes article. Read the full article: hubs.ly/H02WQbKO



How Satellite And Imaging Technologies Are Changing The World As We Kn...

Video In Part 1 of this series, we described the growing ecosystem of imaging and GIS technology companies, the major players within it, and the implications for business. Now, we examine how increa...

Agenda 21

address the need for information, development of appropriate databases and exchange of information as conditions for creating the basis for sustainable development.



Digital Earth (Gore, 1998)

Turning raw data into understandable information!



What is the real situation?



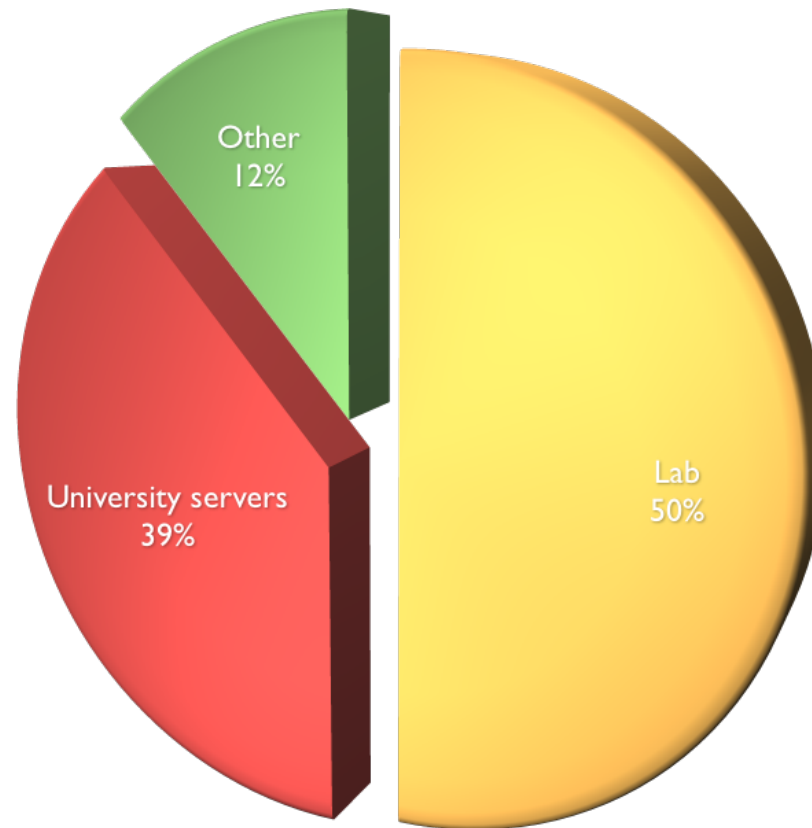
Finding environmental data is difficult

DATA: BY THE NUMBERS



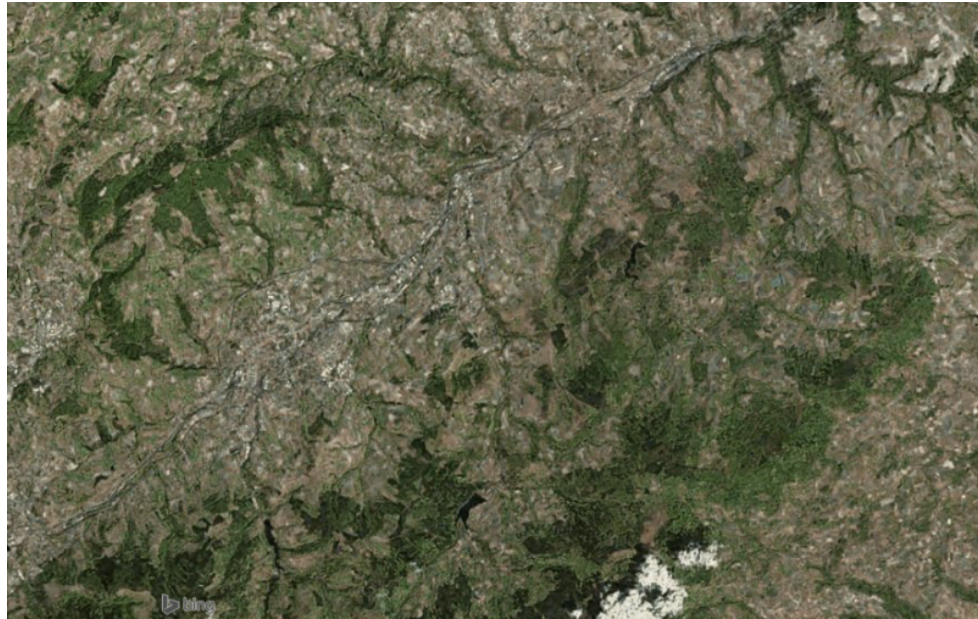
Finding environmental data is difficult

Where do you archive most of the data generated in your lab or your research?



Talking about Landsat...

“In spite of the great need for that information, the vast majority of those images have never fired a single neuron in a single human brain. Instead, they are stored in electronic silos of data” (Gore, 1998)



Today's best tool to search data?

The Google logo, rendered in its characteristic multi-colored font (blue, red, yellow, blue, green, red) with a slight 3D effect and shadow.

Systems operate in isolation



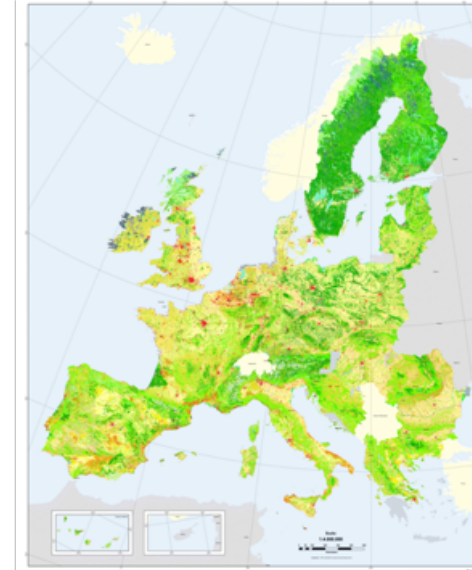
Data are expensive to produce



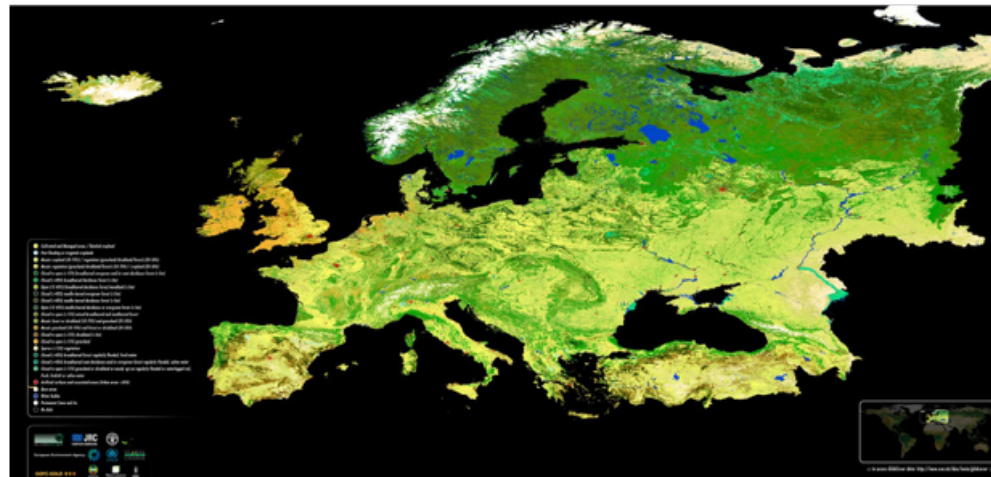
Data formats and quality



GLC2000

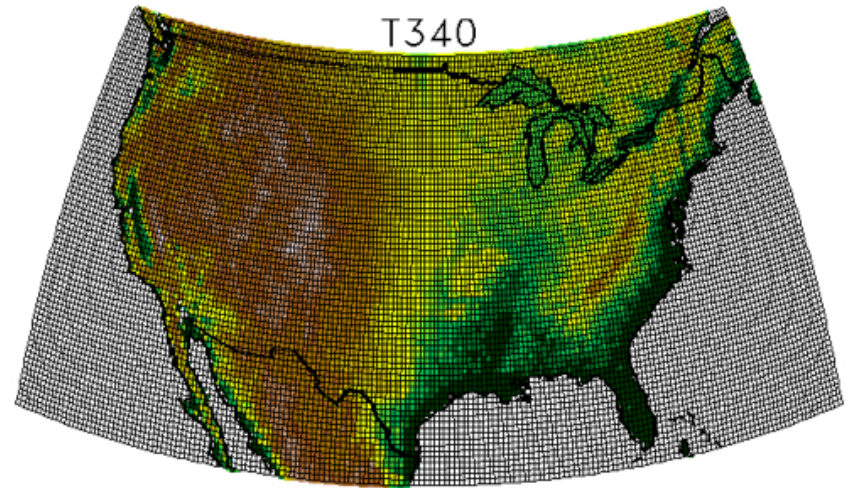
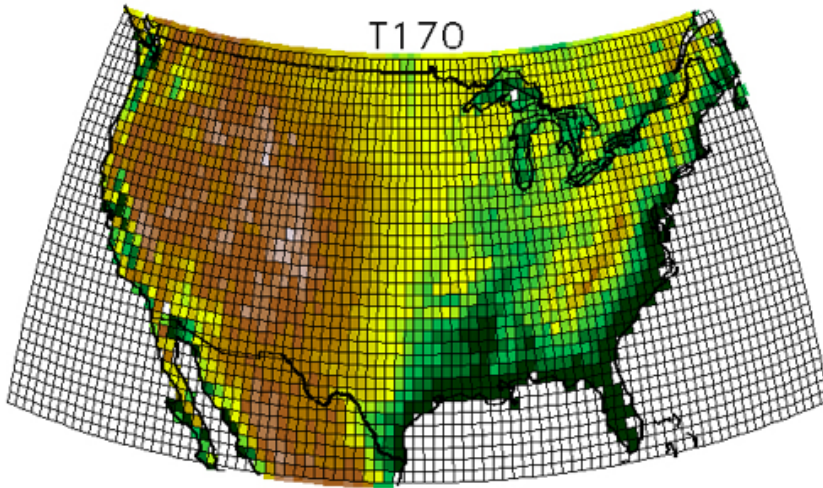
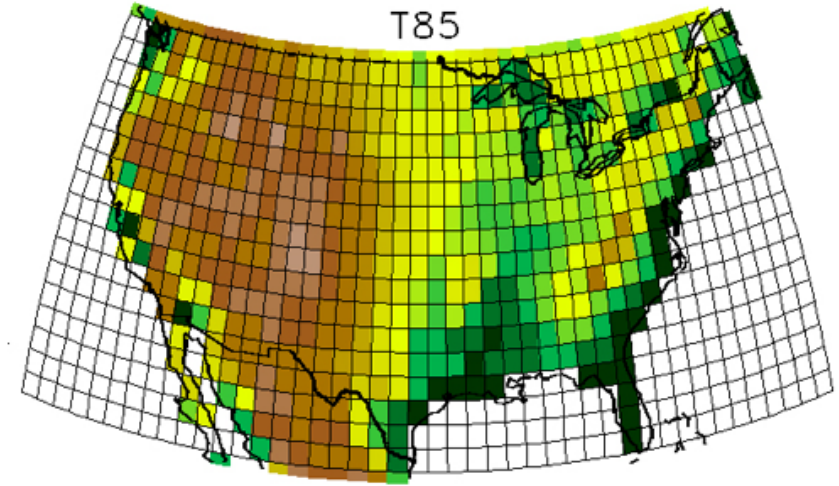
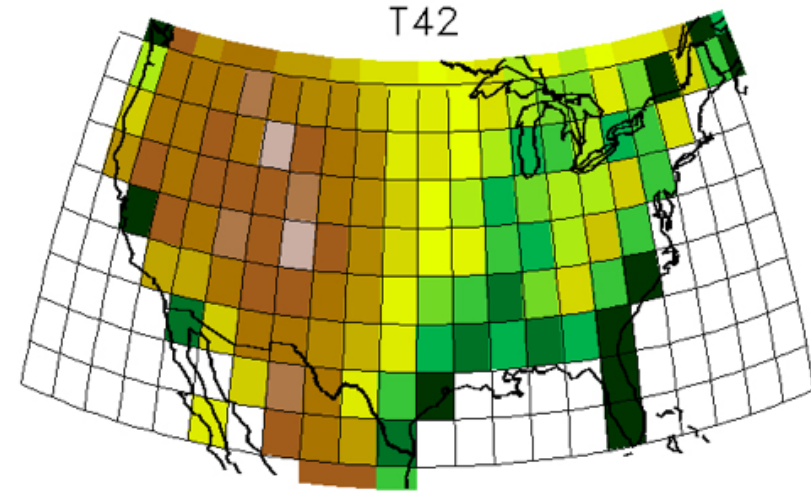


CORINE



GLOBCOVER

Increasing data resolution



Difficult to integrate...



incompatibilities
(formats, models, ...)



missing documentation
(metadata)



data fragmentation
data replication

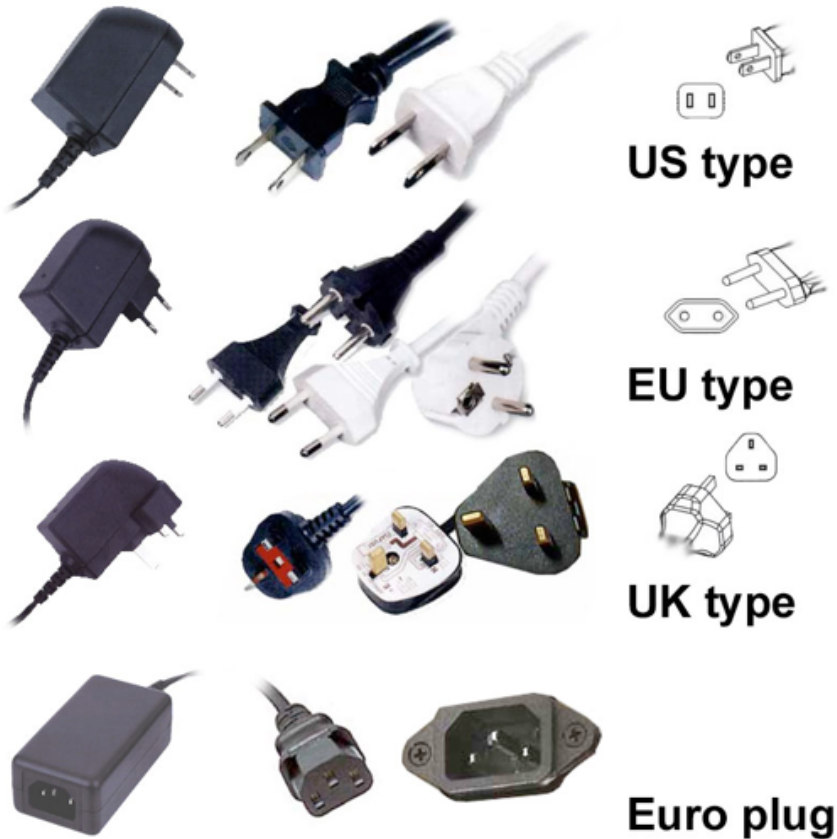


data policies

What else?



An analogy...



Universal adapter

Interoperability

“the ability of two or more systems or components to exchange information and to use the information that has been exchanged”



Levels of interoperability

Technical

Machine to machine communication

Software module interaction

APIs

Formats

Schemas



Semantic

Common understanding

Common concepts, terms, ...

Interdisciplinary special vocabularies



Legal

Digital rights

Ownership

Responsibility

Copyright



Human

Cooperation, collaboration

Training



Interoperability enablers

Metadata

Shared best practices

Standards

Business models

Copyright

Networks

Authorization

Agreements



Incentives to cooperate

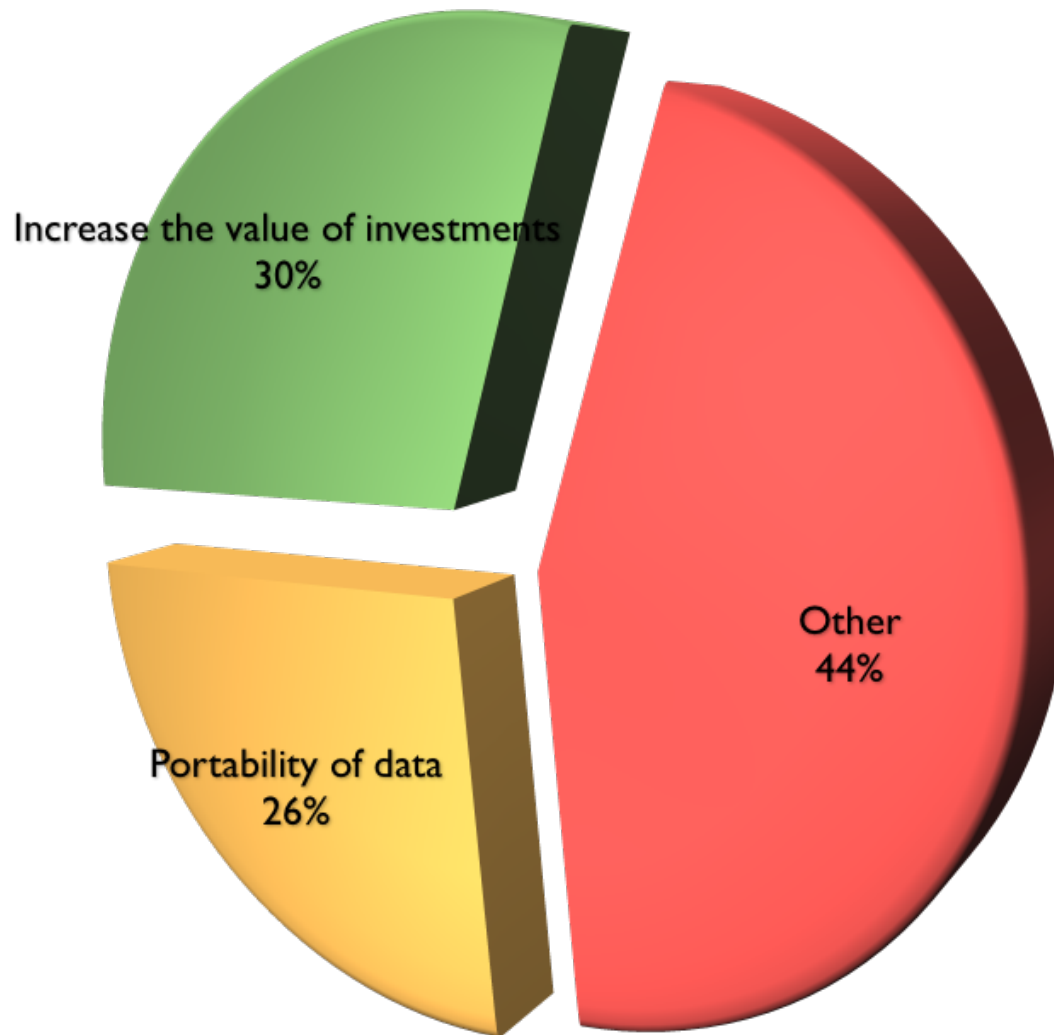
Policy framework

Infrastructure

Standards



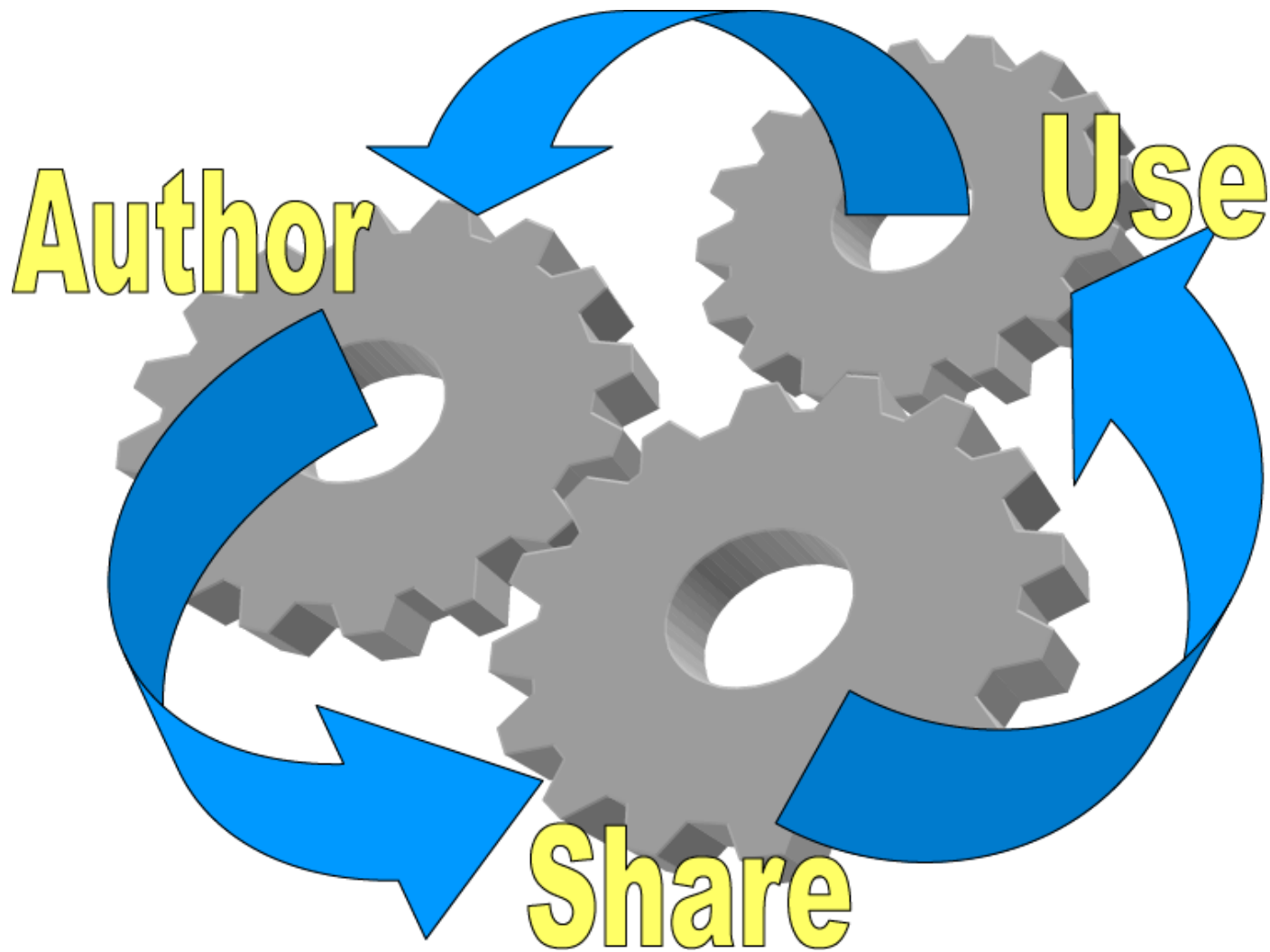
Benefits of standards



Data can be a shared resource



Store once – (re)use many times



OGC standards



Web Mapping Service (WMS)

HTTP protocol for publishing a collection of layers as a map (PNG, JPEG)

Data



Web Feature Service (WFS)

HTTP protocol for publishing feature collections that may be queried and updated by clients (features published as GML,...)



Web Coverage Service (WCS)

HTTP protocol for publishing “coverages” (multi-band raster data) that can be accessed by clients (GeoTiff, HDF)

Metadata



Catalog Services for the Web (CS-W)

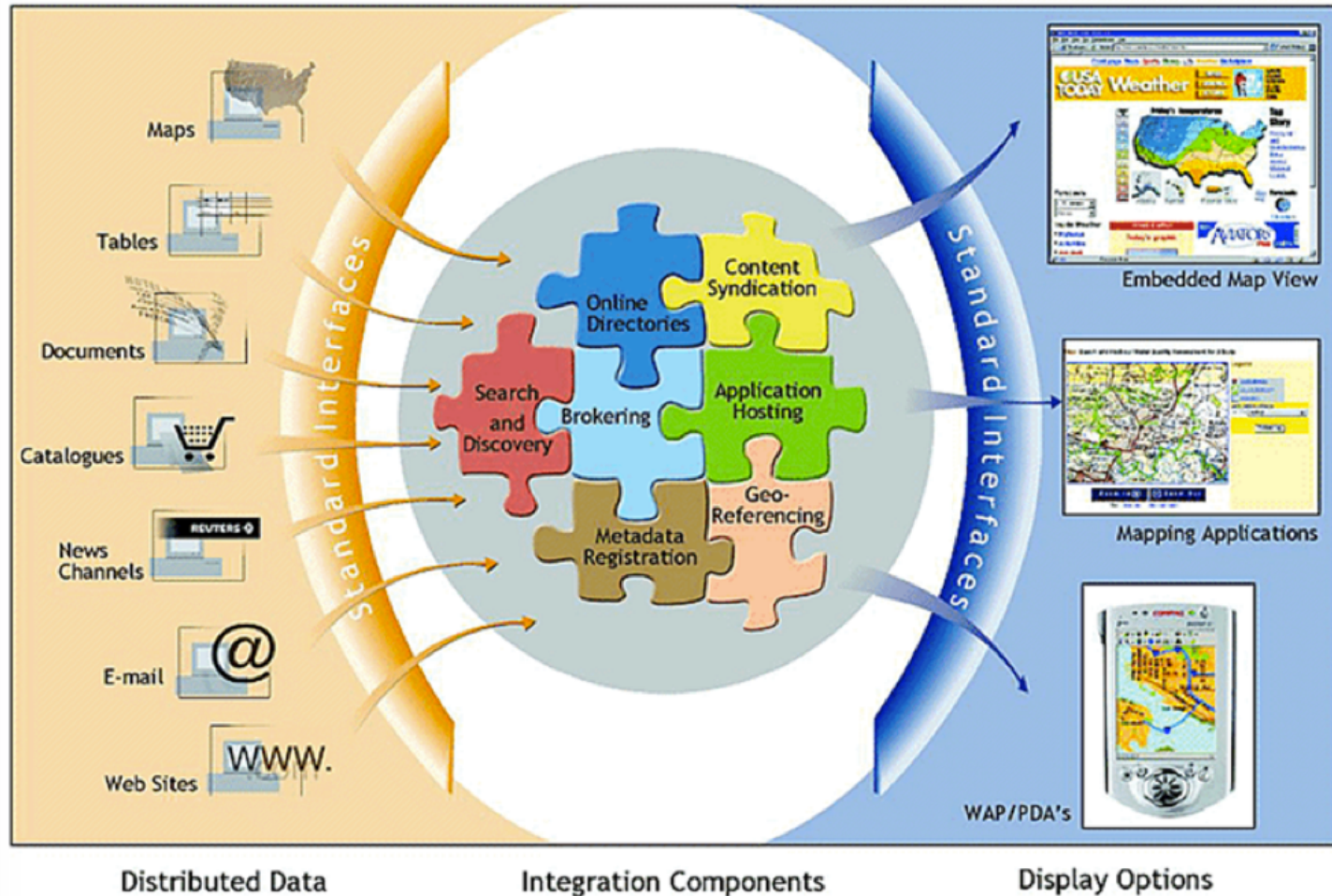
Defines several web interfaces for data discovery

Processing

Web Processing Service (WPS)

Defines an interface to share geoprocessing algorithms

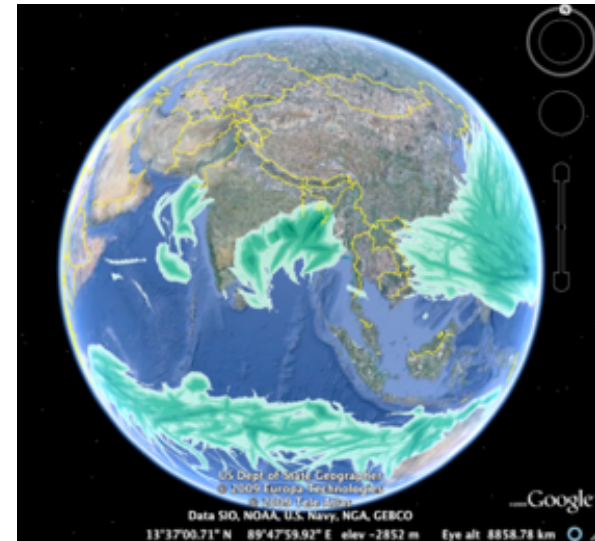
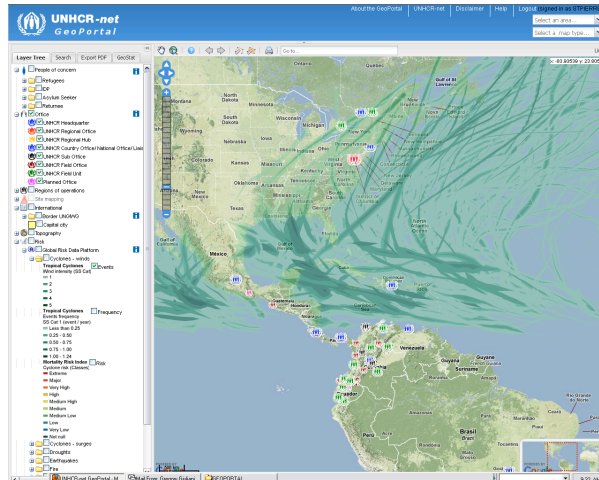
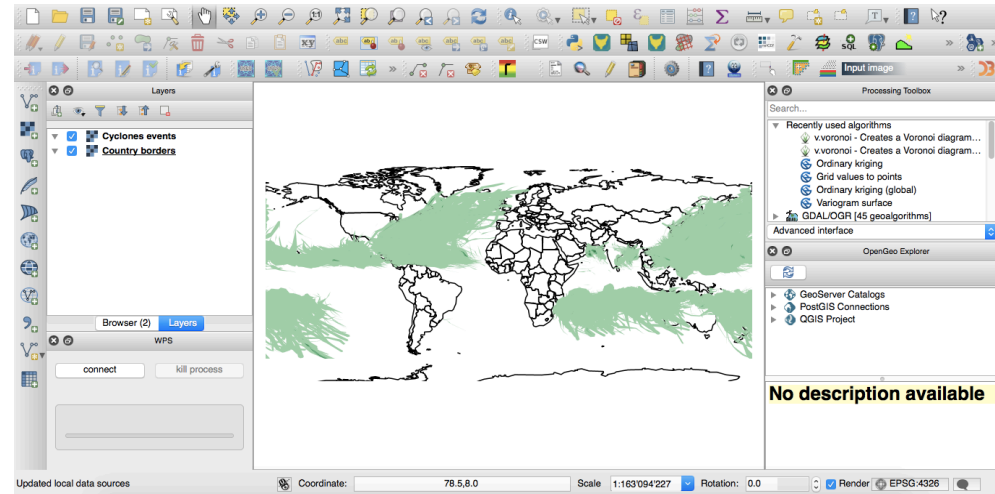
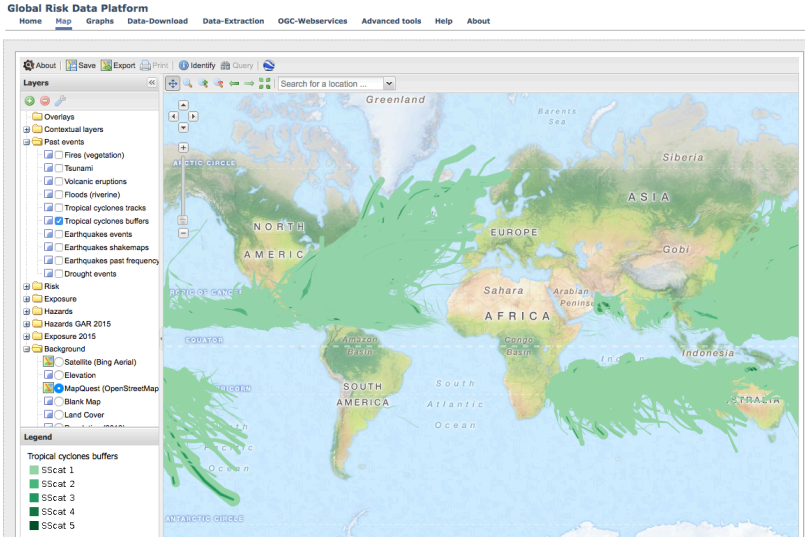
OGC standards



A quick example...

```
http://preview.grid.unep.ch:8080/geoserver/wfs?  
bbox=112.90721,-54.75389,158.96037,-10.1357  
&styles=cyclones_style  
&request=GetFeature  
&version=1.0.0  
&typename=preview:cy_intensity  
&srs=EPSG:4326
```


A quick example...



How to connect distributed & heterogenous data sources?



Spatial Data Infrastructure

- Enabling environment that supports easy access to and utilization of geospatial data.
- SDIs are more than just data repositories.
- Discovery, visualization, evaluation, and access to geospatial data and information.



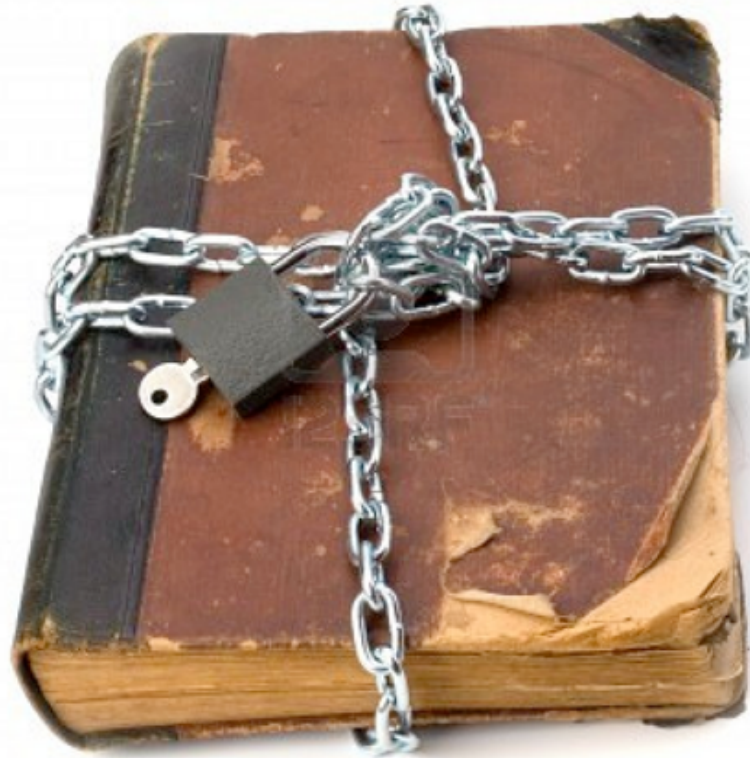
Spatial Data Infrastructure

“an umbrella of policies, standards and procedures under which organizations and technologies interact to foster more efficient use, management and production of geospatial data”

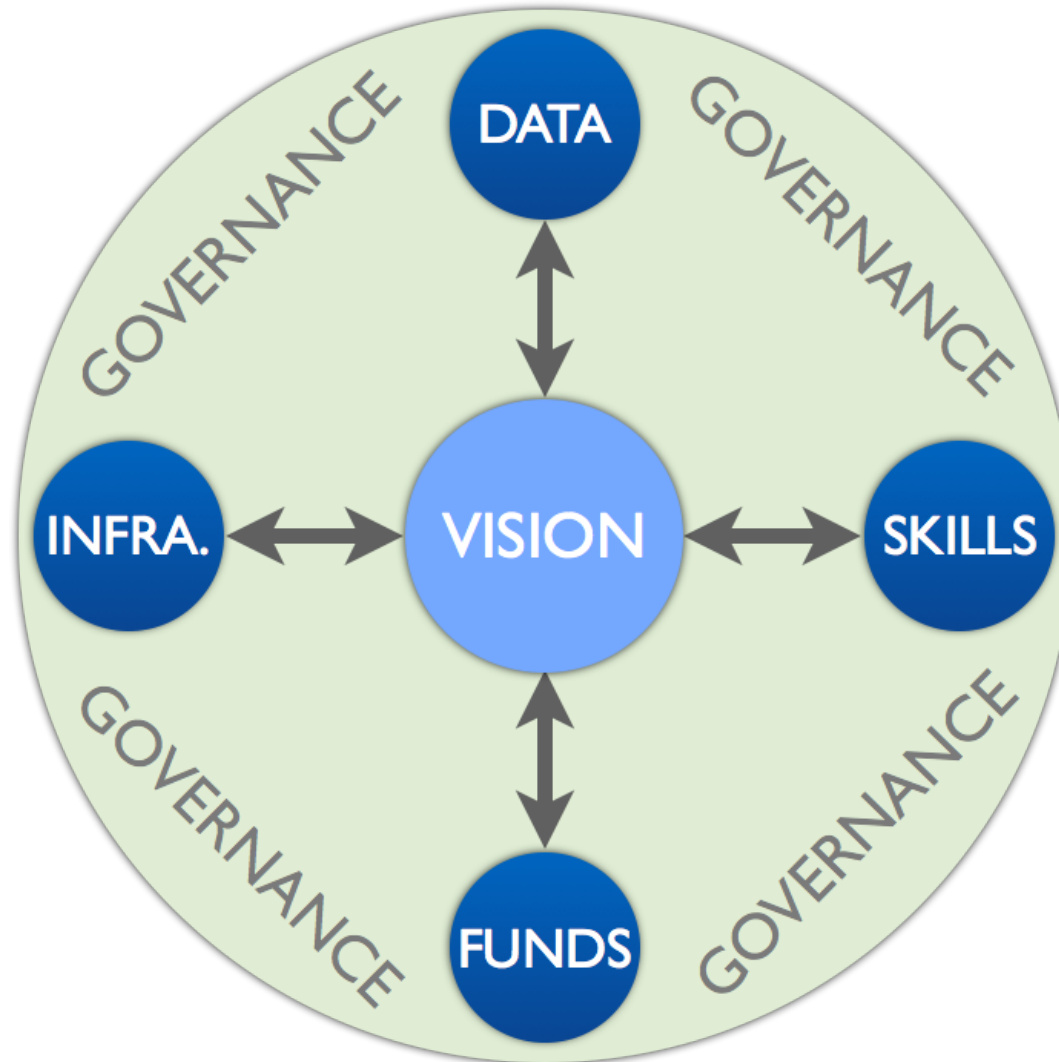


Unlock the power...

...of data, information and services!



Must answer an need!

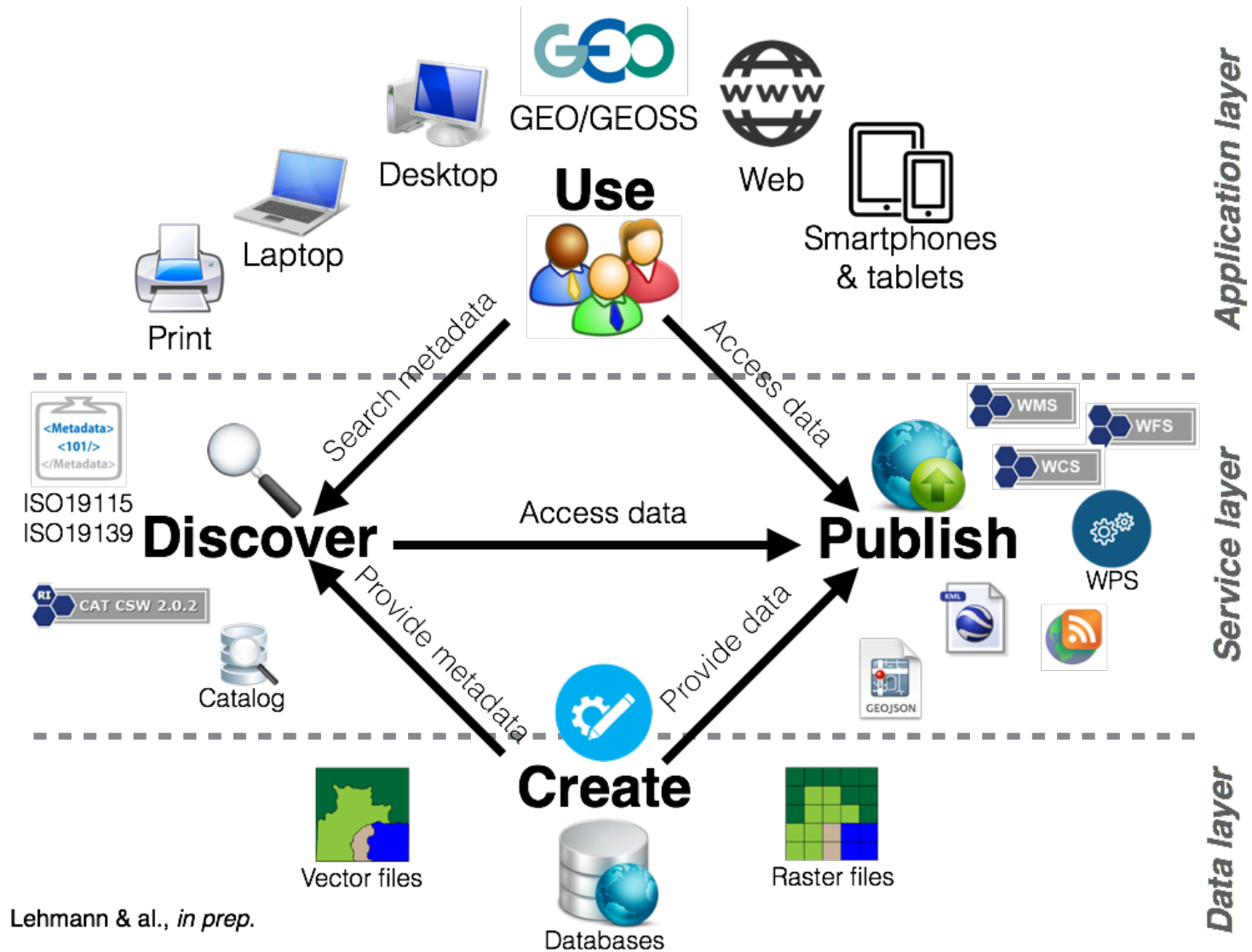


Working smarter and not harder

- Analogous to a road, reliable environment allowing the movement of data.
- All about:
 - reuse: data, capabilities, skills, investments, ...
 - sharing: data, knowledge, ...
 - learning from others: collaboration and co-operation.



Publish – Find - Bind

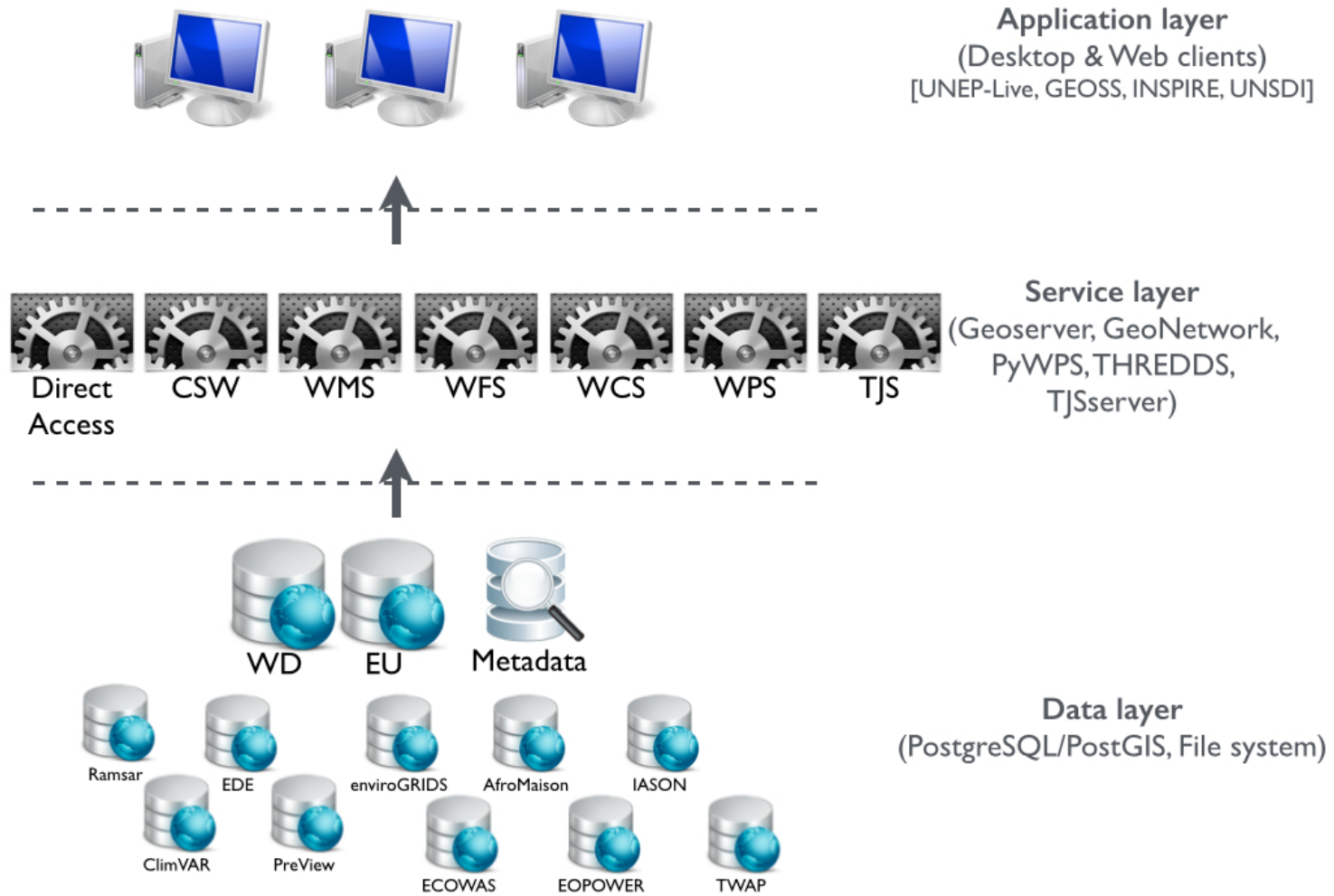


Spending more time in doing science...

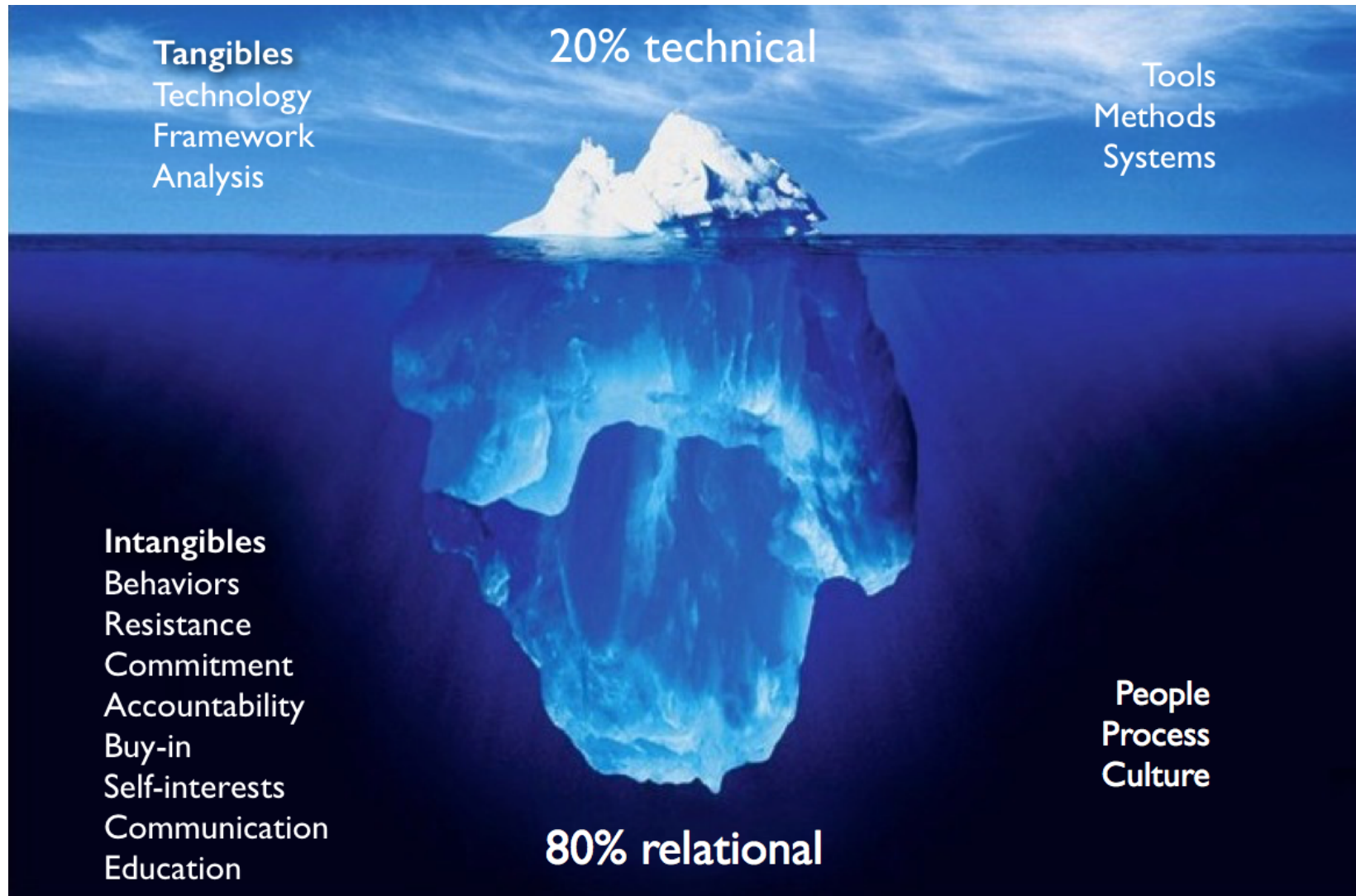
...and less in searching data!



A quick example...



Challenges in building an SDI



Challenges in building an SDI

Answer a need

Education

Commitment

People

“SDIs can be thought as social networks of people and organizations supported by data and technology”

“Technology is cheap, data is expensive, but social relations are invaluable”

Craglia et al. (2009)

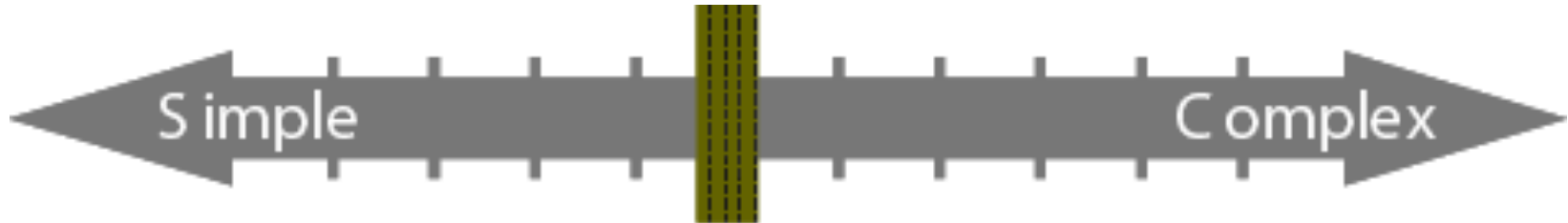
Political - Social - Cultural context

Capacity building

Benefits

Incentives

Working together



Too simple:

- identified requirements cannot be supported
- insufficient harmonisation
- few benefits

Too complex:

- difficult to implement
- substantial benefits available only to few users
- high cost

Capacity building

<http://www.geossintopractice.org>

Gregory Giuliani, Pierre LeGros, Verónica Quijón, Lorenzo Stagni, Nicolas Péro,
Armin Lehmann

Bringing GEOSS services into practice



The "Bringing GEOSS services into practice" workshop aims at teaching how to configure, use and deploy a set of open source software to set up a spatial data infrastructure (SDI). Trainees will learn how to publish and share data and metadata using OGC and ISO standards and how to register services into the Global Earth Observation System of Systems (GEOSS).

The **material** related to the workshop (a **tutorial**, a **virtual machine in VDI format** including data and software, and **PowerPoint presentations**) can be **downloaded** [here](#). The tutorial is available in **PDF**, in **iTunesStore** and **Google Play Books**.

The **programme** of the workshop is the following:

- **Concepts** on spatial data infrastructures
- How to **store** geospatial data? (PostGIS and flat rasters)
- How to **publish** geospatial data? (GeoServer, WMS, WFS, WCS, KML, SLD)
- How to **document and search** geospatial data? (GeoNetwork, CSW, ISO metadata)
- How to **process** geospatial data? (Python, WPS, PyWPS)
- How to **view** geospatial data? (WMS, OpenLayers, QGIS, KML)
- How to **download** geospatial data? (WFS, WCS, QGIS)
- How to **analyze** geospatial data? (WPS local/remote)
- How to **share** geospatial data? (GEOSS, Discovery and Access Broker)

GEO

- Voluntary partnership of governments and international organizations
- 10 Year Implementation plan (2005-2015) & (2015-2025)
- *“The Global Earth Observation System of Systems will provide decision-support tools to a wide variety of users. As with the Internet, GEOSS will be a global and flexible network of content providers allowing decision makers to access an extraordinary range of information at their desk.”*



<http://www.earthobservations.org>

home >

search our site here



what is GEO - what we do - global initiatives - meetings resources - how to get involved contact



What we do	Featured articles	What's new?
<p>GEO 2016-25 Strategic Plan & 2016 Work Programme</p> <p>Monitoring & Evaluation</p> <p>Data Sharing & Data Management</p> <p>Radio Frequency Protection</p> <p>GEOSS</p> <p>Regional Coordination & Products</p> <p>Capacity Building</p> <p>User Needs & Knowledge Base</p> <p>GEO & the 2030 SD Agenda</p> <p>Climate</p>	<p>Mexico City Ministerial Summit</p> <p>2015 Ministerial Summit Earth Observations to Address Global Challenges Mexico City, 13 November 2015</p> <p>Photo by: IISD</p>	<p>Latest GEO News</p> <p>Africa's first High Frequency Radar System operational in Morocco</p> <p>ASTER: substantial increase in orders of Earth observation images as a result of free and open data policy</p> <p>Africa data on the GEOSS Portal through RCMRD</p> <p>GEO-CRADLE establishes network and Data Hub for Earth Observation in MENA and the Balkans</p>
<p> Biodiversity and Ecosystem Sustainability</p> <p> Infrastructure and Transportation Management</p>	<p> Disaster Resilience</p> <p> Public Health Surveillance</p>	<p> Energy and Mineral Resources Management</p> <p> Sustainable Urban Development</p> <p> Food Security and Sustainable Agriculture</p> <p> Water Resources Management</p>
<p>Earth observation information & services</p>	<p>Global Initiatives</p> <p> </p>	<p>Featured Video</p> <p>Mexico City Ministerial welcome v... </p>

GEO

ADVOCATE – ENGAGE - DELIVER



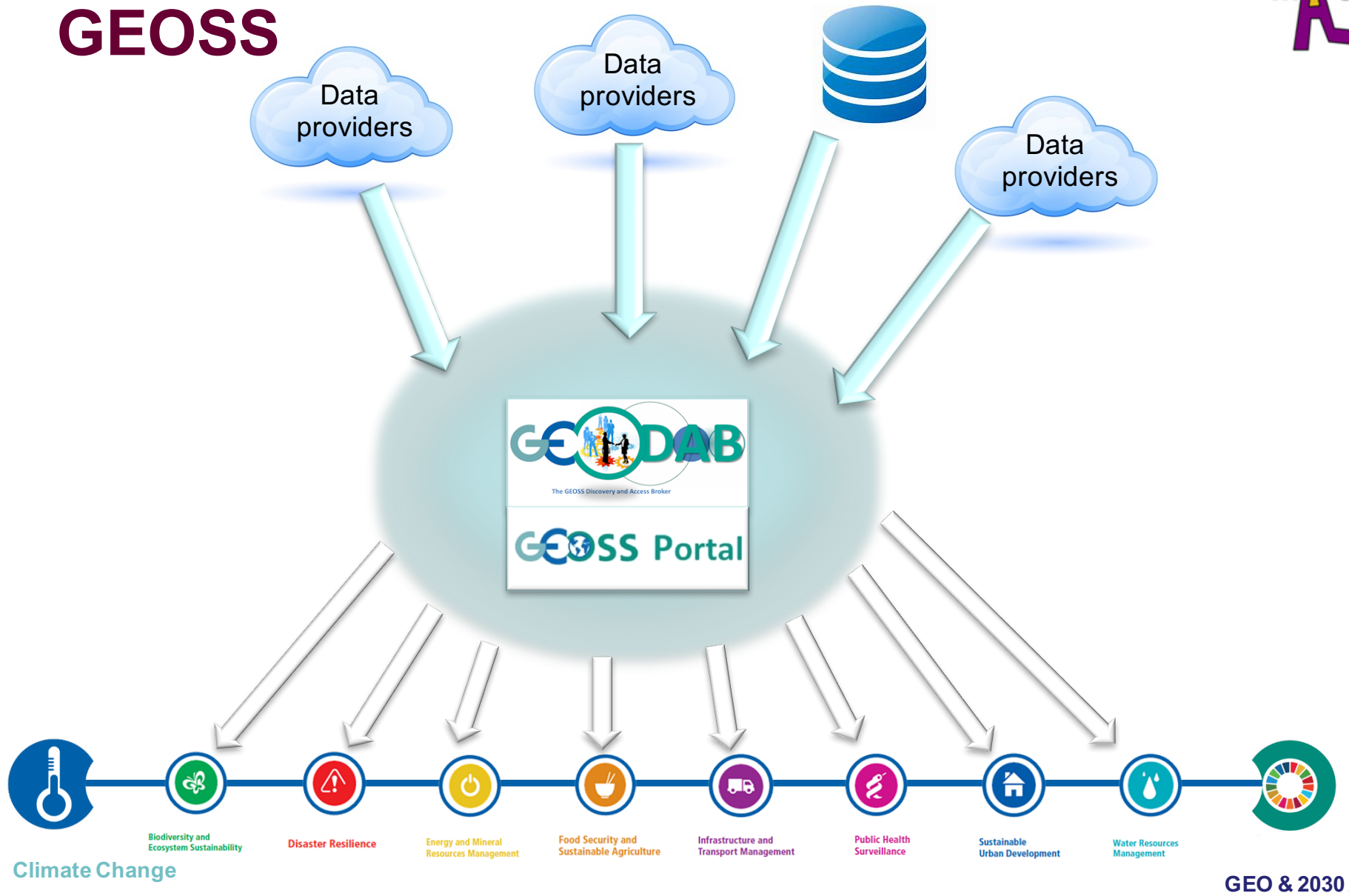
Societal Benefit Areas



GEO – Data Sharing Principles

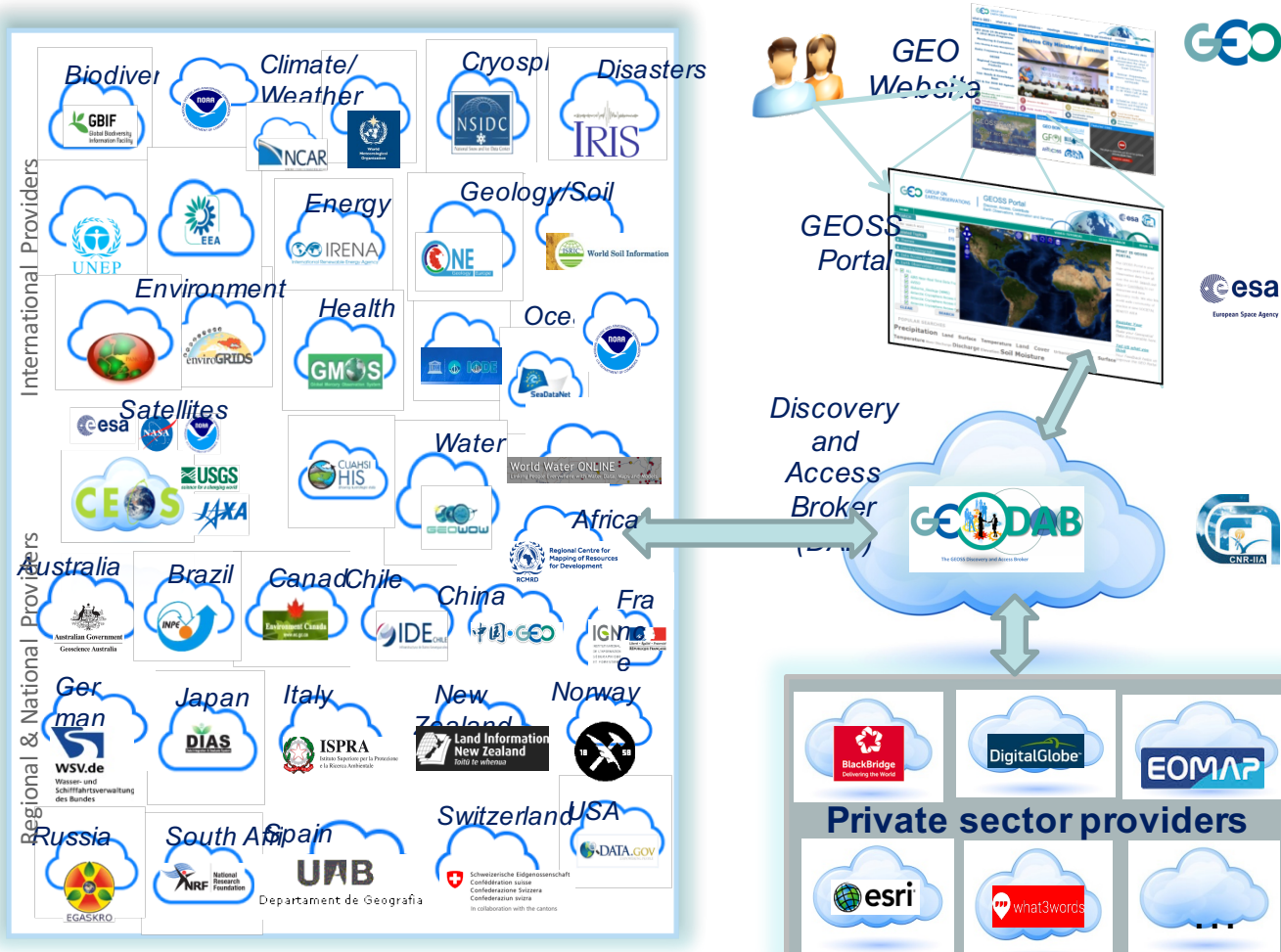
- There will be full and open exchange of data, metadata, and products shared within GEOSS, recognizing relevant international instruments and national policies and legislation.
- All shared data, metadata, and products will be made available with minimum time delay and at minimum cost.
- All shared data, metadata, and products being free of charge or no more than cost of reproduction will be encouraged for research and education.

GEOSS



GEOSS – Data & Access Broker

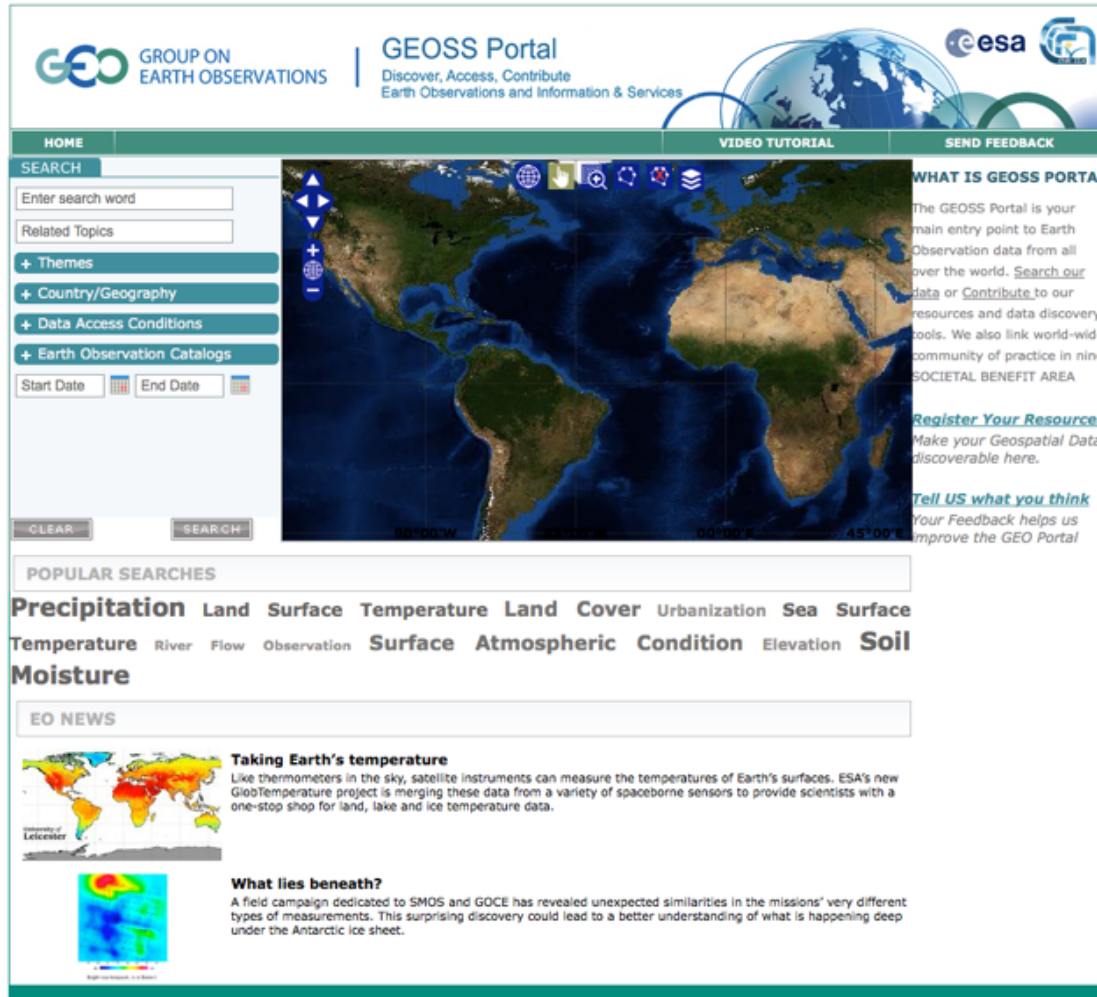
<http://www.geodab.net>



... more than 100 public providers...

GEOSS – Portal

<http://www.geoportal.org>

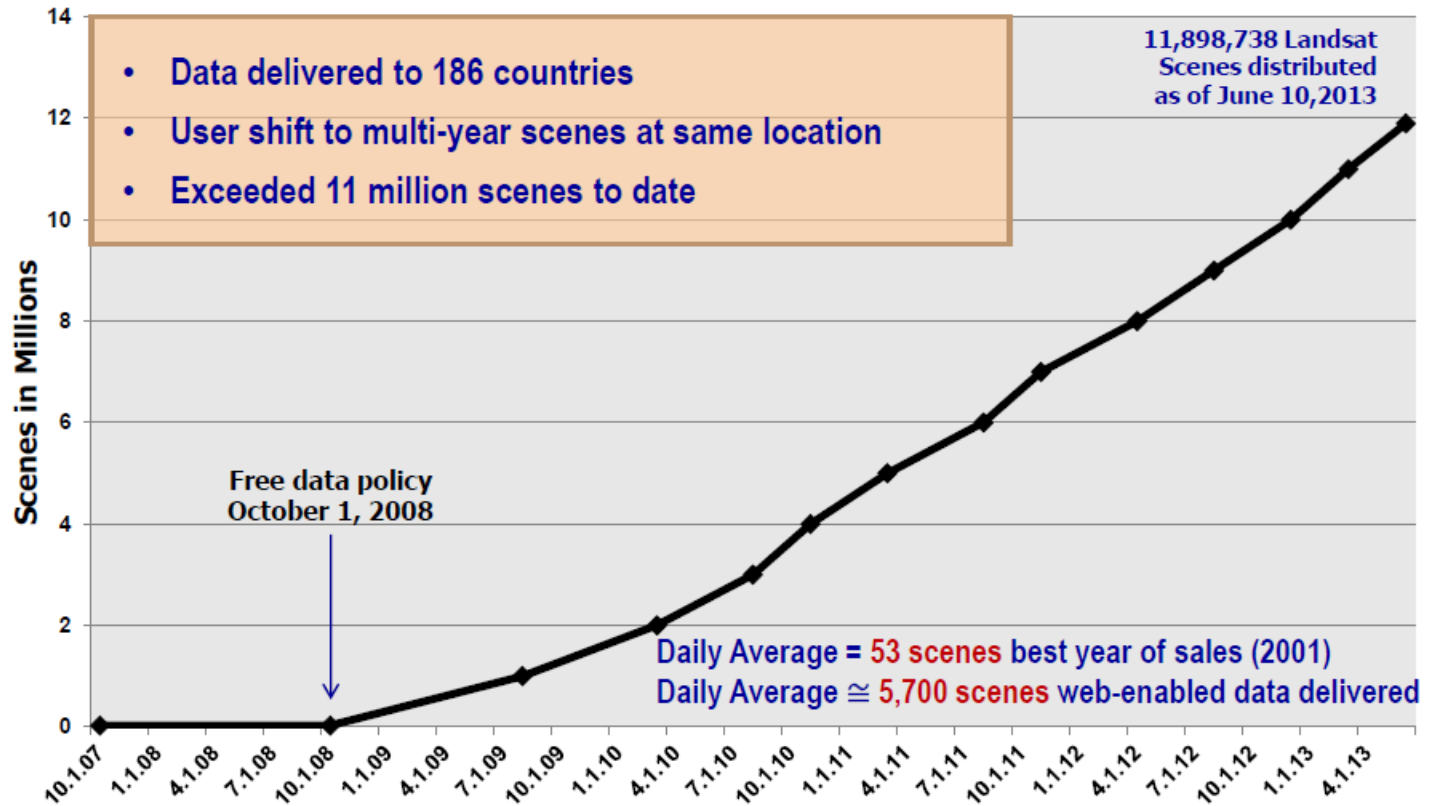


The screenshot shows the GEOSS Portal homepage. At the top, it features the logos for the Group on Earth Observations (GEO) and the European Space Agency (ESA). The main navigation bar includes links for HOME, VIDEO TUTORIAL, and SEND FEEDBACK. A central search bar is prominently displayed, with a search button and a clear button. Below the search bar, there are several filter options: Themes, Country/Geography, Data Access Conditions, and Earth Observation Catalogs. A world map is shown in the center, with various icons overlaid on it. To the right of the map, there is a section titled 'WHAT IS GEOSS PORTAL' which provides an overview of the portal's purpose and resources. Below the map, there is a 'POPULAR SEARCHES' section with a list of search terms including Precipitation, Land Surface Temperature, Land Cover, Urbanization, Sea Surface Temperature, River Flow, Observation, Surface Atmospheric Condition, Elevation, Soil Moisture, and Temperature. The 'EO NEWS' section features two articles: 'Taking Earth's temperature' and 'What lies beneath?'. The first article includes a world map showing temperature data, and the second article includes a small image of a satellite instrument.

GEOSS – Open Data Policy



Increasing Demand for Free Landsat Data



INSPIRE

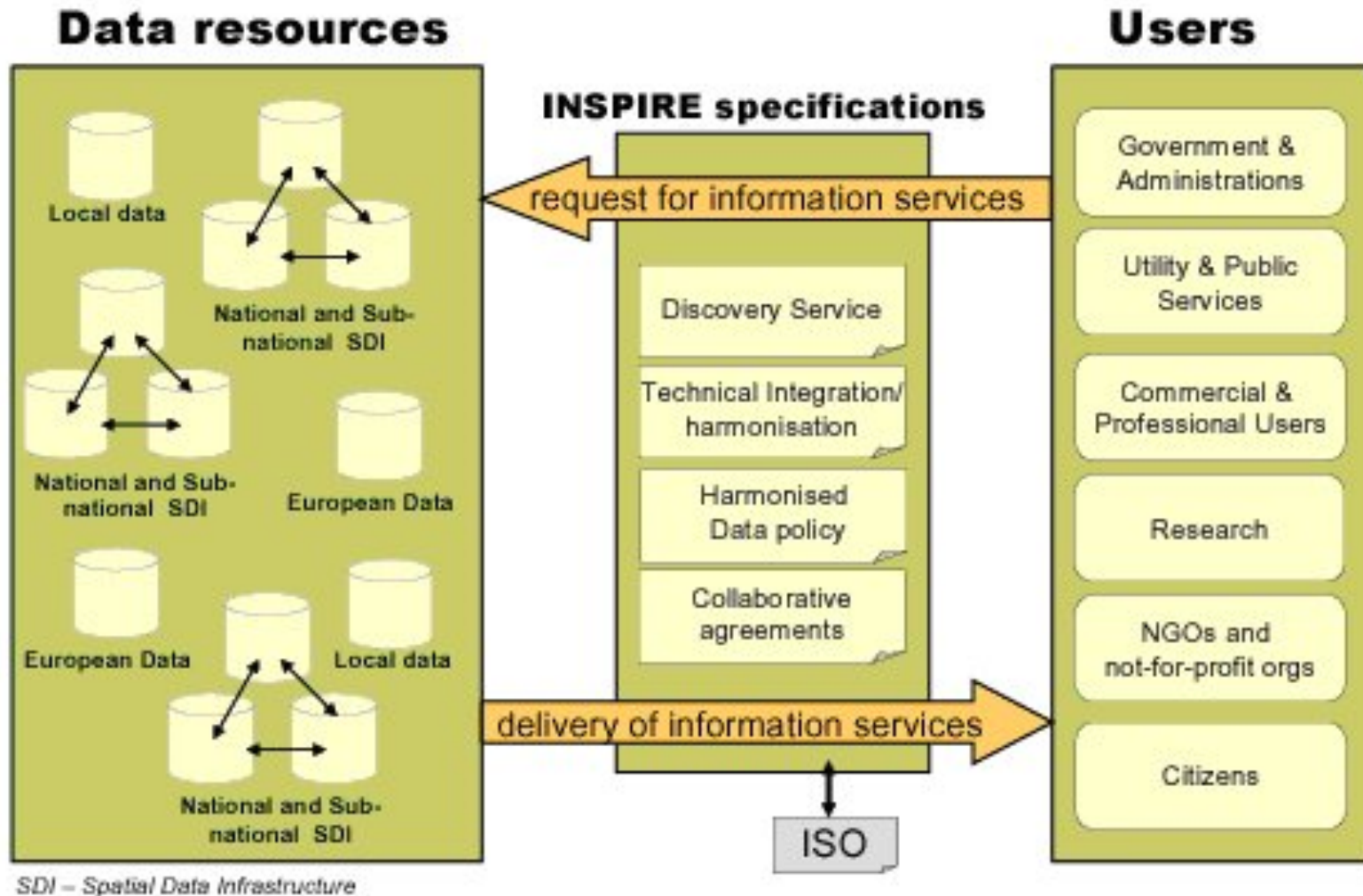
- Infrastructure for Spatial Information in the European Community
- *“The INSPIRE directive aims to create a European Union (EU) spatial data infrastructure. This will enable the sharing of environmental spatial information among public sector organisations and better facilitate public access to spatial information across Europe. A European Spatial Data Infrastructure will assist in policy-making across boundaries.”*



INSPIRE - Principles

- Data should be collected only once and kept where it can be maintained most effectively.
- It should be possible to combine seamless spatial information from different sources across Europe and share it with many users and applications.
- It should be possible for information collected at one level/scale to be shared with all levels/scales; detailed for thorough investigations, general for strategic purposes.
- Geographic information needed for good governance at all levels should be readily and transparently available.
- Easy to find what geographic information is available, how it can be used to meet a particular need, and under which conditions it can be acquired and used.

INSPIRE – Information flow



INSPIRE - Services

- **Discovery services:** support discovery of data, evaluation and use of spatial data and services through their metadata properties
- **View services:** as a minimum, display, navigate, zoom in/out, pan, or overlay spatial data sets and display legend information and any relevant content of metadata.
- **Download services:** enabling copies of complete spatial data sets, or parts of such sets, to be downloaded.
- **Transformation services:** enabling spatial data sets to be transformed (projection and harmonization).
- **Invoke spatial data services:** enabling data services to be invoked.

INSPIRE – Implementing rules










- <http://inspire.jrc.ec.europa.eu/index.cfm/pageid/47>
- Metadata:
<http://inspire.jrc.ec.europa.eu/index.cfm/pageid/101>
- Data Specifications:
<http://inspire.jrc.ec.europa.eu/index.cfm/pageid/2>
- Network Services:
<http://inspire.jrc.ec.europa.eu/index.cfm/pageid/5>
- Data and Service Sharing:
<http://inspire.jrc.ec.europa.eu/index.cfm/pageid/62>
- Monitoring and Reporting:
<http://inspire.jrc.ec.europa.eu/index.cfm/pageid/182>

INSPIRE - Themes

<http://inspire.ec.europa.eu/index.cfm/pageid/2/list/7>

View information for the INSPIRE themes

ANNEX 1

 Addresses	 Geographical names
 Administrative units	 Hydrography
 Cadastral parcels	 Protected sites
 Coordinate reference systems	 Transport networks
 Geographical grid systems	

ANNEX 2

 Elevation
 Geology
 Land cover
 Orthoimagery

ANNEX 3

 Agricultural and aquaculture facilities	 Habitats and biotopes	 Population distribution and demography
 Area management / restriction / regulation zones & reporting units	 Human health and safety	 Production and industrial facilities
 Atmospheric conditions	 Land use	 Sea regions
 Bio-geographical regions	 Meteorological geographical features	 Soil
 Buildings	 Mineral Resources	 Species distribution
 Energy Resources	 Natural risk zones	 Statistical units
 Environmental monitoring Facilities	 Oceanographic geographical features	 Utility and governmental services

INSPIRE - Directive

<http://inspire.ec.europa.eu>

Contact | Legal notice | Privacy statement | English (en) ▼

INSPIRE
Infrastructure for Spatial Information in the European Community

European Commission > INSPIRE >

INSPIRE DIRECTIVE

The INSPIRE Directive: a brief description

http://inspire-geoportal.ec.europa.eu/
water pollution

ABOUT

- Home
- About INSPIRE
- Legislation
- History
- Who's who in INSPIRE
- INSPIRE library
- INSPIRE Conferences

IMPLEMENTATION

- Roadmap
- Monitoring and Reporting
- IOC
- INSPIRE GeoPortal
- Maintenance and Implementation

ADOPTION

- Roadmap
- Implementing Rules
- Monitoring and Reporting

In Europe a major recent development has been the entering in force of the INSPIRE Directive in May 2007, establishing an infrastructure for spatial information in Europe to support Community environmental policies, and policies or activities which may have an impact on the environment.

INSPIRE is based on the infrastructures for spatial information established and operated by the 28 Member States of the European Union. The Directive addresses **34 spatial data themes** needed for environmental applications, with key components specified through technical implementing rules. This makes INSPIRE a unique example of a

SEARCH INSPIRE

INSPIRE Documents
INSPIRE Website

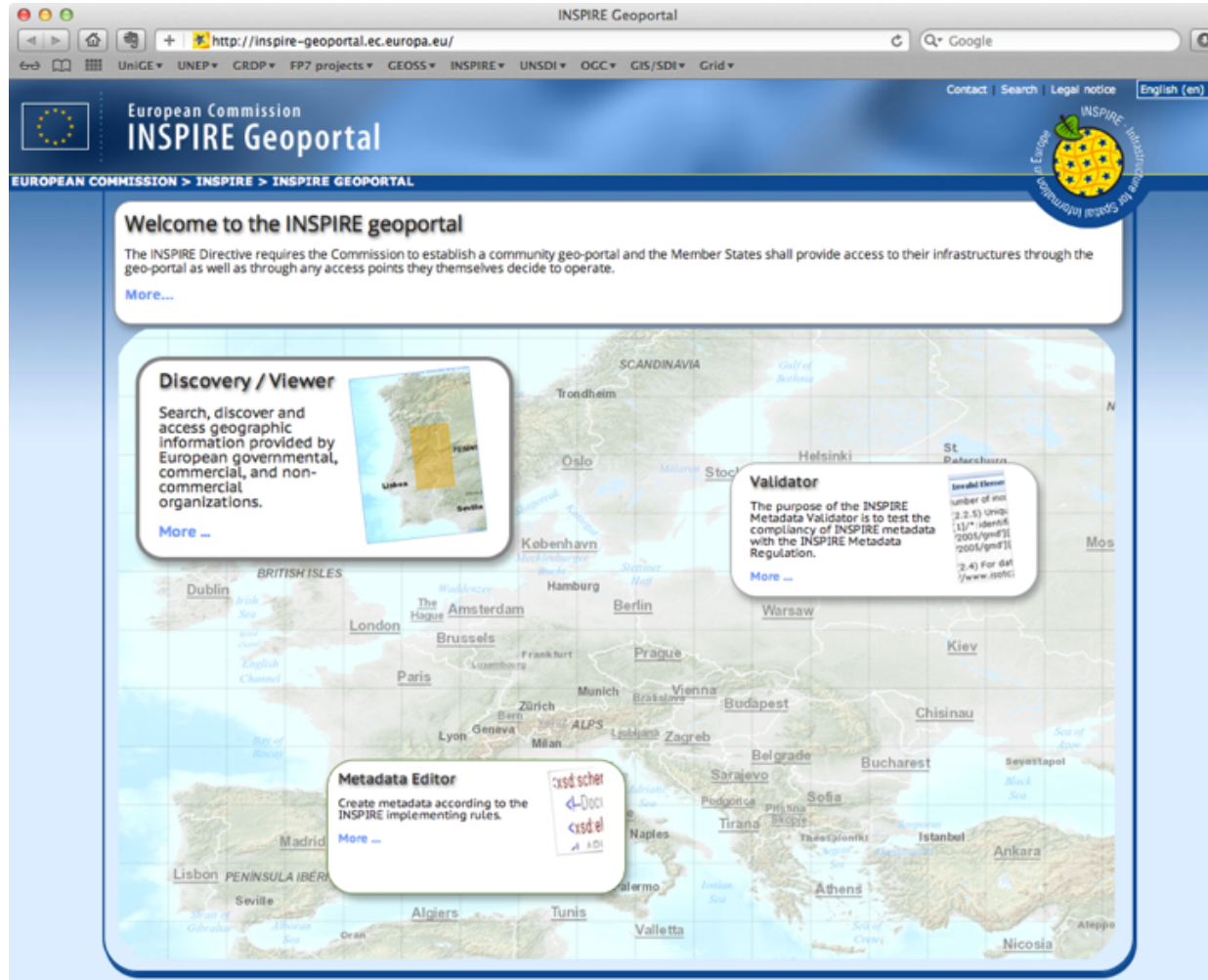
LOGIN / REGISTRATION

INSPIRE Conference 2016
Barcelona, 26th - 30th September

INSPIRE

INSPIRE - Portal

http://inspire-geoportal.ec.europa.eu



The screenshot shows the INSPIRE Geoportal website in a browser window. The address bar displays 'http://inspire-geoportal.ec.europa.eu/'. The page header includes the European Commission logo and the text 'INSPIRE Geoportal'. A navigation menu contains links for 'Contact', 'Search', 'Legal notice', and 'English (en)'. The main content area features a 'Welcome to the INSPIRE geoportal' message, followed by a 'Discovery / Viewer' section with a map of Europe and a 'Validator' section. A 'Metadata Editor' section is also visible at the bottom of the map area.

Welcome to the INSPIRE geoportal
 The INSPIRE Directive requires the Commission to establish a community geo-portal and the Member States shall provide access to their infrastructures through the geo-portal as well as through any access points they themselves decide to operate.
[More...](#)

Discovery / Viewer
 Search, discover and access geographic information provided by European governmental, commercial, and non-commercial organizations.
[More ...](#)

Validator
 The purpose of the INSPIRE Metadata Validator is to test the compliancy of INSPIRE metadata with the INSPIRE Metadata Regulation.
[More ...](#)

Metadata Editor
 Create metadata according to the INSPIRE implementing rules.
[More ...](#)

Digital Agenda for Europe

<https://ec.europa.eu/digital-single-market/en>

Create An ECAS Account | ECAS Login | About | Contact | Legal notice | Search English (en) ▾



DIGITAL SINGLE MARKET

Digital Economy & Society

European Commission > Europe 2020 strategy

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 [The strategy](#) |
 [Economy](#) |
 [Society](#) |
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 [Research & innovation](#) |
 DG CONNECT

DG CONNECT

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- [Funding Opportunities](#)
- [Newsletters](#)
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- [Discussions](#)

Europe 2020 strategy

The Digital Agenda presented by the European Commission forms one of the seven pillars of the Europe 2020 Strategy which sets objectives for the growth of the European Union (EU) by 2020. The Digital Agenda proposes to better exploit the potential of Information and Communication Technologies (ICTs) in order to foster innovation, economic growth and progress.



The European Commission's Digital Agenda forms one of the seven pillars of the Europe 2020 Strategy which sets objectives for the growth of the European Union (EU) by 2020.

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Europe – Reuse of Public Sector Info.



DIGITAL SINGLE MARKET

Digital Economy & Society

European Commission > European legislation on reuse of public sector information

- [Home](#)
- [The strategy](#)
- [Economy](#)**
- [Society](#)
- [Access & connectivity](#)
- [Research & innovation](#)
- [DG CONNECT](#)

Economy

[Startup Europe](#)

Data

[Big Data strategy](#)

[What big data can do for you](#)

[Data Public-Private Partnership](#)

Open Data

[Open Data Portals](#)

[Legislative measures](#)

[Non-legislative measures](#)

[EU Funded Projects](#)

[Language Technologies](#)

[Cloud Computing](#)

European legislation on reuse of public sector information

- Article**
- [Latest](#)
- [Blogs](#)

The Directive on the re-use of public sector information provides a common legal framework for a European market for government-held data (public sector information). It is built around two key pillars of the internal market: transparency and fair competition.

The Directive on the re-use of public sector information (Directive 2003/98/EC, known as the 'PSI Directive') entered into force on 31 December 2003. It was revised by Directive 2013/37/EU which entered into force on 17 July 2013.



It focuses on the economic aspects of re-use of information rather than on the access of citizens to information. It encourages the Member States to make as much information available for re-use as possible. It addresses material held by public sector bodies in the Member States, at national,

Search

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@DSMeu

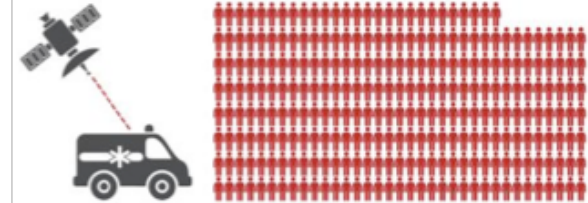
[European Commission](#)

Economic Value of GeoServices

Geo services global revenues are \$150-\$270 billion per year



Geo services aid faster emergency response; for example, in England Geo services may have helped to save at least 152 lives per year



Geo services global added value is around \$100 billion per year



Geo services can improve agricultural irrigation, helping to achieve global cost savings per year of:



Geo services facilitate competition, leading to savings from reduced prices among infrequently bought goods and services of up to:

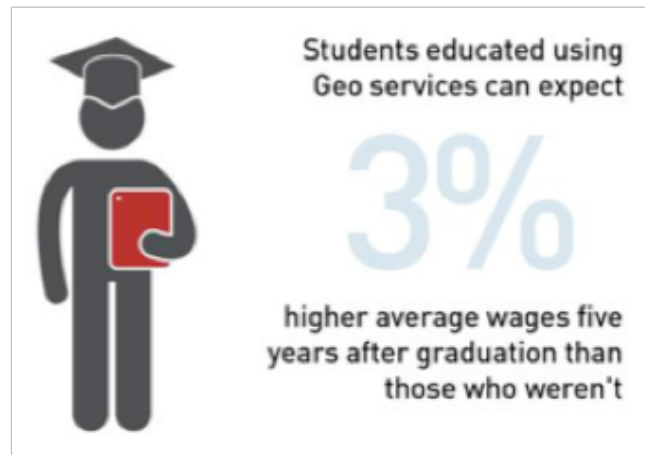


Economic Value of GeoServices

Geo services save:



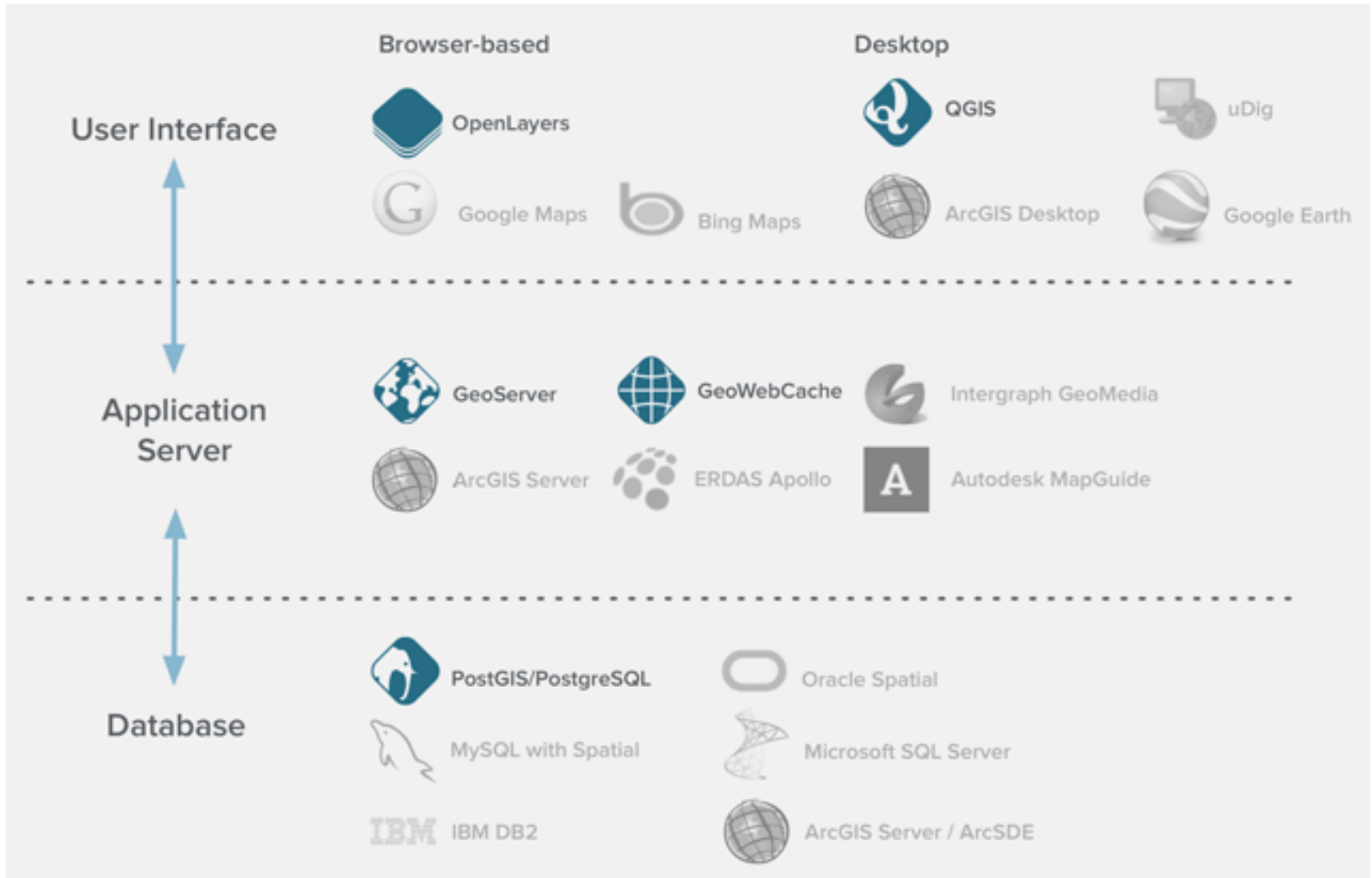
Geo services save 3.5 billion litres of gasoline per year—approximately 0.1% of the total world production of 5 trillion litres of liquid oil products



Some tools...

- Storage: PostgreSQL, PostGIS
- Data services: GeoServer
- Metadata services: GeoNetwork
- Processing services: PyWPS
- Visualization: OpenLayers, Leaflet
- CMS: GeoNode

Some tools...



Some tools...

WFP
wfp.org

WFPGeoNode

Search... Sign in

LAYERS MAPS DOCUMENTS USERS

Welcome to the WFPGeoNode

Our corporate web application for creating and sharing geospatial data and maps designed for non-GIS experts.

Get Started

Image Credit: NASA

Layers 358 Maps 43 Static Maps 1024 Users 117

Search...

Recent Maps

- CAR Operational OverV... 177
- WFP Presence by Region... 137
- Chad Cash & Vouchers P... 64
- Vulnerability and Risks in... 81

Explore Data

Click to search for geospatial data from our corporate SDI or published by other users, organizations and public sources.

Explore Maps

Data is available for browsing aggregating and styling to generate maps which can be shared publicly or restricted to specific users only.

Upload Data

GeoNode allows registered users to easily upload geospatial data in several formats including shapefile, GeoTiff and KML.

Powered by GeoNode 2.0 | Contacts | Terms of Use | Get Started

English

WFP wfp.org

Global Sustainability Challenges

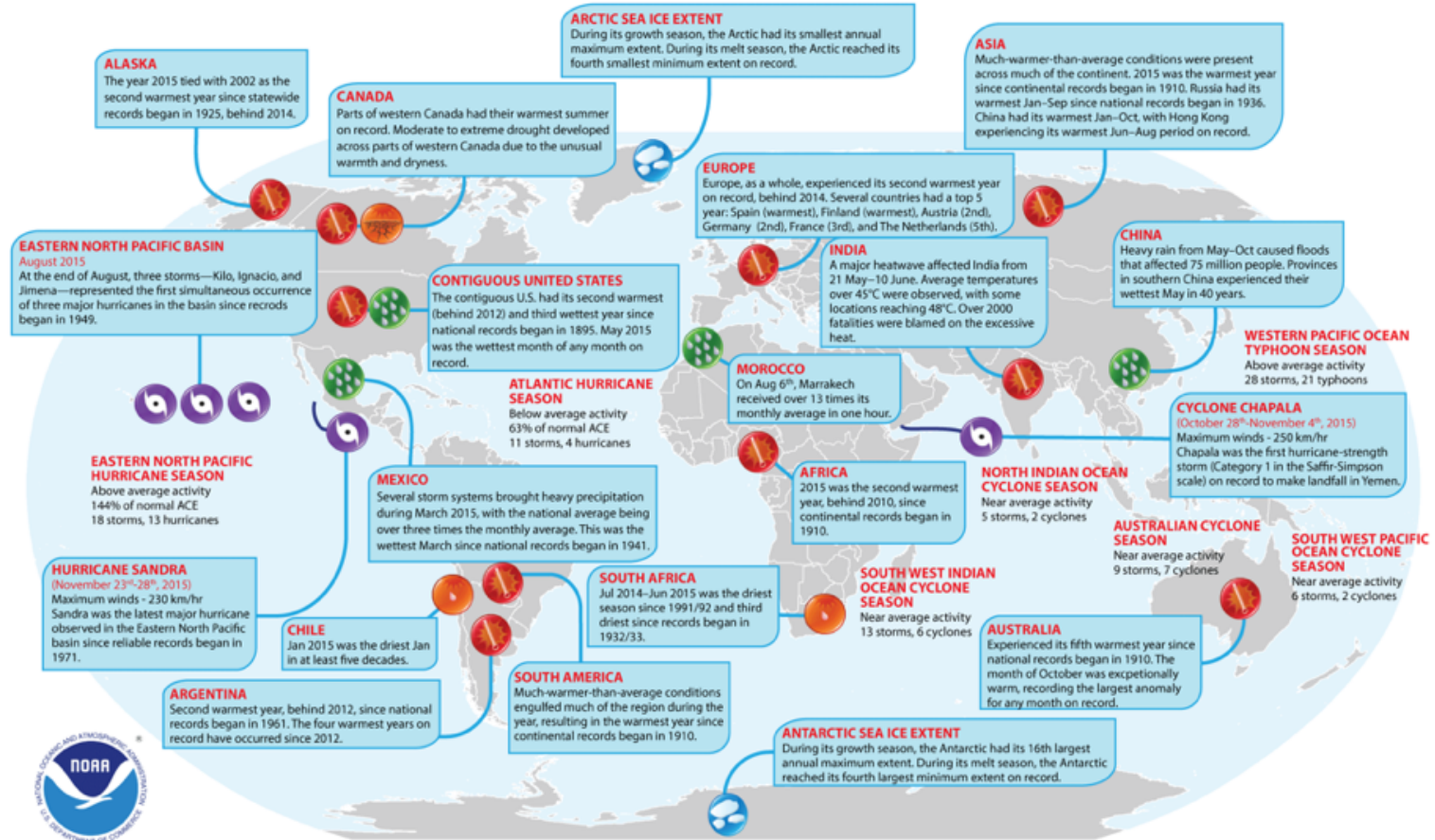
Sept 2015 – 2030 Agenda on SD



Global Sustainability Challenges

Dec 2015 – COP21 Paris Declaration

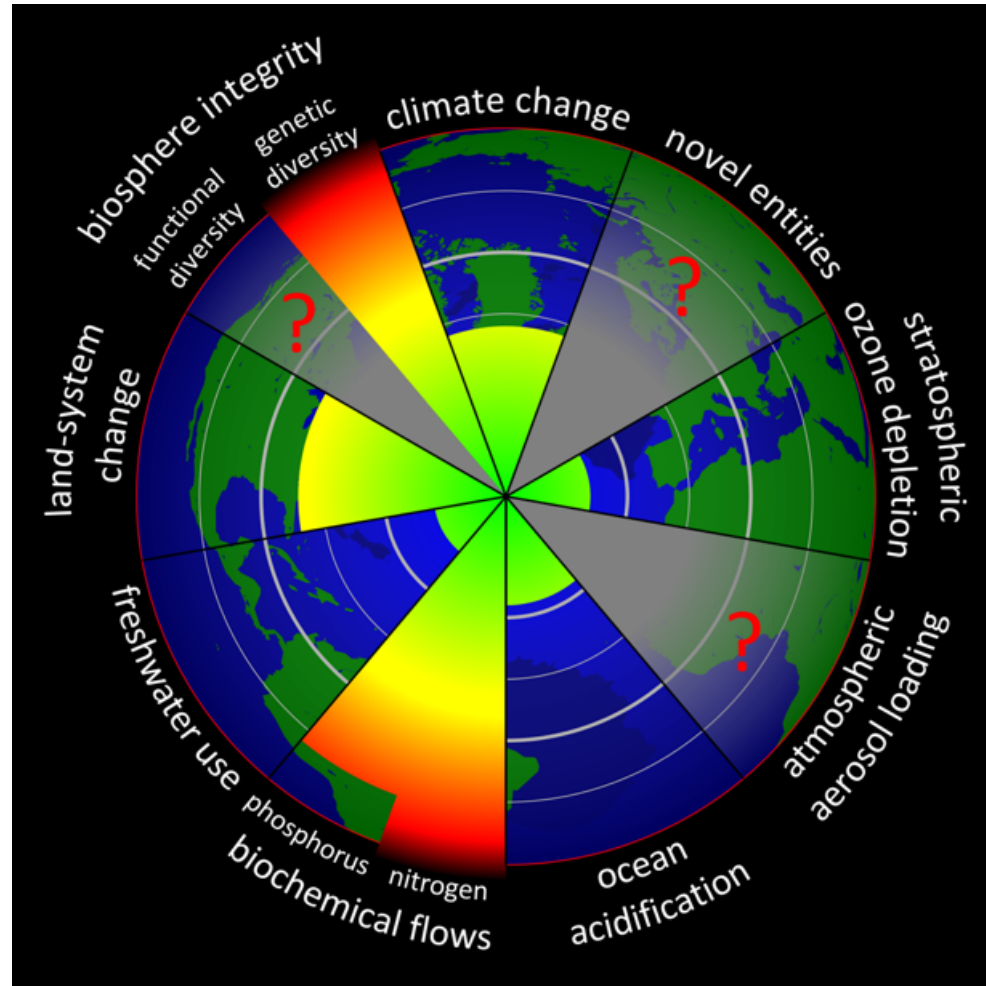
Selected Significant Climate Anomalies and Events in 2015



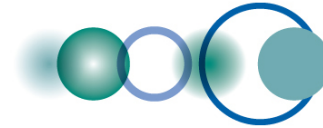
Please Note: Material provided in this map was compiled from NOAA's NCEI State of the Climate Reports and the WMO Provisional Status of the Climate in 2015. For more information please visit: <http://www.ncdc.noaa.gov/sotc>

Global Sustainability Challenges

Planetary boundaries

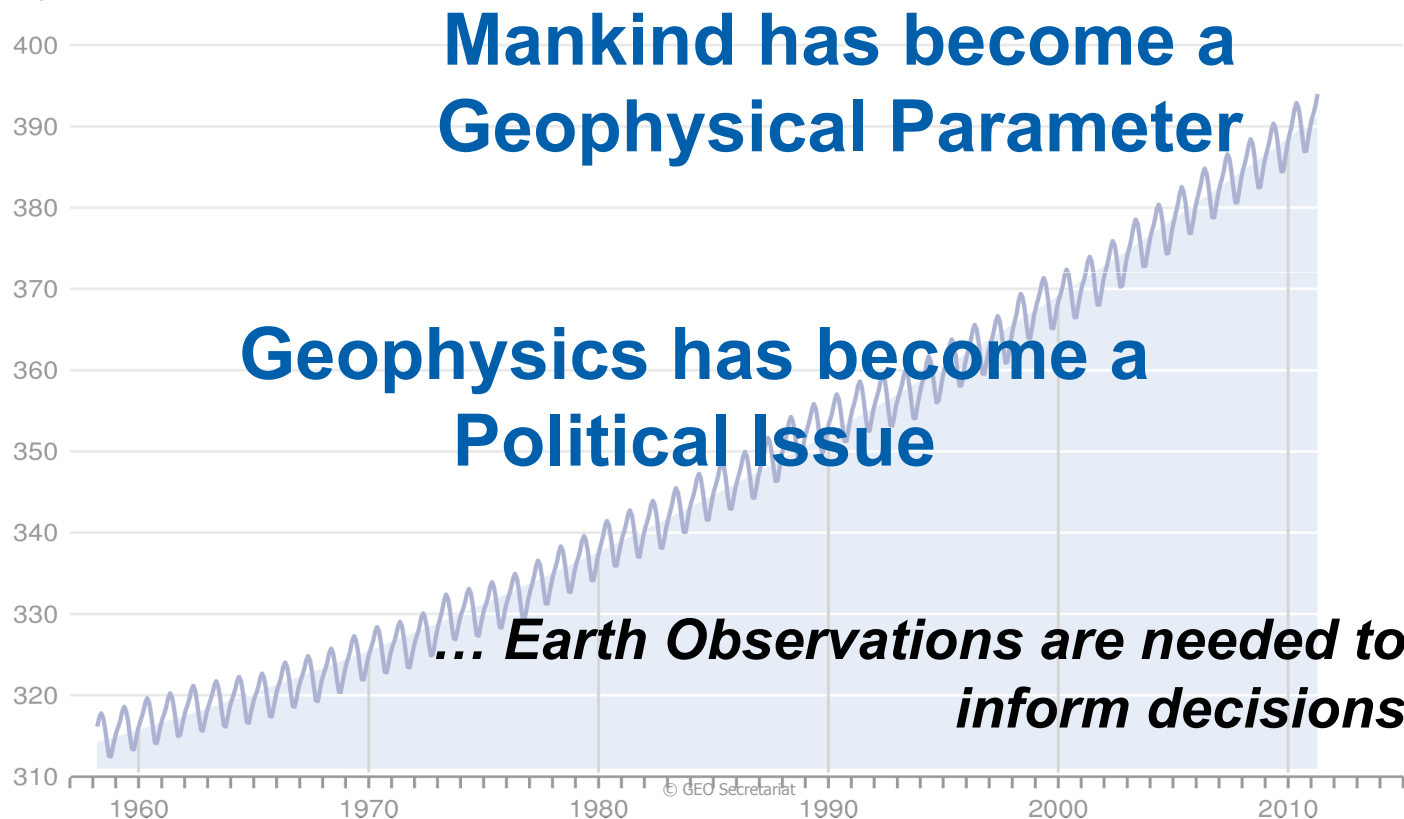


Global Sustainability Challenges

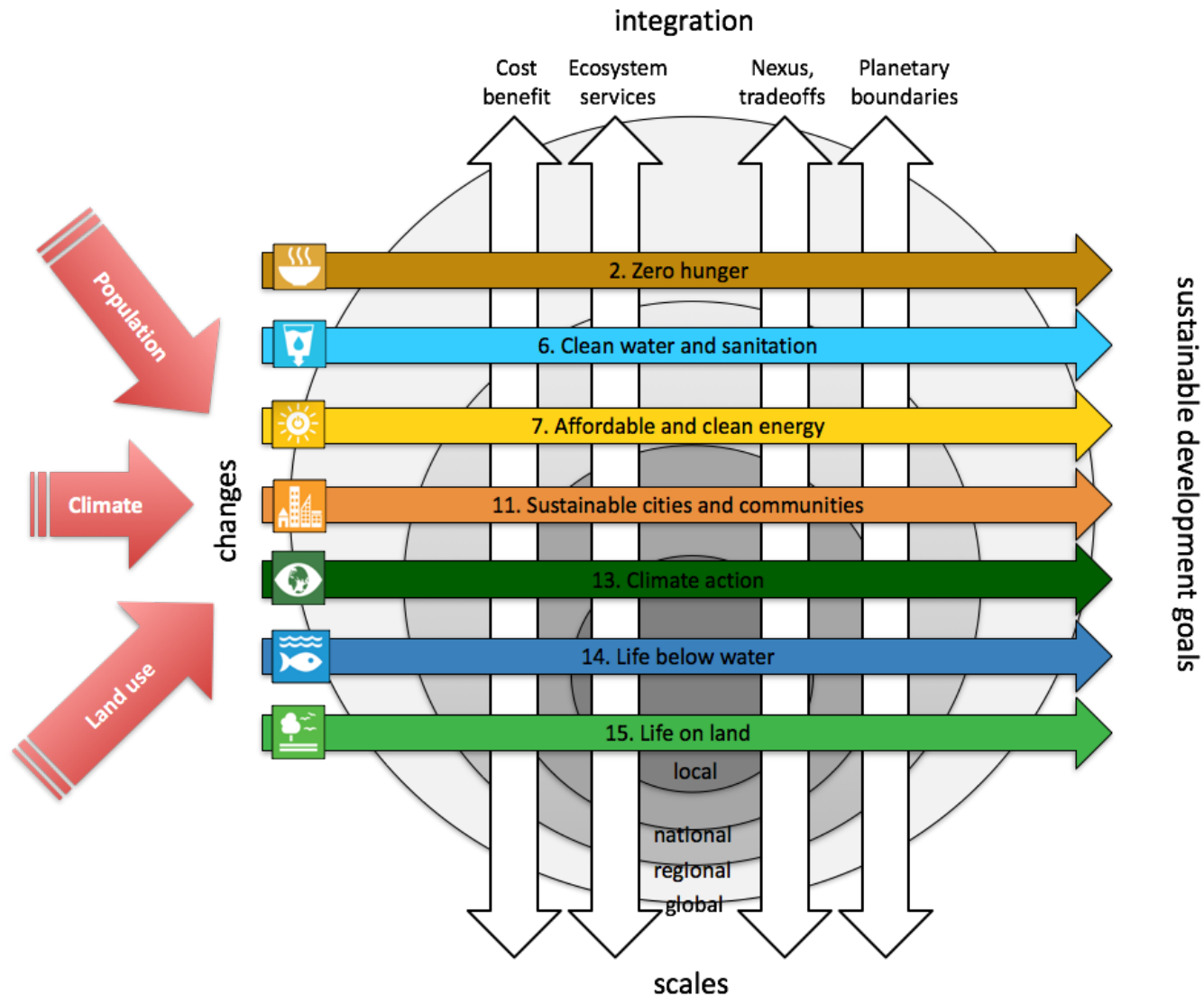


Monthly Carbon Dioxide Concentration

parts per million



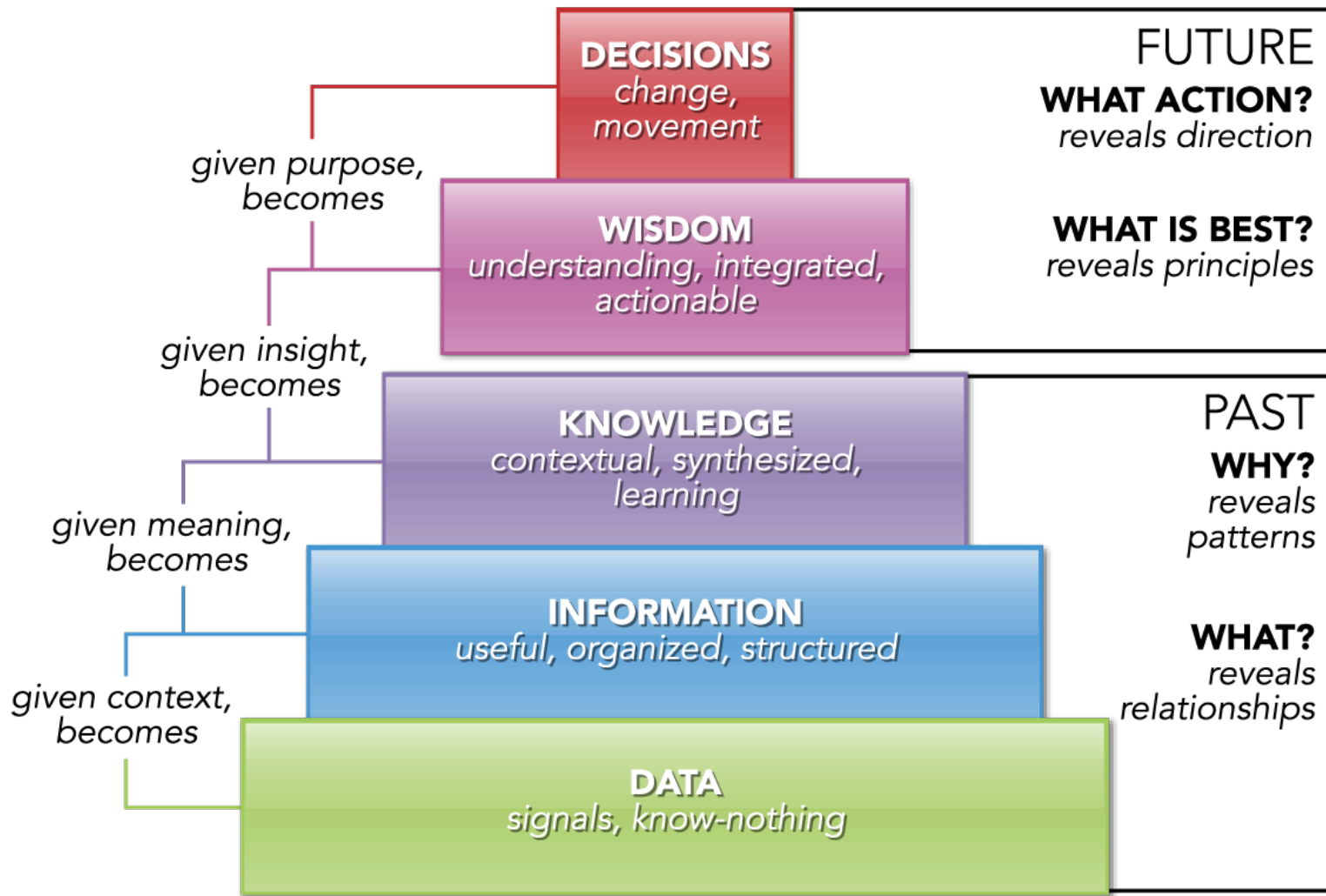
Global Sustainability Challenges



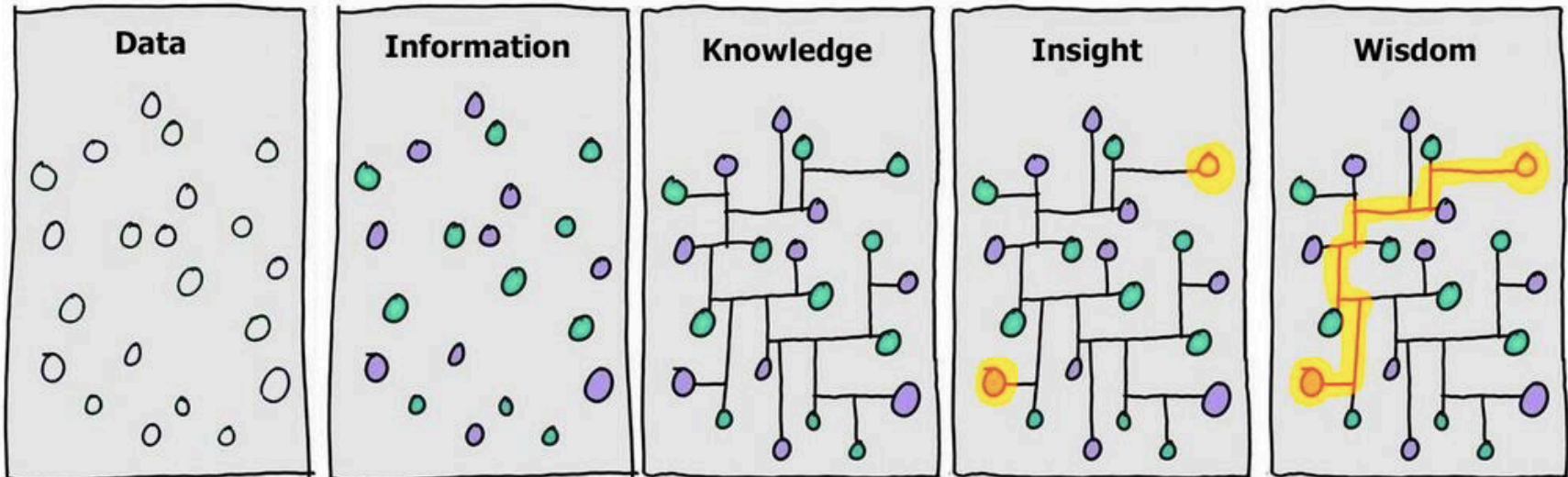
Informed & evidence-based decision making



Transforming data into knowledge

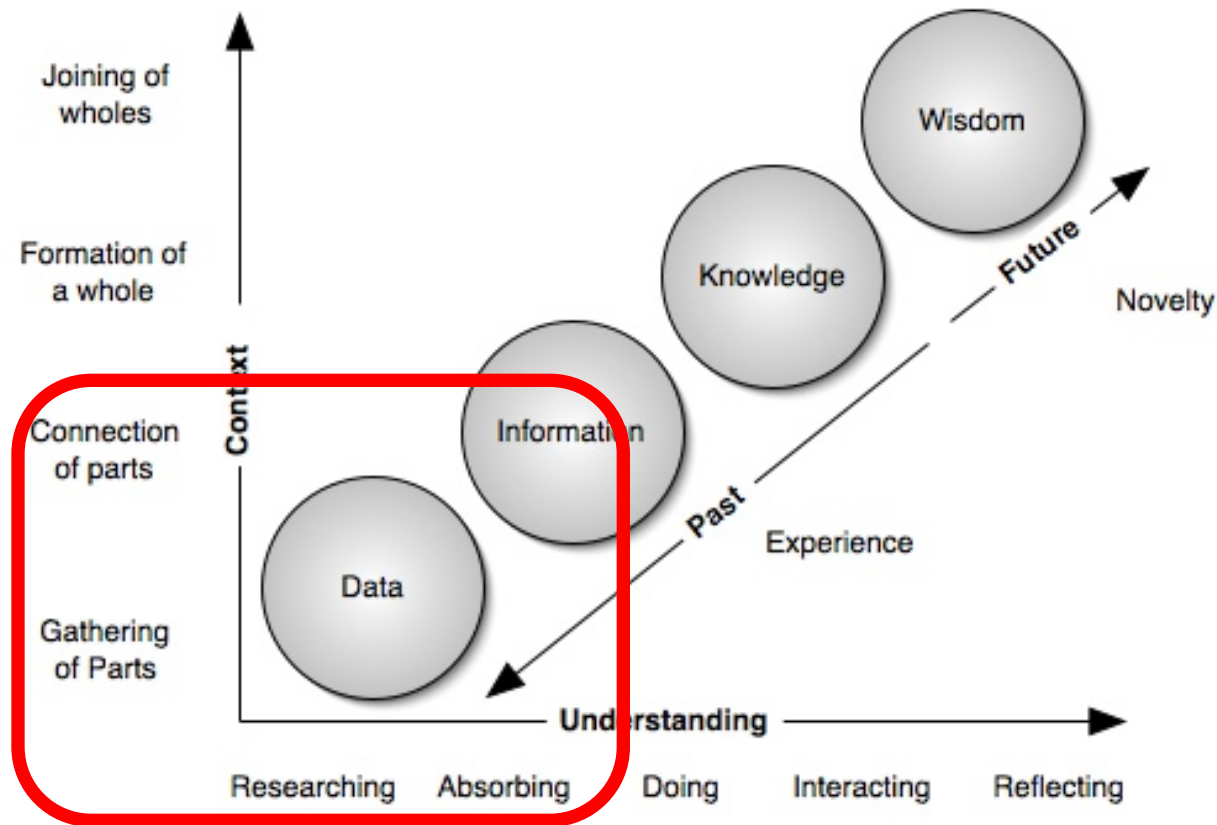


Transforming data into knowledge



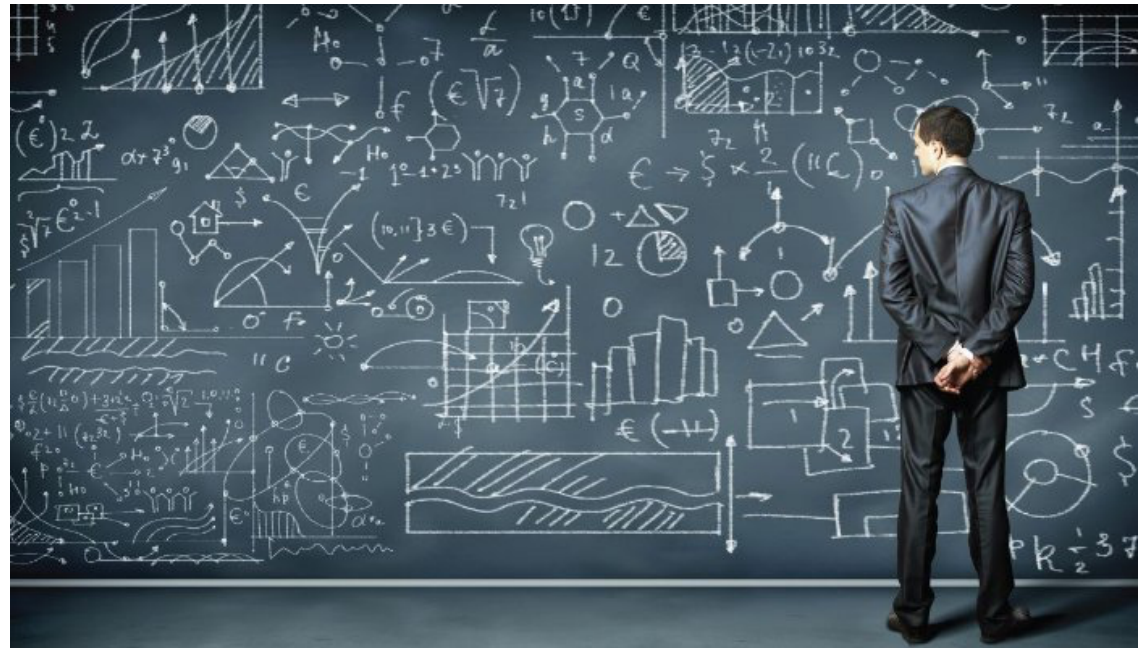
Making data interoperable...

...is only the first step towards the objective of transforming data into knowledge!

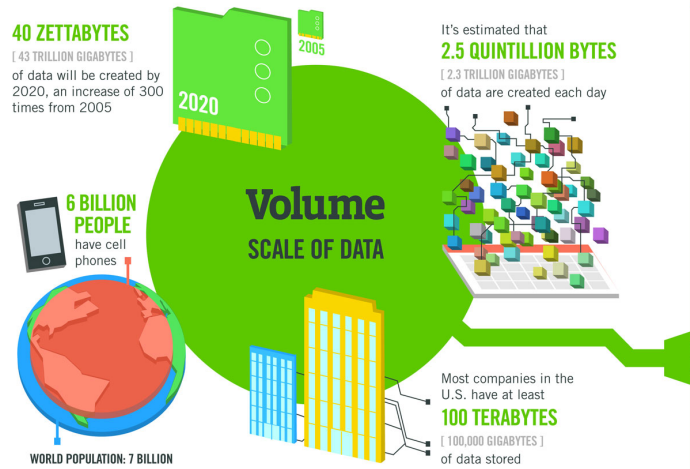


Emerging trends

- **Three drivers:** Usability – Automation – Web-based processing
- **Three domains of research:** Semantic web – processing chains - Artificial Intelligence
- Data Science



Big Data



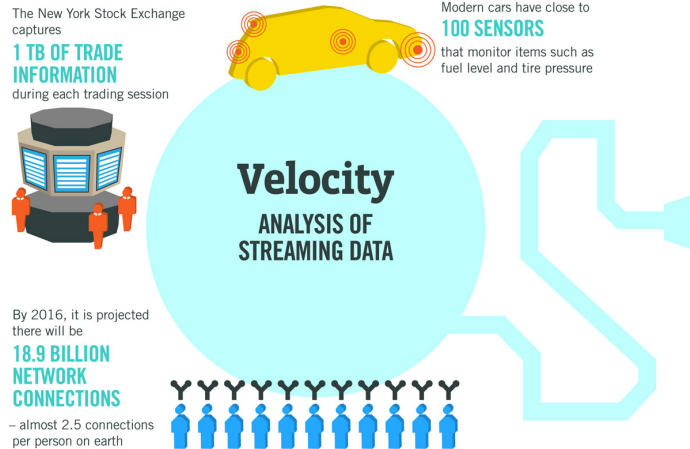
The FOUR V's of Big Data

From traffic patterns and music downloads to web history and medical records, data is recorded, stored, and analyzed to enable the technology and services that the world relies on every day. But what exactly is big data, and how can these massive amounts of data be used?

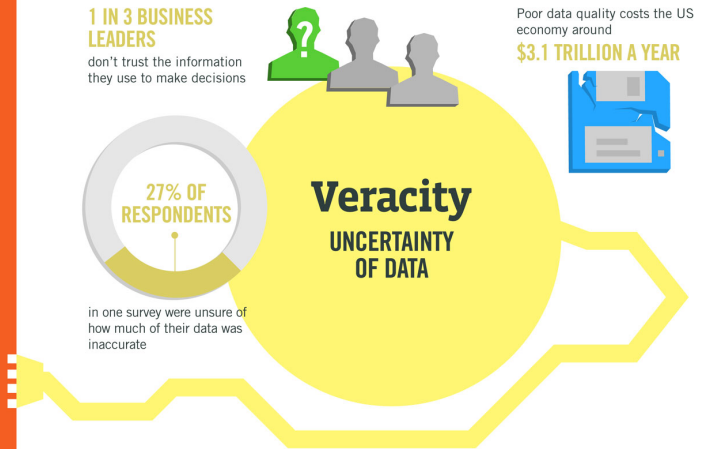
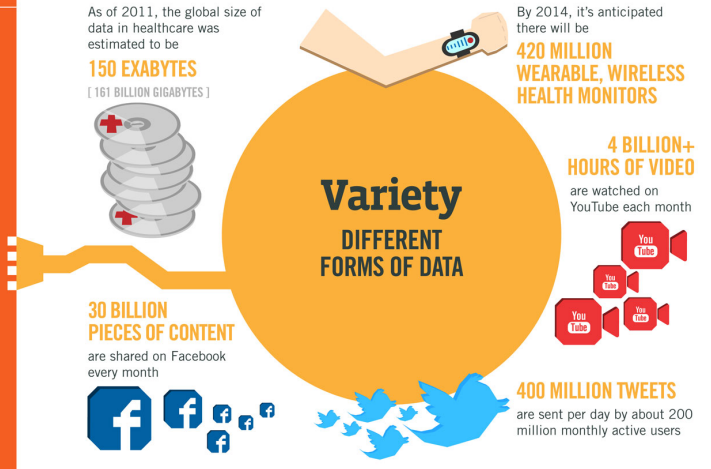
As a leader in the sector, IBM data scientists break big data into four dimensions: **Volume, Velocity, Variety and Veracity**

Depending on the industry and organization, big data encompasses information from multiple internal and external sources such as transactions, social media, enterprise content, sensors and mobile devices. Companies can leverage data to adapt their products and services to better meet customer needs, optimize operations and infrastructure, and find new sources of revenue.

By 2015 **4.4 MILLION IT JOBS** will be created globally to support big data, with 1.9 million in the United States

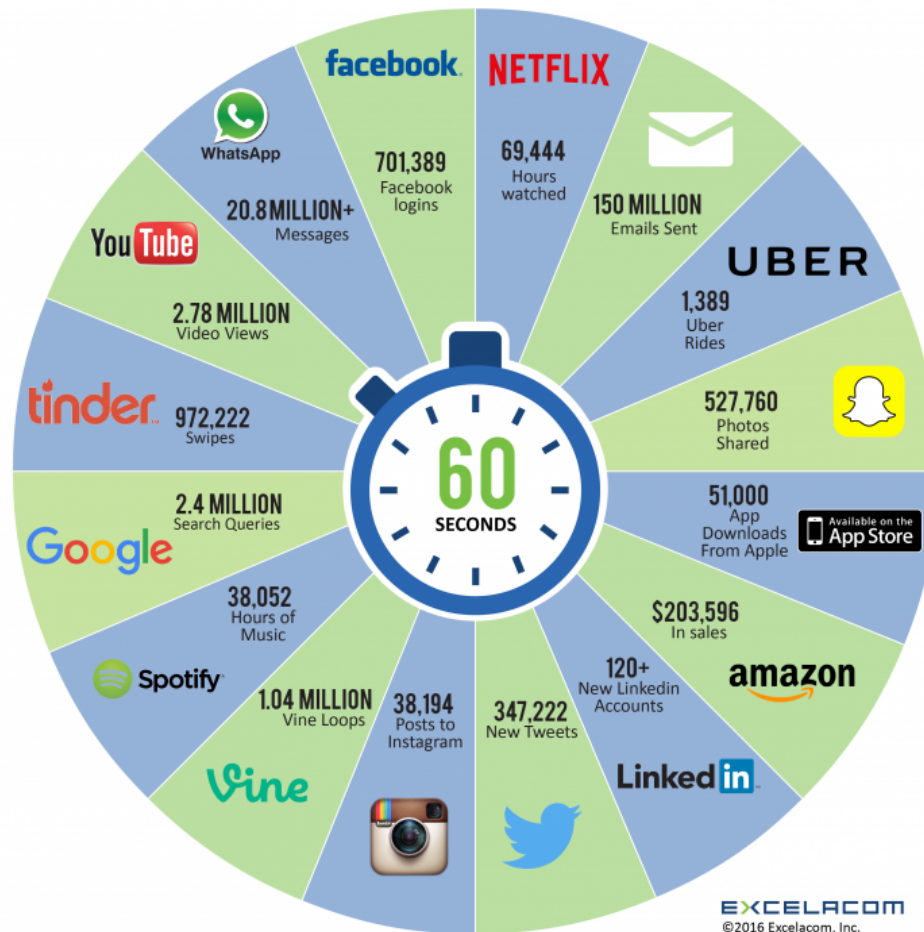


Sources: McKinsey Global Institute, Twitter, Cisco, Gartner, EMC, SAS, IBM, MEPTec, QAS



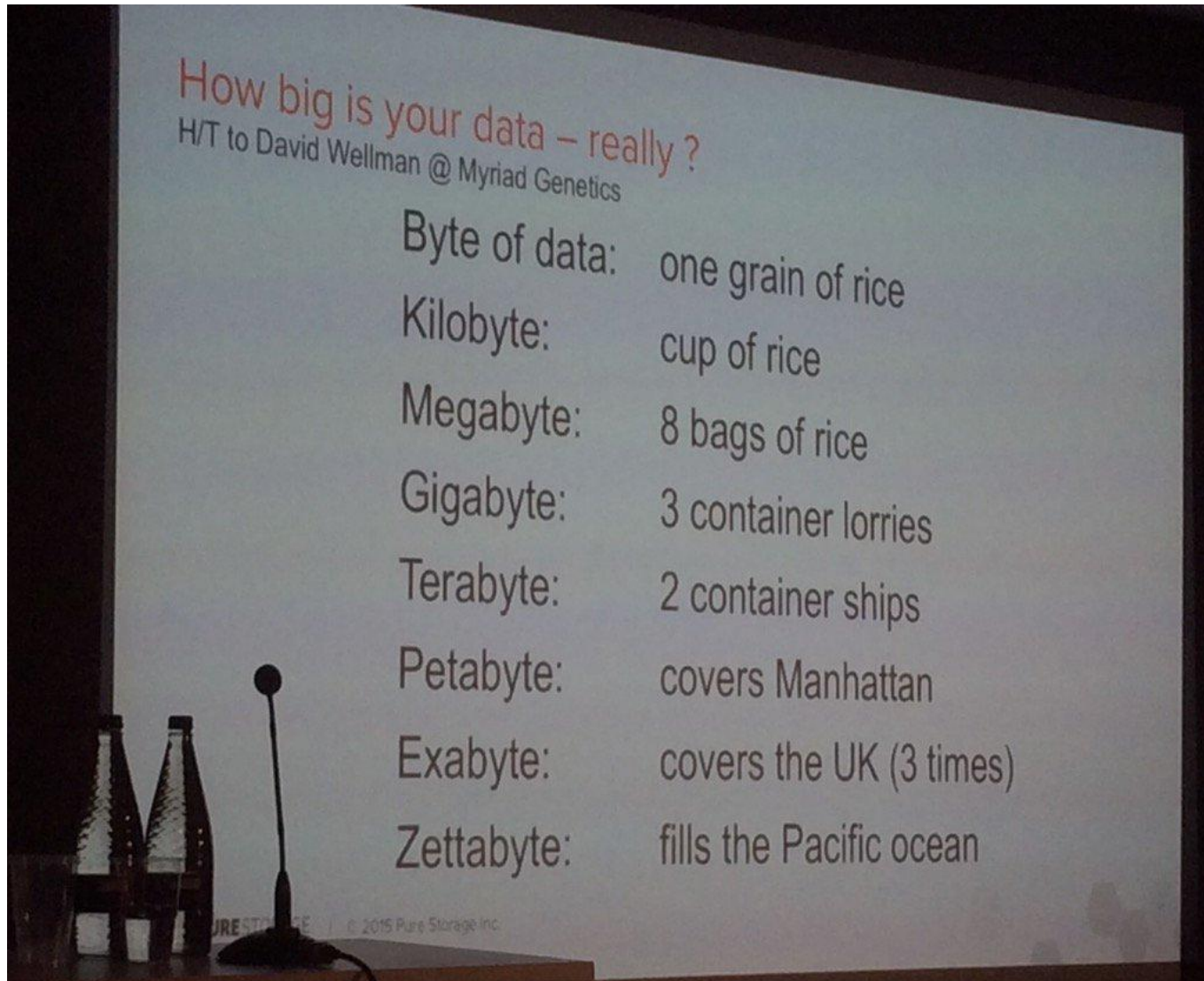
Big Data

2016 What happens in an INTERNET MINUTE?



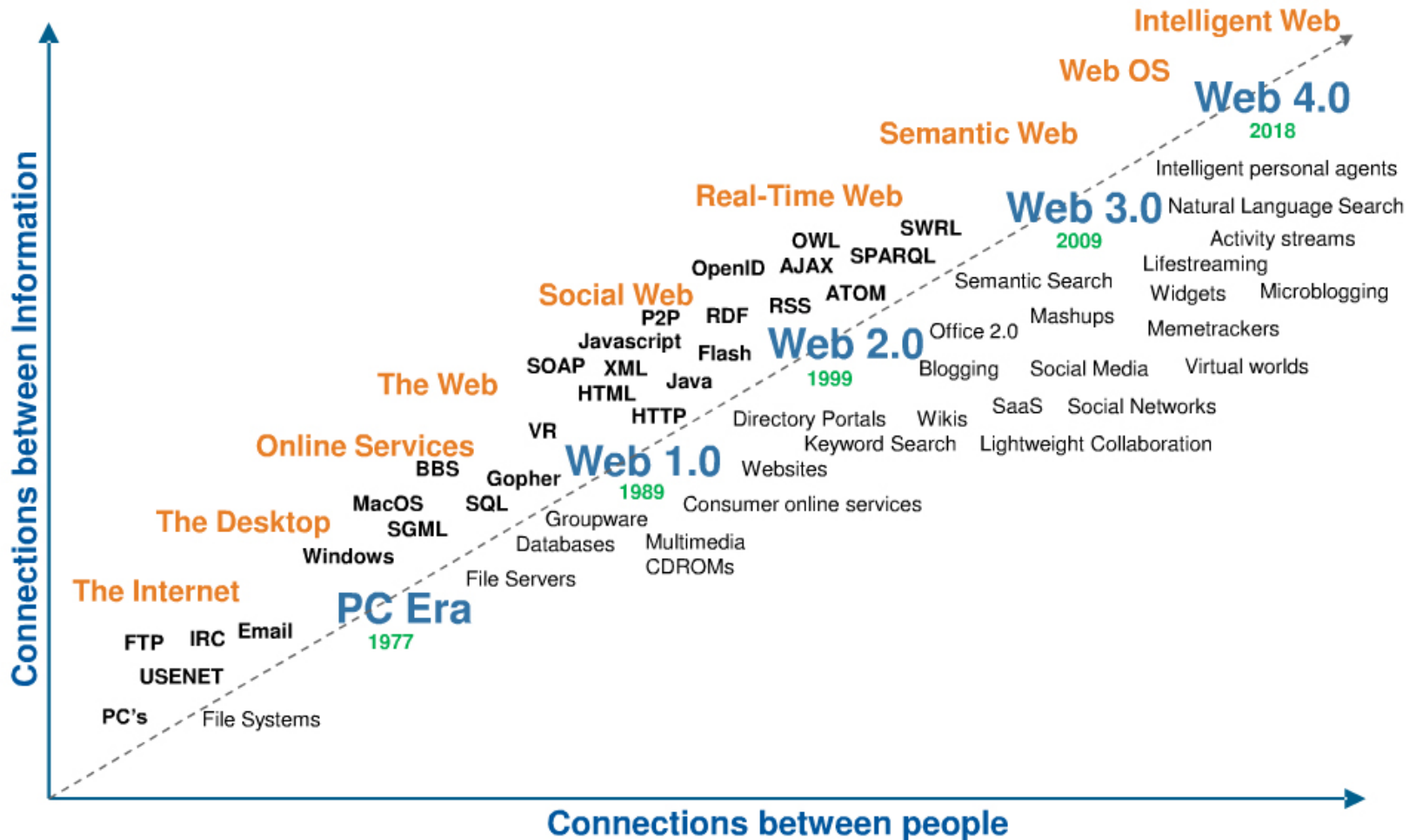
EXCELACOM
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Big Data



Semantic Web

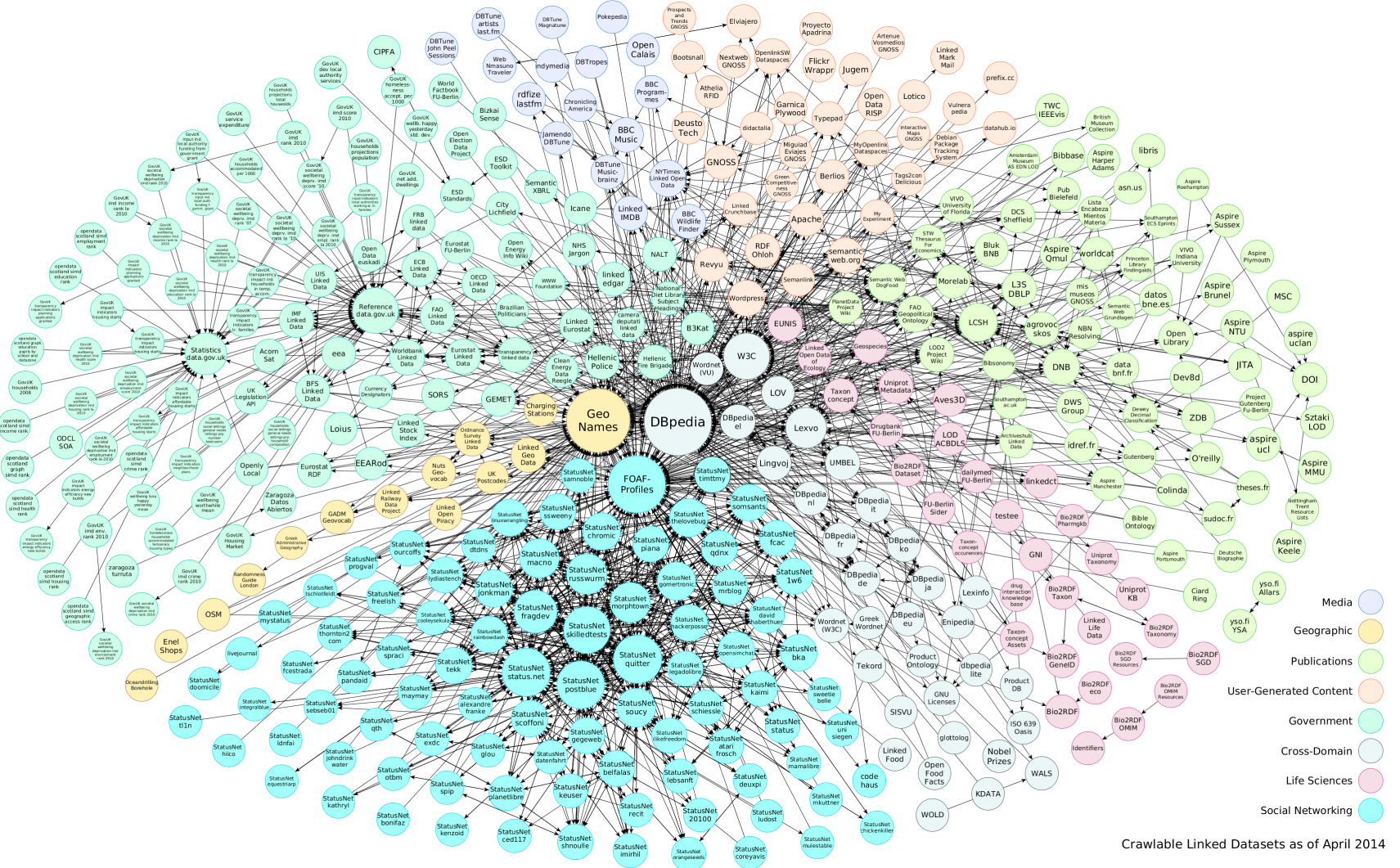
The Intelligence is in the Connections



Semantic Web & Linked Data

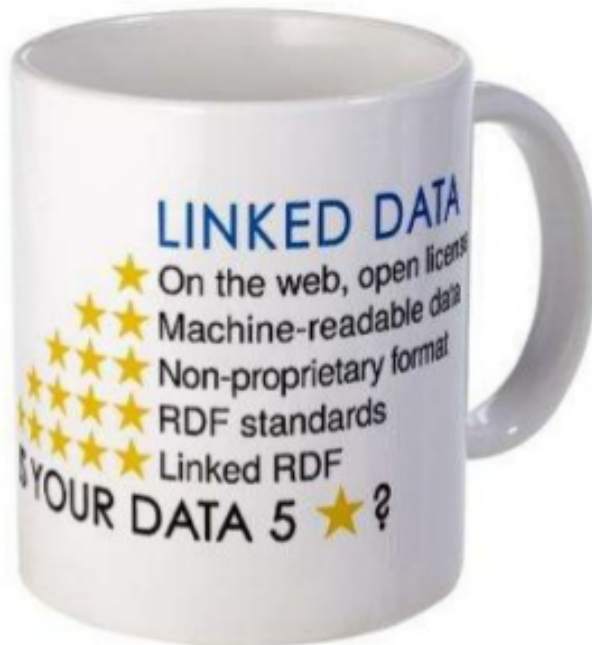
- The **Semantic Web** is an extension of the **Web** through standards by the World Wide **Web** Consortium (W3C). The standards promote common data formats and exchange protocols on the **Web**, most fundamentally the Resource Description Framework (RDF).
- In computing, **linked data** (often capitalized as **Linked Data**) is a method of publishing structured **data** so that it can be interlinked and become more useful through semantic queries.

Linked Data



Linked Data

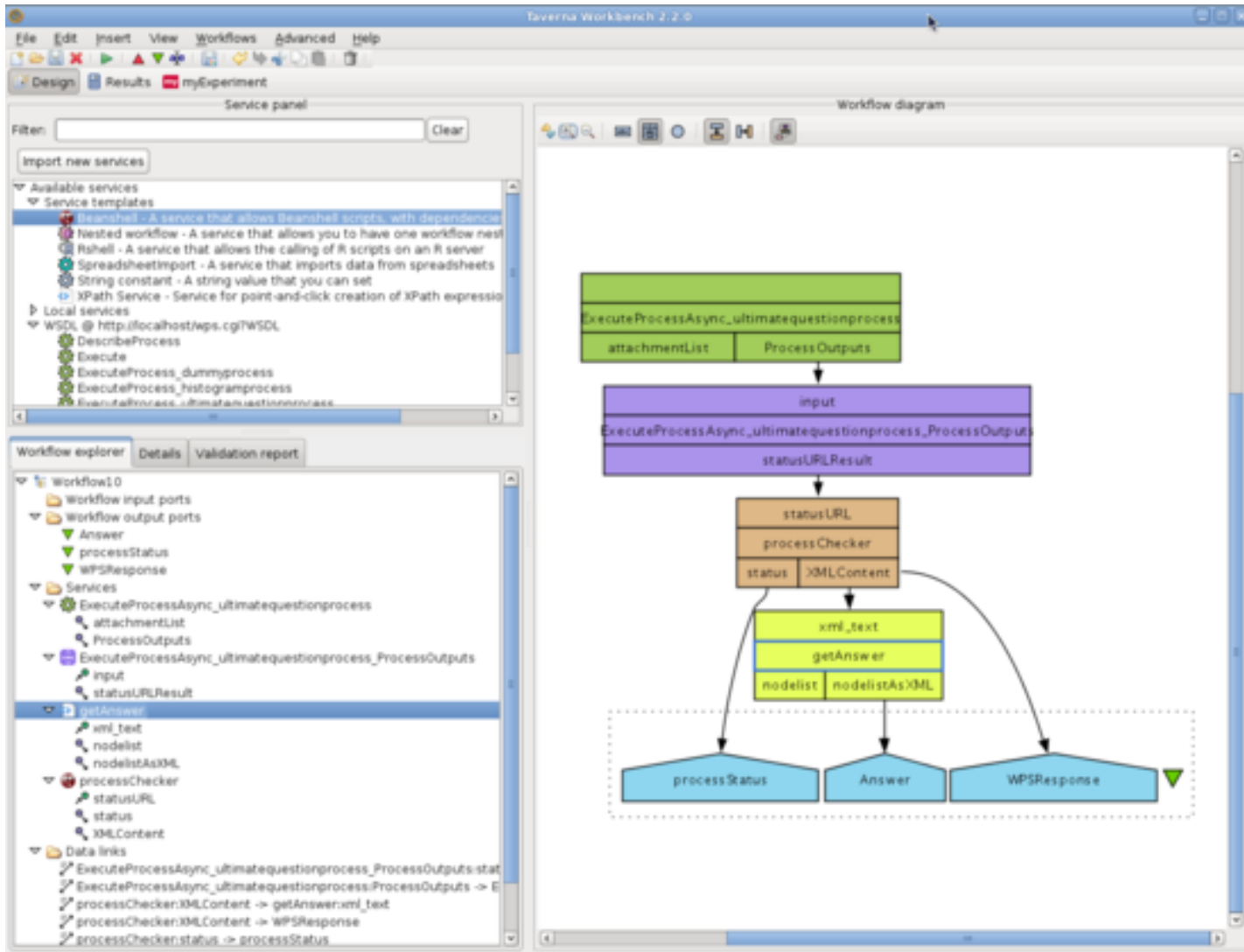
Linked Data five star system



★	Available on the web (whatever format), but with an open license
★★	Available as machine-readable structured data (e.g. excel instead of image scan of a table)
★★★	as (2) plus non-proprietary format (e.g. CSV instead of excel)
★★★★	All the above plus, Use open standards from W3C (RDF and SPARQL) to identify things, so that people can point at your stuff
★★★★★	All the above, plus: Link your data to other people's data to provide context

www.w3.org/designissues/linkedata.html

Processing chains



Artificial Intelligence

- Artificial Intelligence is usually defined as the science of making computers do things that require intelligence when done by humans



Artificial Intelligence

What is Intelligence????



- “Intelligence is the name we give to the data processing activity of entities which respond to information with behaviour which appears to be intended to be optimal with respect to pre-set goals”
- “Intelligence involves Knowing and Choosing”



Artificial Intelligence

What is Artificial Intelligence?

Building on i.a.

Mathematics
Philosophy
Cognitive psychology
Biology

Methods

Knowledge based methods
Behavioural methods
Subsymbolic methods

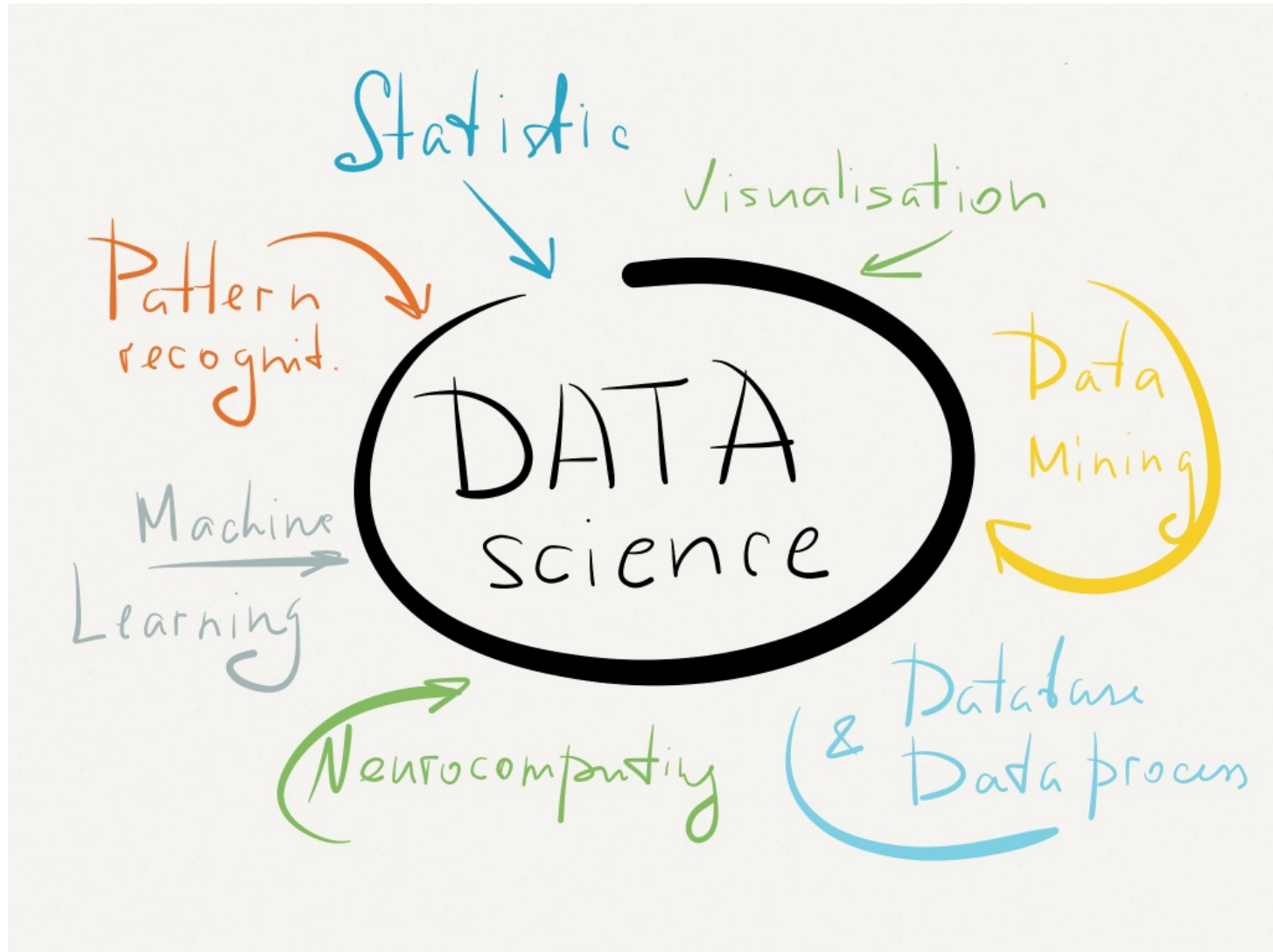
Scientific perspective

Study of intelligent systems related to computational processes

Technological perspective

Build systems that display intelligent behaviour i.e. "Smart systems"

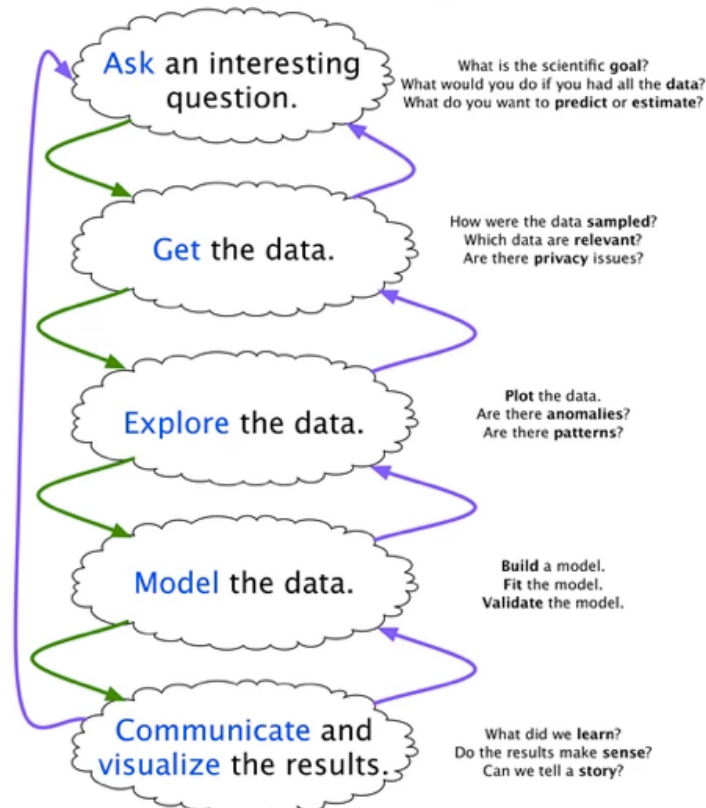
Data Science



Data Science

The Process

The Data Science Process



Joe Blitzstein and Hanspeter Pfister, created for the Harvard data science course <http://cs109.org/>.

Data Science

MODERN DATA SCIENTIST

Data Scientist, the sexiest job of 21st century requires a mixture of multidisciplinary skills ranging from an intersection of mathematics, statistics, computer science, communication and business. Finding a data scientist is hard. Finding people who understand who a data scientist is, is equally hard. So here is a little cheat sheet on who the modern data scientist really is.

MATH & STATISTICS

- ☆ Machine learning
- ☆ Statistical modeling
- ☆ Experiment design
- ☆ Bayesian inference
- ☆ Supervised learning: decision trees, random forests, logistic regression
- ☆ Unsupervised learning: clustering, dimensionality reduction
- ☆ Optimization: gradient descent and variants



PROGRAMMING & DATABASE

- ☆ Computer science fundamentals
- ☆ Scripting language e.g. Python
- ☆ Statistical computing package e.g. R
- ☆ Databases SQL and NoSQL
- ☆ Relational algebra
- ☆ Parallel databases and parallel query processing
- ☆ MapReduce concepts
- ☆ Hadoop and Hive/Pig
- ☆ Custom reducers
- ☆ Experience with xaaS like AWS

DOMAIN KNOWLEDGE & SOFT SKILLS

- ☆ Passionate about the business
- ☆ Curious about data
- ☆ Influence without authority
- ☆ Hacker mindset
- ☆ Problem solver
- ☆ Strategic, proactive, creative, innovative and collaborative

COMMUNICATION & VISUALIZATION

- ☆ Able to engage with senior management
- ☆ Story telling skills
- ☆ Translate data-driven insights into decisions and actions
- ☆ Visual art design
- ☆ R packages like ggplot or lattice
- ☆ Knowledge of any of visualization tools e.g. Flare, D3.js, Tableau

a data scientist should be able to run a regression, write a sql query, scrape a web site, design an experiment, factor matrices, use a data frame, pretend to understand deep learning, steal from the d3 gallery, argue r versus python, think in mapreduce, update a prior, build a dashboard, clean up messy data, test a hypothesis, talk to a businessperson, script a shell, code on a whiteboard, hack a p-value, machine-learn a model. **specialization is for engineers.**

JOEL GRUS

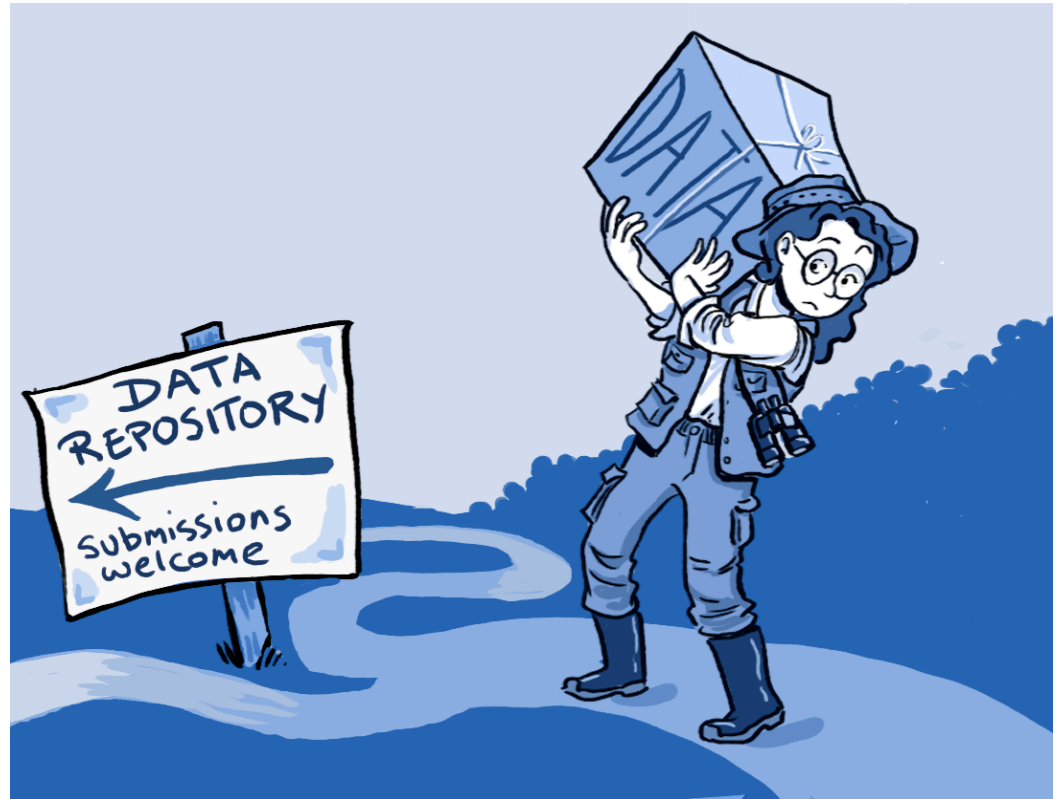
Take home messages

- Without sharing environmental data:
 - Doing science can be difficult
 - Taking sound decisions can be problematic
 - And envisioning a sustainable development can be complicated



Take home messages

- Publicly funded data are a public good, produced in the public interest and thus should be freely available to the maximum extent possible.



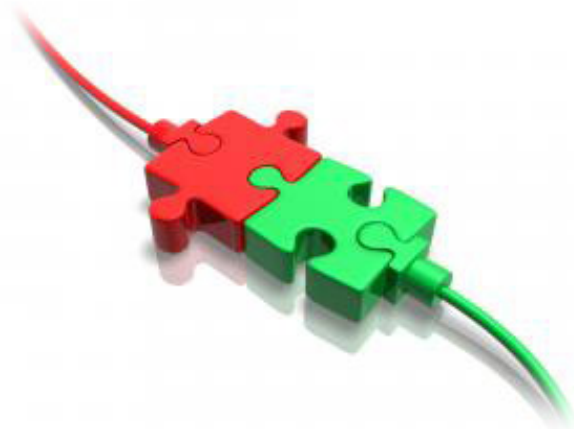
Take home messages

- Sharing and documenting data is part of the elementary scientific approach.
- Enhance scientific accountability and credibility.



Take home messages

- Keep it simple and let users experience the benefits of interoperability
- Make your data discoverable
- Promote and contribute to GEOSS & OGC
- Document your data (e.g., metadata)
- Don't forget: a map is not a data

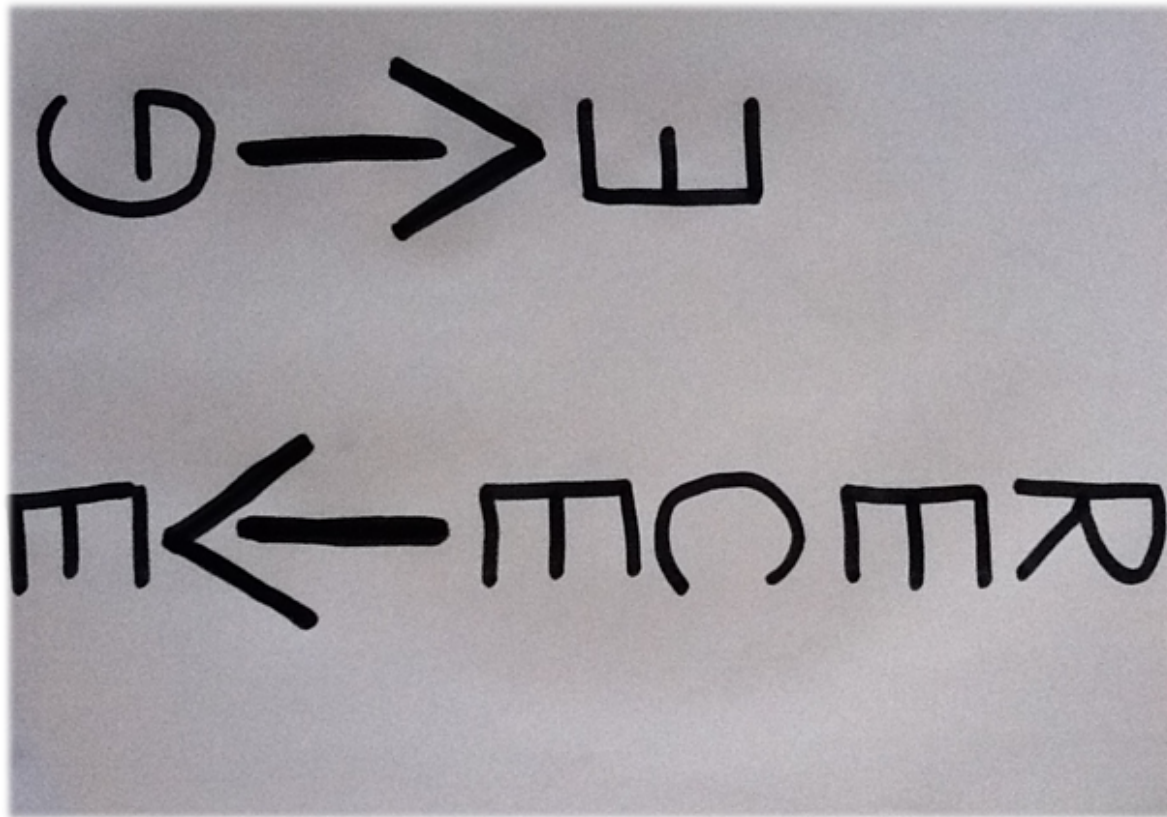


Take home messages



Data is like love...

- The more you give...
- The more you get!



Further readings

- Nebert, D. D. (2005). Developing Spatial Data Infrastructure: The SDI Cookbook.
- Giuliani, G. (2016). "Partage de données environnementales." Techniques de l'Ingénieur: 24.
- Giuliani, G. (2011). Spatial data infrastructures for environmental sciences. Université de Genève
- Nativi, S., P. Mazzetti, M. Santoro, F. Papeschi, M. Craglia and O. Ochiai (2015). "Big Data challenges in building the Global Earth Observation System of Systems." Environmental Modelling & Software **68**(0): 1-26.
- Masser, I. (2005). GIS Worlds: Creating Spatial Data Infrastructures, ESRI Press.
- Craglia, M., M. F. Goodchild, A. Annoni, G. Camara, M. Gould, W. Kuhn, D. Mark, I. Masser, D. Maguire, S. Liang and E. Parsons (2008). "Next-Generation Digital Earth: A position paper from the Vespucci Initiative for the Advancement of Geographic Information Science." International Journal of Spatial Data Infrastructures Research **3**: 22.



Thank you!

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<http://www.unige.ch/envirospace/people/giuliani>