

Concept and implementation of an architecture for the immediate provision of geodata in disaster management

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Titel: ...
Datum: ...
Projekt: ...

MEMO
Aufträge
Verplan

Source: Prägitzer (2006)

Outline

1. Motivation & relevance
2. Some existing solutions
3. Our approach: It's architecture and data sources
4. Results & summary

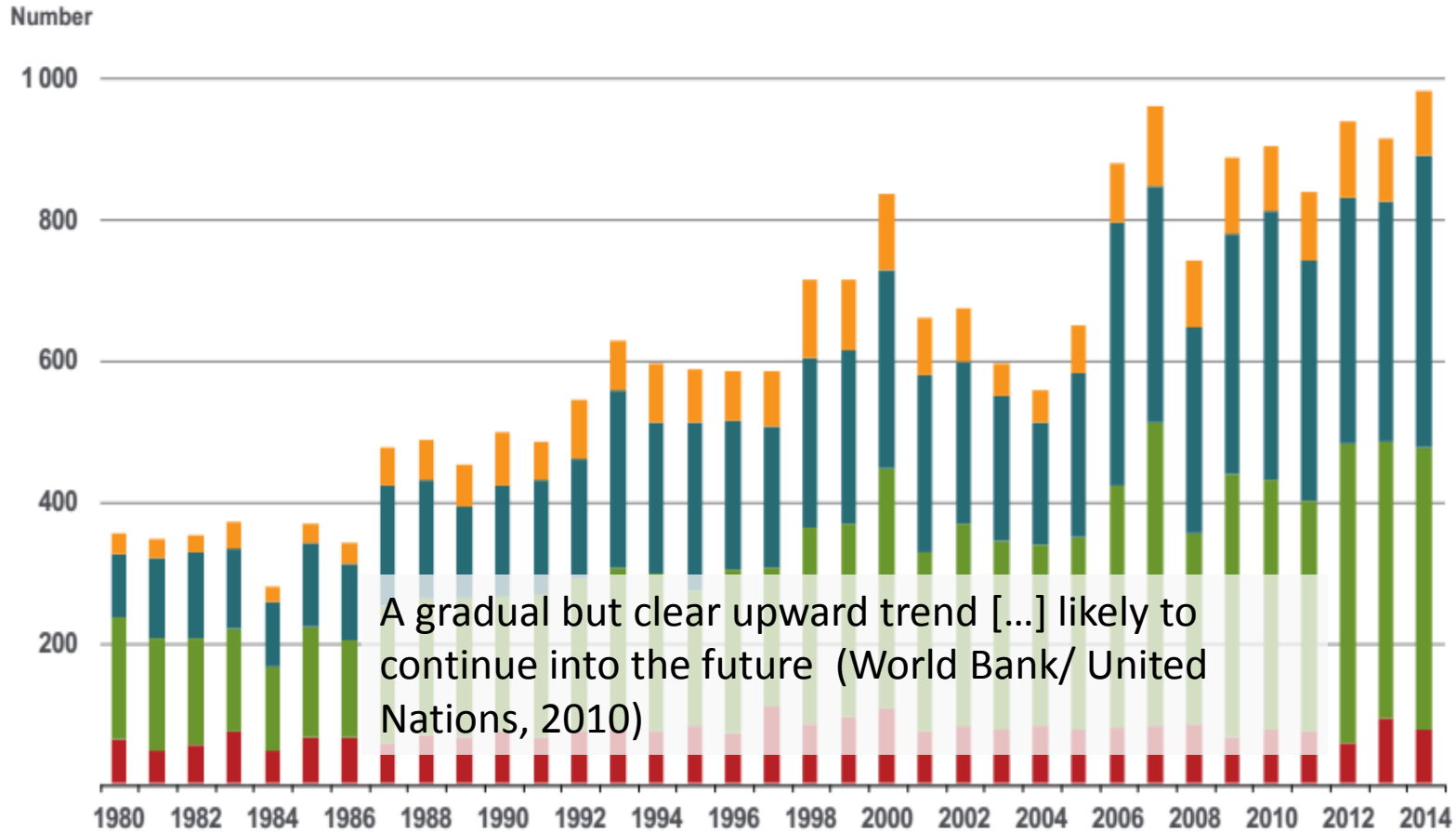
A first definition

- **Disaster:** a serious **disruption** of the functioning of society, which poses a significant, widespread threat to human life, health, property, **infrastructure** or the **environment**, whether arising from accident, nature or human activity, whether developing suddenly or as the result of long-term processes, but excluding armed conflict. [IDRL 2011]
- Rapid response is needed, comprising geospatial information.

[1] <http://emergency.copernicus.eu/mapping/ems/service-overview>

[2] <http://www.statcan.gc.ca/pub/92-195-x/2011001/other-autre/map-carte/def-eng.htm>

Motivation



Geophysical events
(Earthquake, tsunami, volcanic activity)

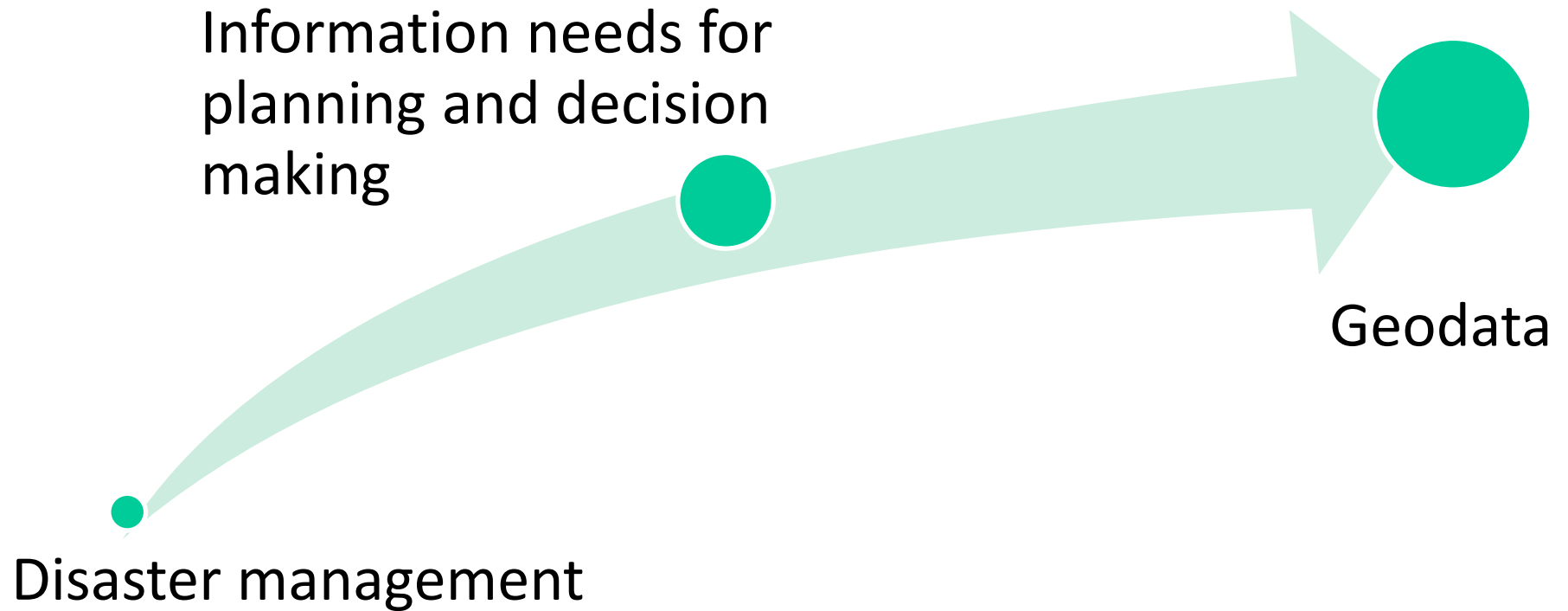
Meteorological events
(Tropical storm, extratropical storm, convective storm, local storm)

Hydrological events
(Flood, mass movement)

Climatological events
(Extreme temperature, drought, forest fire)

http://www.prevention-web.net/files/44281_19802014paketworldisde4zu3.pdf, [08.12.2016]: S. 3

Relevance



„The Management [...] of disasters require **static geodata** (for certain areas) as well **dynamic geodata** (i.e. flooded areas).“

(Municipal Coordination Board 2013)

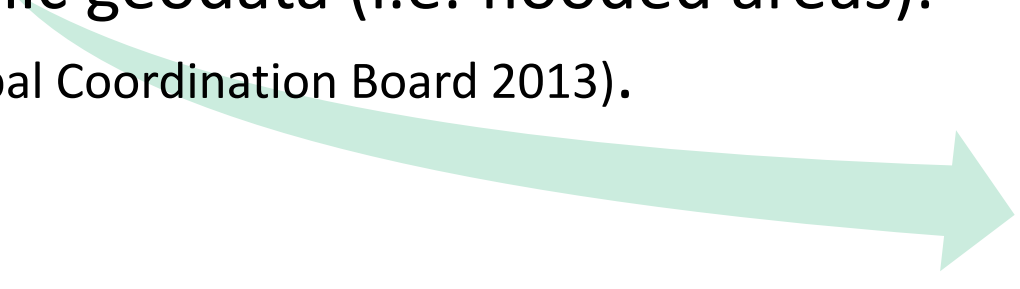
Kommunales Koordinierungsgremium (Municipal Coordination Board) GDI-DE, 2013: Einsatz von Geoinformationen in den Kommunen. Ergebnisse der Umfrage Good Practice Beispiele Handlungsempfehlungen Deutscher Städtetag; Deutscher Landkreistag; Deutscher Städte- und Gemeindebund. Berlin. Online verfügbar unter http://www.geoportal.de/SharedDocs/Downloads/DE/GDI-DE/KoKoStudie_Einsatz_Geoinfo_Kommunen.pdf?__blob=publicationFile.

„The Management [...] of disasters require static geodata (for certain areas) as well dynamic geodata (i.e. flooded areas).“

(Municipal Coordination Board 2013).



Topographic data
In vector format



Up-to-date
remotely sensed
data

Koordinierungsgremium 2013] Kommunales Koordinierungsgremium GDI-DE, 2013: Einsatz von Geoinformationen in den Kommunen. Ergebnisse der Umfrage Good Practice Beispiele Handlungsempfehlungen Deutscher Städtetag; Deutscher Landkreistag; Deutscher Städte- und Gemeindebund. Berlin. Online verfügbar unter http://www.geoportal.de/SharedDocs/Downloads/DE/GDI-DE/KoKoStudie_Einsatz_Geoinfo_Kommunen.pdf?__blob=publicationFile.

Topographic data

- Terrain height, toponyms (names and unique identifiers of standard geographic areas),
- major cultural and physical features, i.e. roads, railroads, coastlines, rivers and lakes
- Buildings

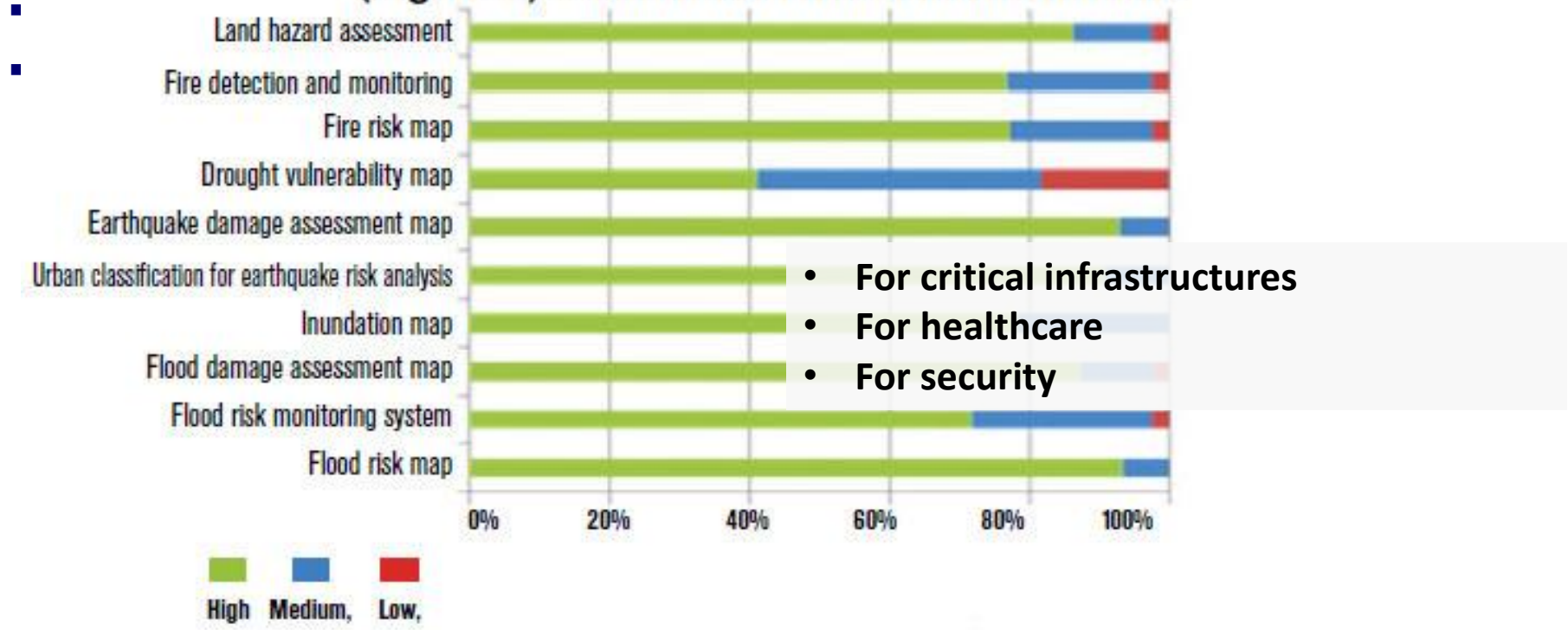
- By
 - mapping agencies or
 - Crowd based geographical information(VGI)

Satellite Imagery

- Regional or global coverage, with certain repetition rate
- Platforms
 - Satellite-borne,
 - airborne sensors (UAV, balloons)
- To deal with natural or man-made disasters, i.e.
 - Floods, Earthquakes & tsunamis, Landslides, Severe Storms, Volcanic eruptions
 - Forest fires
 - Drought and Humanitarian crises
 - Technological disasters

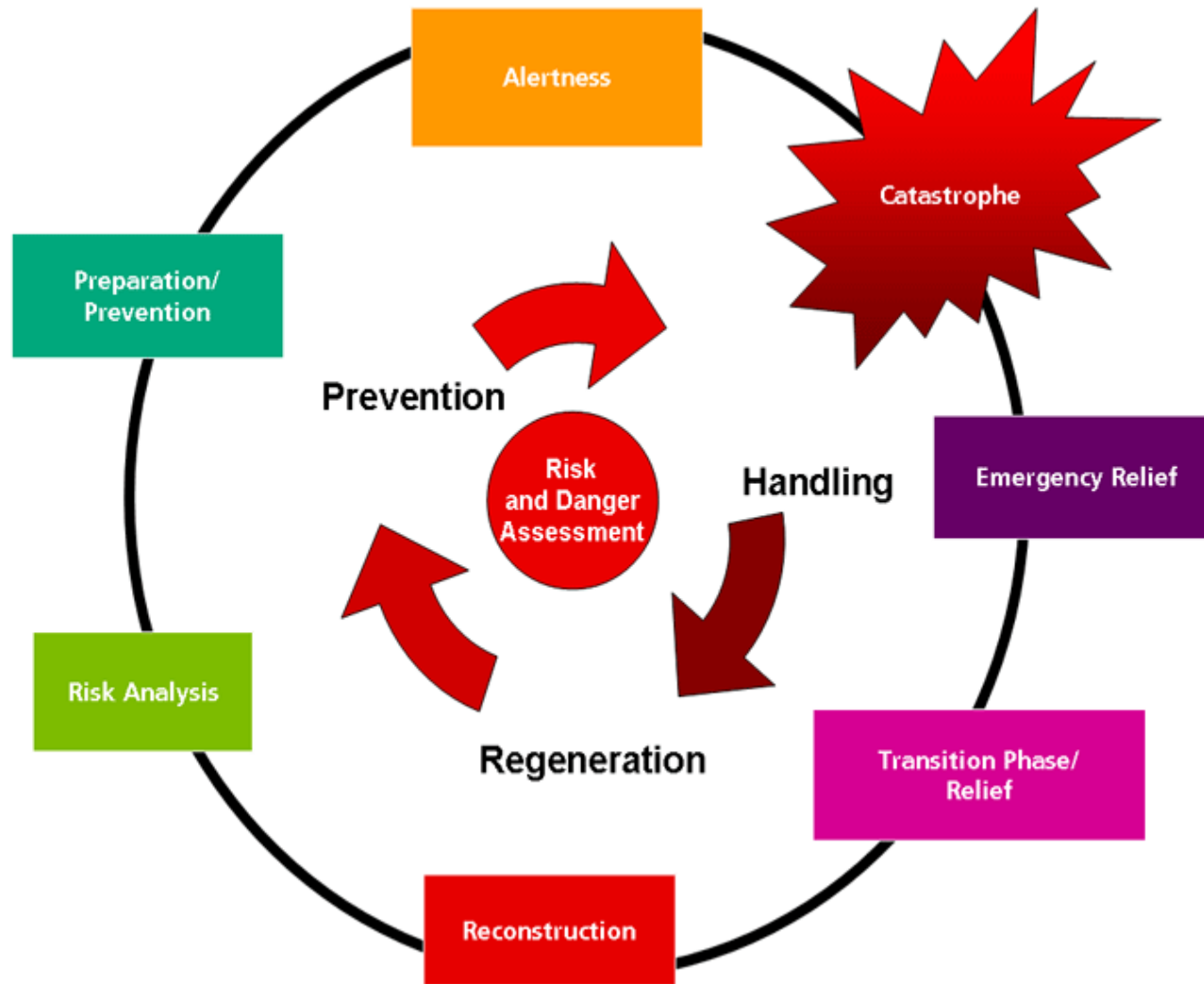
The benefits of Geospatial Information

(Figure 2): Benefit for critical infrastructure



Altan et al. 2013: The Value of Geoinformation for Disaster and Risk Management (VALID)

Robert Backhaus (2013): Value of geoinformation for disaster and risk management. <http://geospatialworld.net>



Source: <https://www.zki.dlr.de/image/937>

Some definitions regarding disaster mapping I

- **Rapid Mapping:** “consists of the [...] provision (*within hours or days*) of geospatial information in support of emergency management activities immediately following an emergency event. The products are standardized.”
- **Reference Maps:** shows the boundaries, names and unique identifiers of standard geographic areas, as well as major cultural and physical features, such as roads, railroads, coastlines, rivers and lakes, i.e. topography
- **Delineation Maps:** *extends of the area* affected by the disaster
- **Grading Maps:** assessment of the *damage grade* and its spatial distribution after the disaster

[1] <http://emergency.copernicus.eu/mapping/ems/service-overview>

[2] <http://www.statcan.gc.ca/pub/92-195-x/2011001/other-autre/map-carte/def-eng.htm>

Some definitions regarding disaster mapping II

- **Emergency Mapping:** creation of
 - maps,
 - geo-information products and
 - spatial analyses
- dedicated to providing situational awareness emergency management and immediate crisis information for response by means of extraction of reference (pre-event) and crisis (post-event) geographic information/data.

Emergency Mapping Guidelines drafted by the International Working Group on Satellite Emergency Mapping (IWG-SEM), cited after: <http://www.ithacaweb.org/projects/rapid-mapping/>

Some players

- Copernicus Emergency Management Service (EMS) Mapping (started February 2015)
<http://emergency.copernicus.eu/>
- International Charter 'Space and Major Disasters'
<https://www.disasterscharter.org/>
- Humanitarian OpenStreetMap Team (HOT) – VGI (!), updating the OpenStreetMap database.
<https://www.hotosm.org/>
- United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN SPIDER)
- ...

International Charter 'Space and Major Disasters'

- a consortium of space agencies and satellite data providers, founded 1999, aiming at providing a unified system of rapid space data acquisition and delivery in case of natural or man-made disasters.
- Each member agency of the Charter has committed resources to support **some specified authorised users** such as relief organisations as well as civil protection and defence organisations with free of charge satellite data in order to help mitigating the effects of disasters on human life and property.
- The Charter data [...] will be analysed by associated **Value Adders**, like the ZKI.
- The results are **provided to the Authorized Users, requesting authorities** and also to the public.
- 16 partners, providing data of approx. 30 satellite missions

UN-SPIDER



UNITED NATIONS
Office for Outer Space Affairs

English Español Français

UN-SPIDER KNOWLEDGE PORTAL

Space-based information for Disaster Management and Emergency Response

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International Working Group on Satellite based Emergency Mapping (IWG-SEM)



The International Working Group on Satellite-based Emergency Mapping (IWG-SEM) is a voluntary group of organizations involved in satellite based emergency mapping. It was founded in order to improve cooperation, communication and professional standards among the global network of satellite based emergency mapping providers. The chairperson of the group is nominated for a term of one year and is responsible for organizing the monthly telecons and bi-annual meetings. The current chair is from Paris-Lodron-University Salzburg Department of Geoinformatics Z_GIS / Spatial Services Ltd.

The group meets twice a year in person, at venues arranged by meeting participants. These meetings are forums for reviewing what has been accomplished to date and to define the steps forward. The regular monthly teleconferences are held to monitor progress on actions and for discussions on particular matters of interest to the group.

Contact

For any inquiries to the chair, please [contact peter.zeil@spatial-services.com](mailto:peter.zeil@spatial-services.com).

To send inquiries to the entire group, [please use the contact form](#).

IWG-SEM members

- ADPC
- AHA Center
- AIT
- AKDN-FOCUS
-  CNES
- CU-Boulder
-  DFO
-  DLR
-  EC-ECHO
-  EC-GROW
-  EC-JRC
-  ESA

Vision and Mission of IWG-SEM

During the first meeting in April 2012, the group defined its general direction through the following vision:

"Supporting disaster response by improving international cooperation in satellite based emergency mapping."

Its working program was defined by this mission statement:

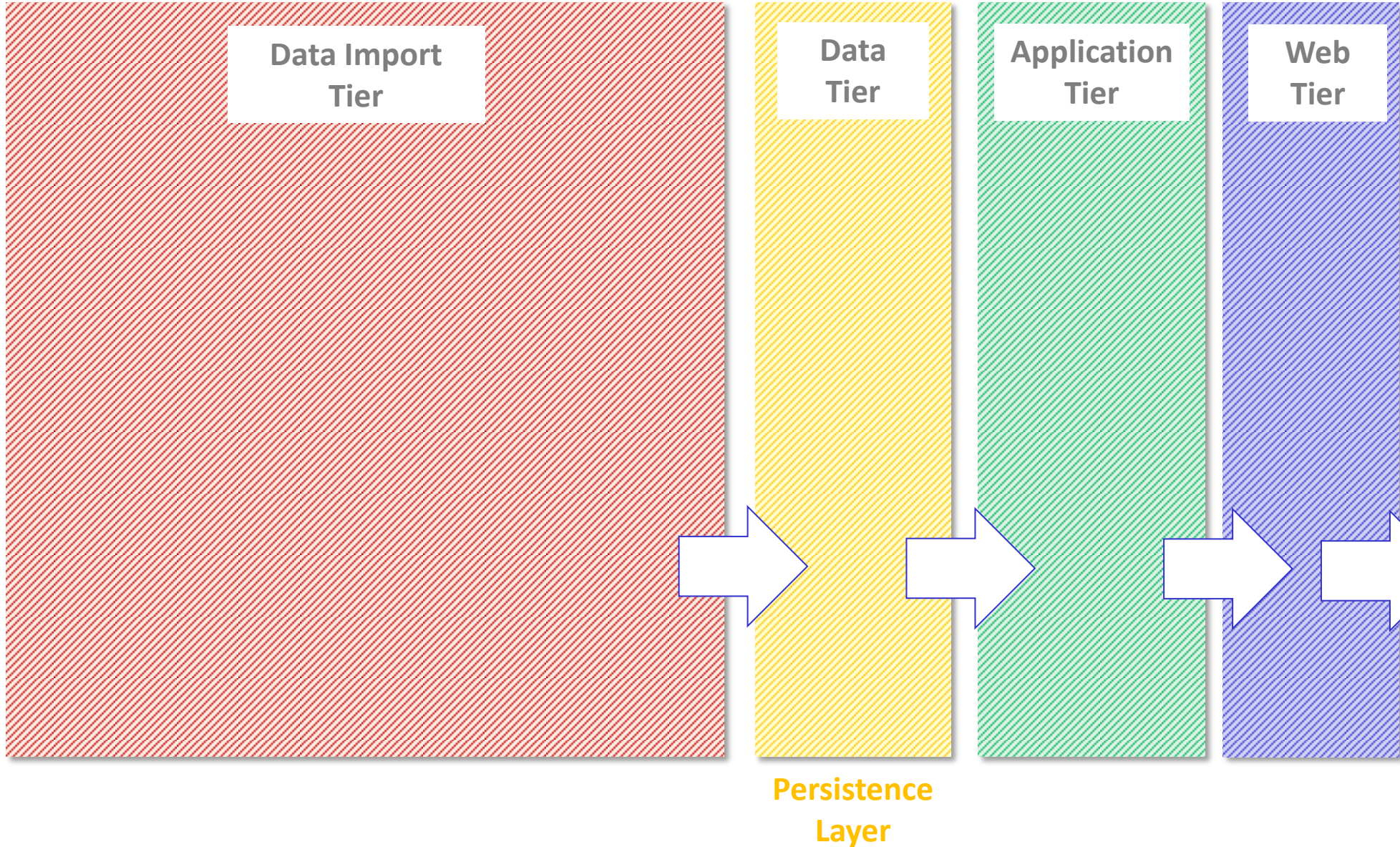
"Establish best practices between operational satellite-based emergency mapping programs, stimulate communication and collaboration, support the definition of emergency mapping guidelines, strengthen the sharing of expertise and capacities and review relevant technical standards as well as protocols. Work with the appropriate organizations to define professional standards for emergency mapping."

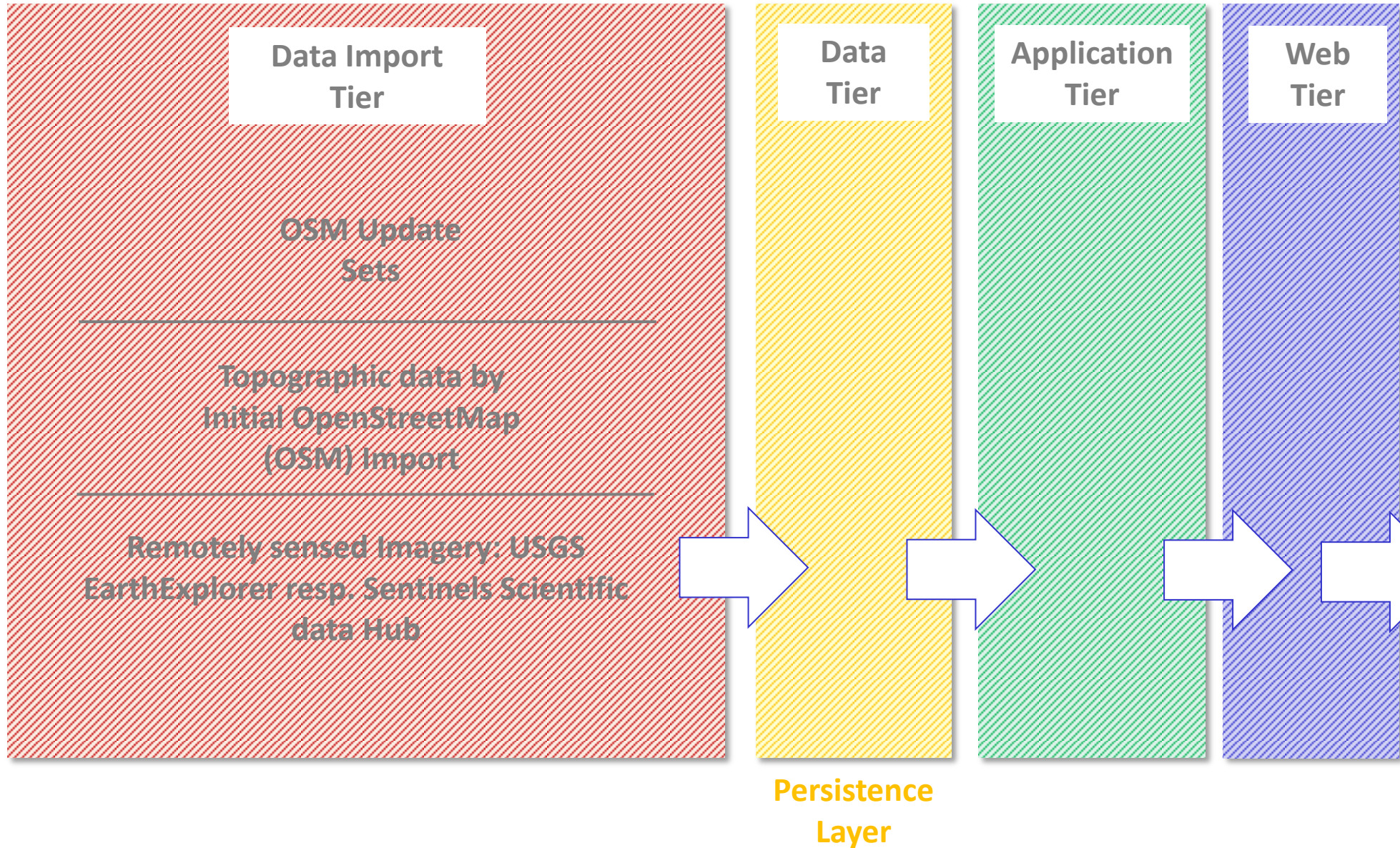
Our approach: „disasterGIS“

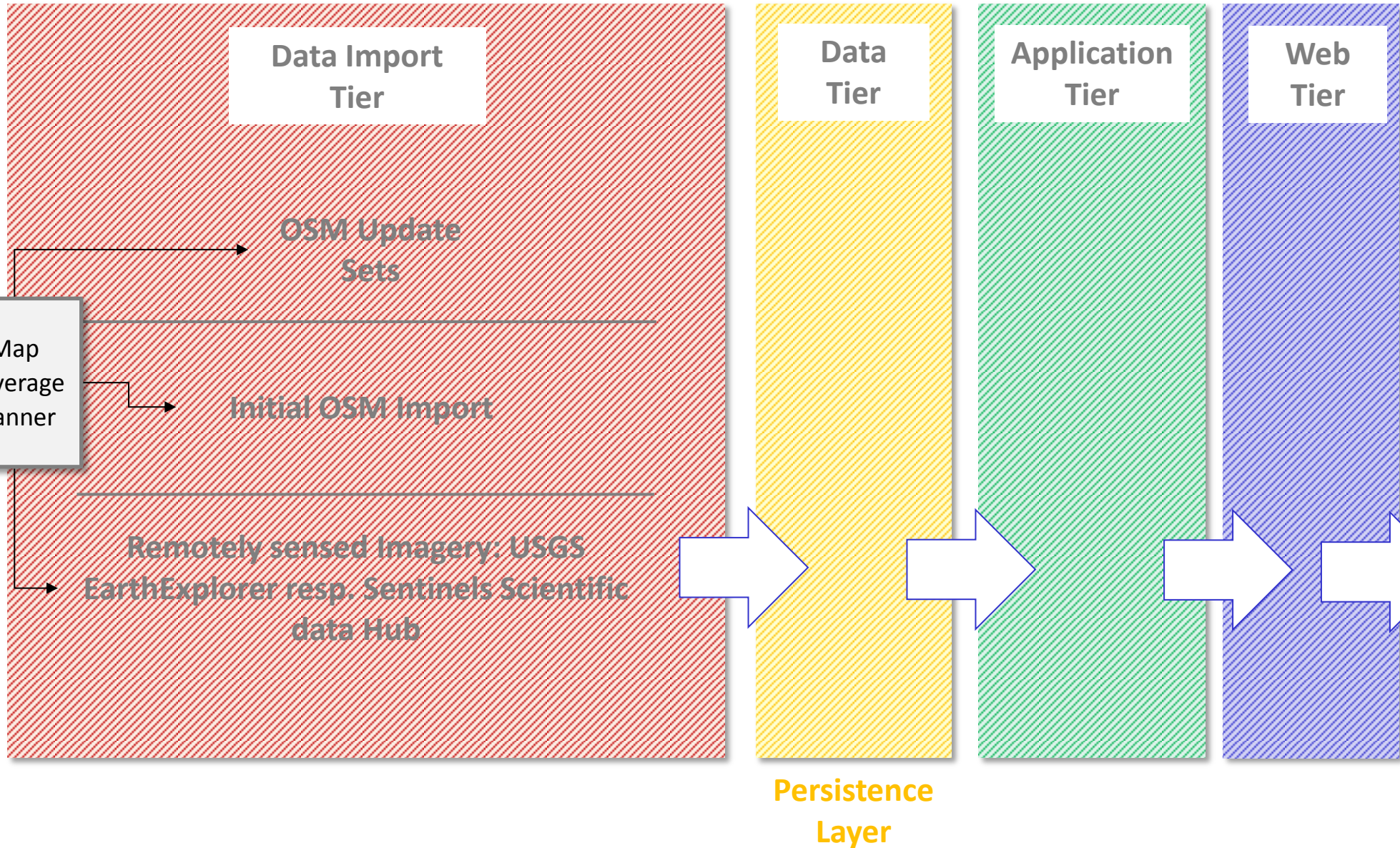


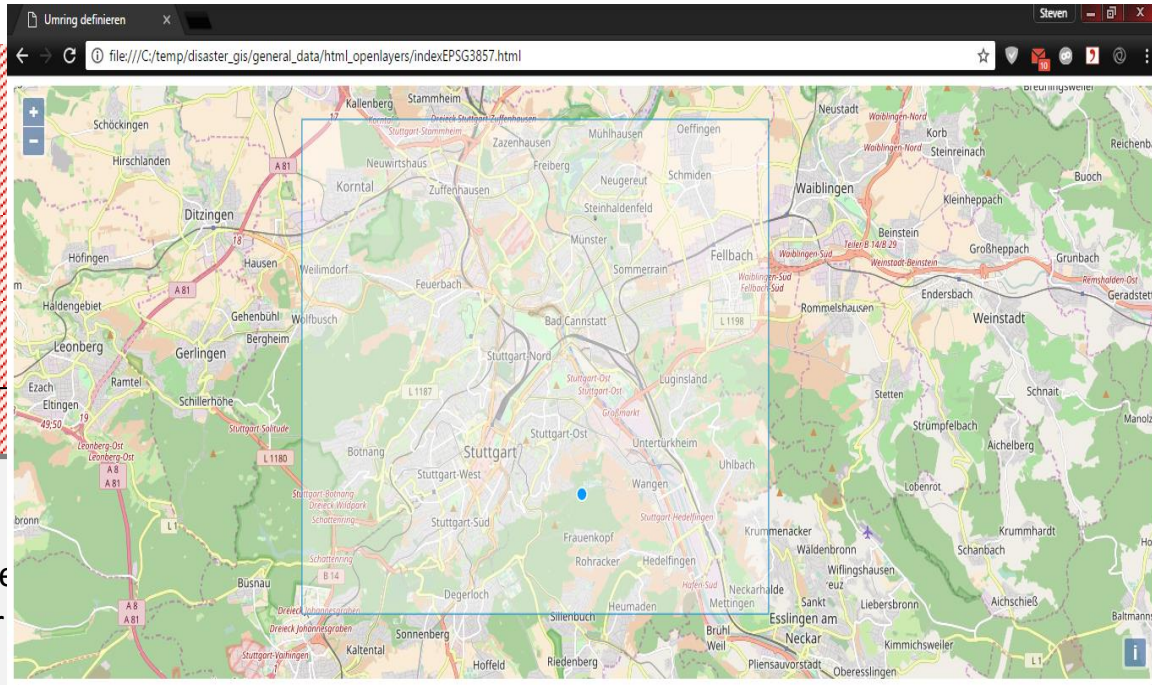
Delivers *rapidly* geodata products to support disaster management

Architecture









Map Coverage Planner

9.103576105729545,48.74556827525572,9.293090265885795,48.84553233756682

Letzten Umring kopieren und Fenster schließen

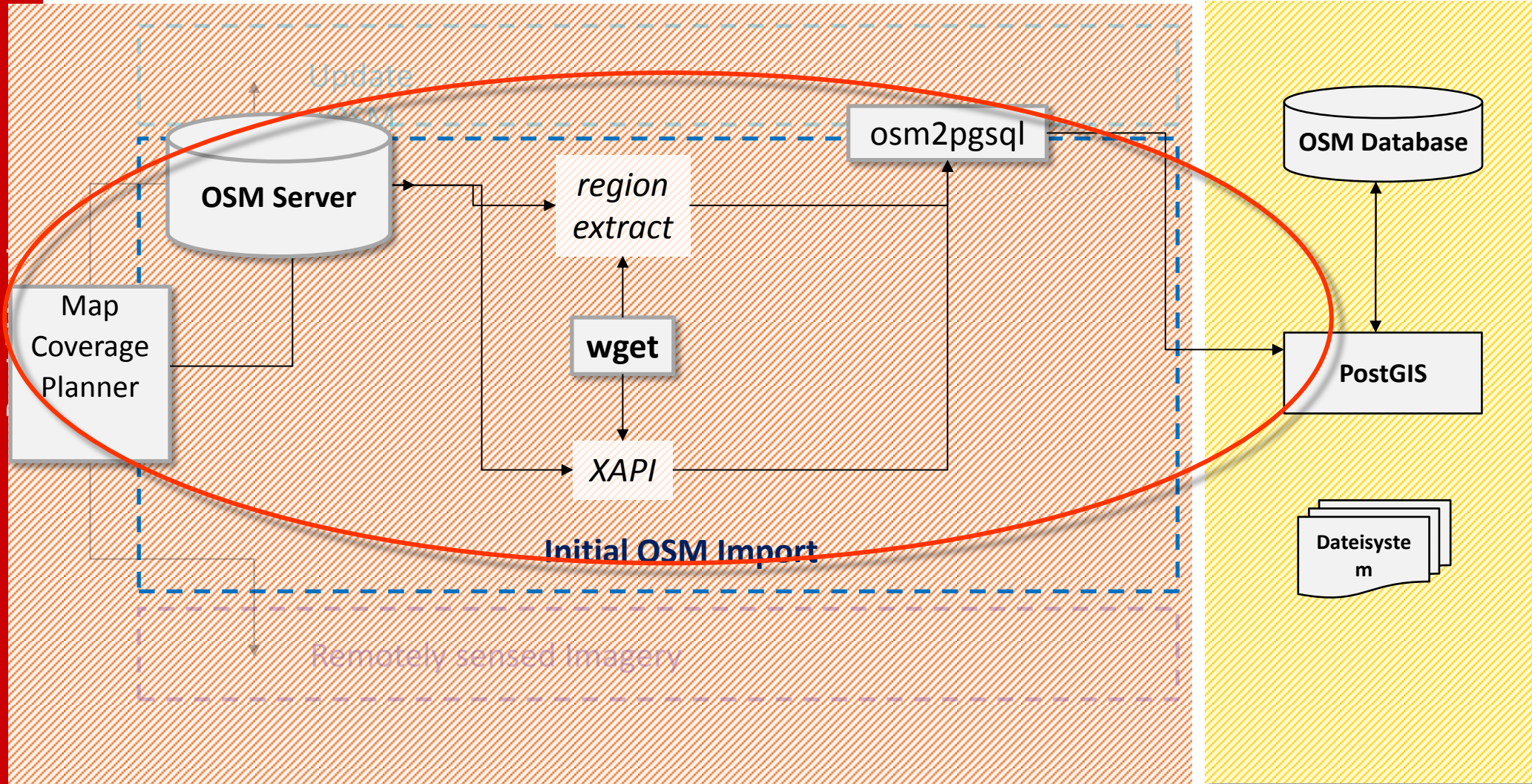
EarthExplorer resp. Sentinels Scientific data Hub



Application Tier

Web Tier

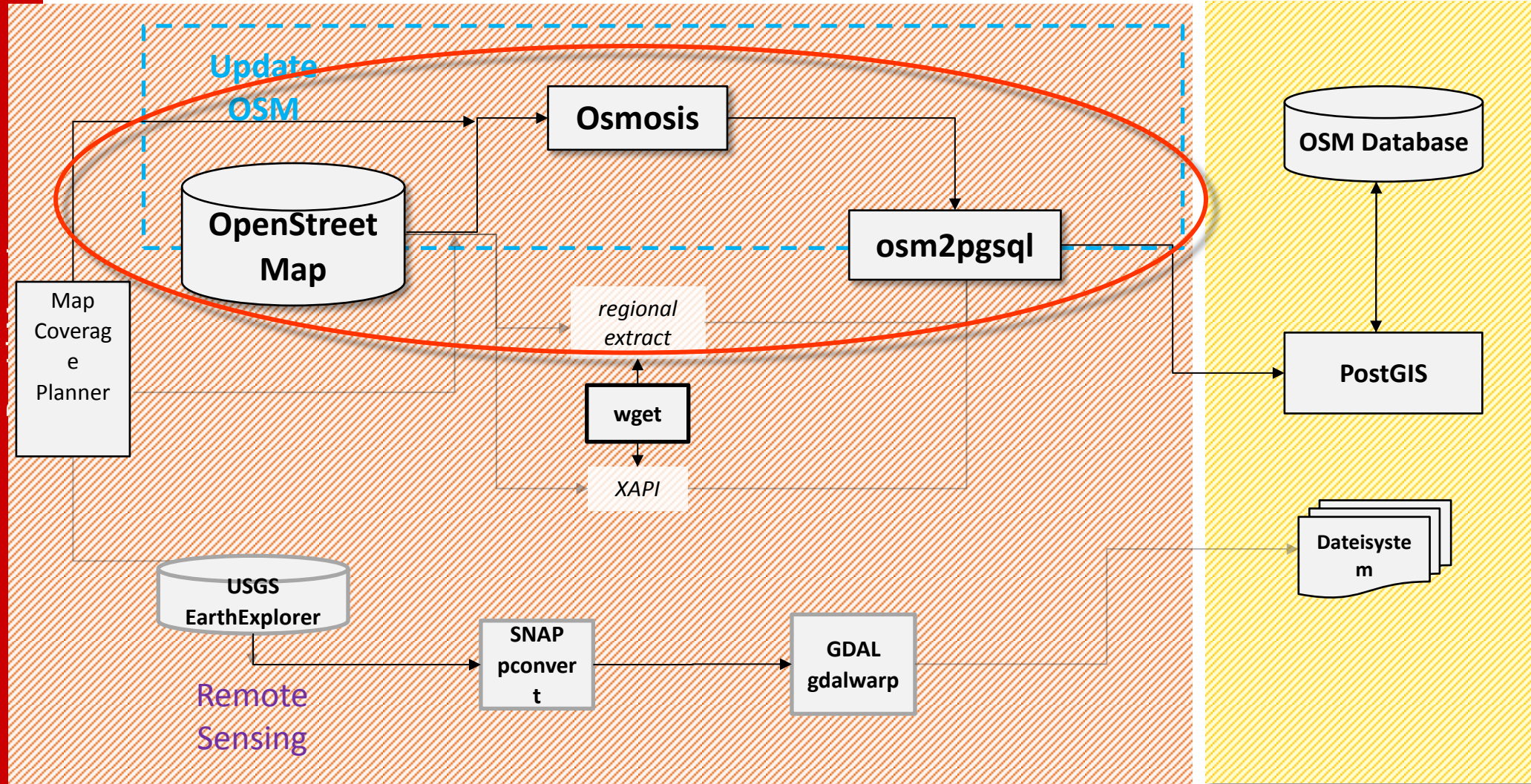
Persistence Layer



Data Import Tier

Data Tier

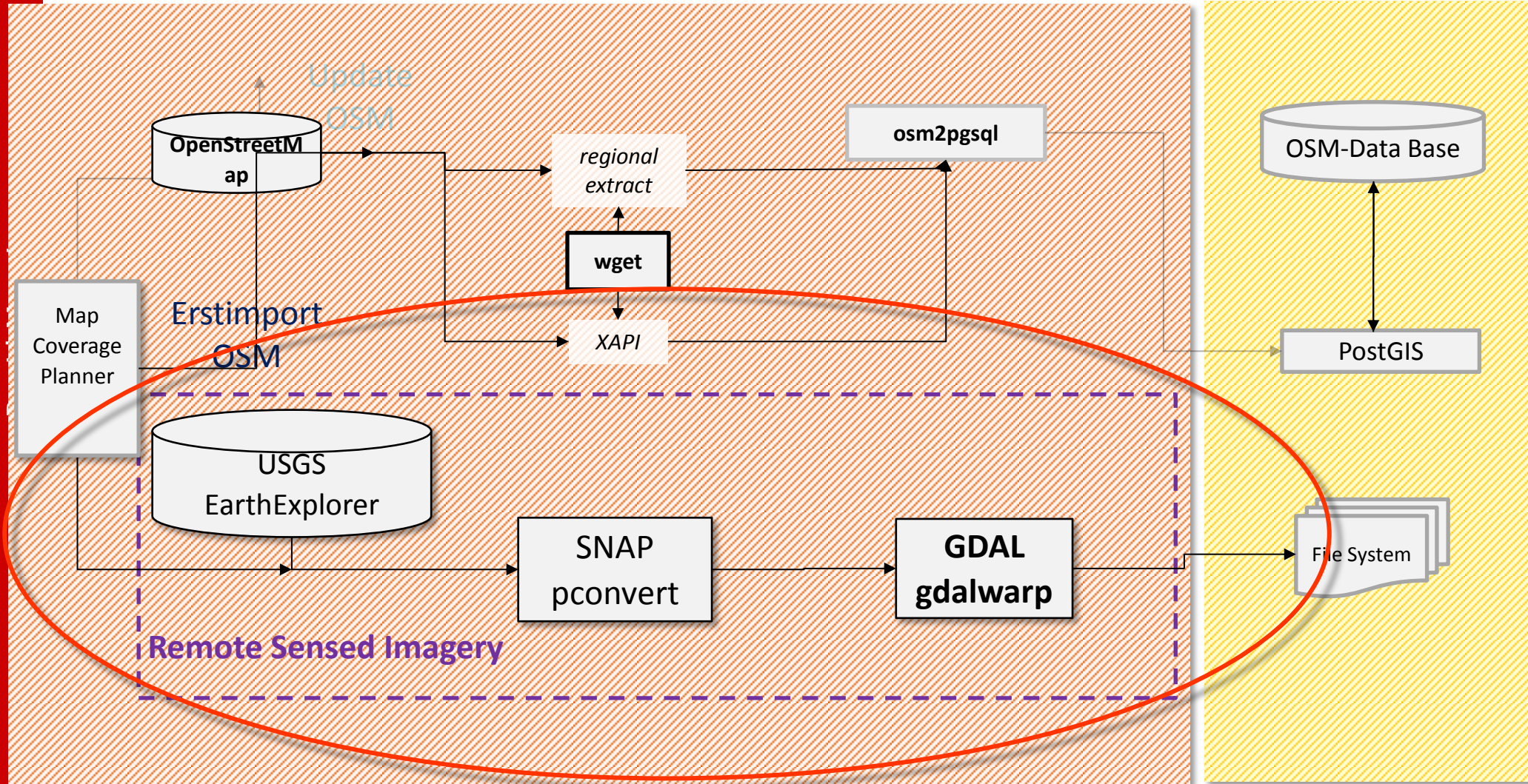
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Data Import Tier

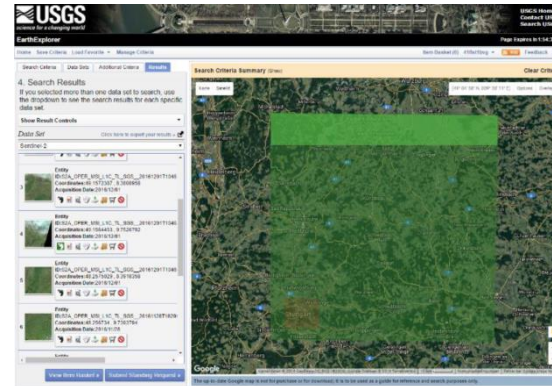
Data Tier

Our approach – „disasterGIS“

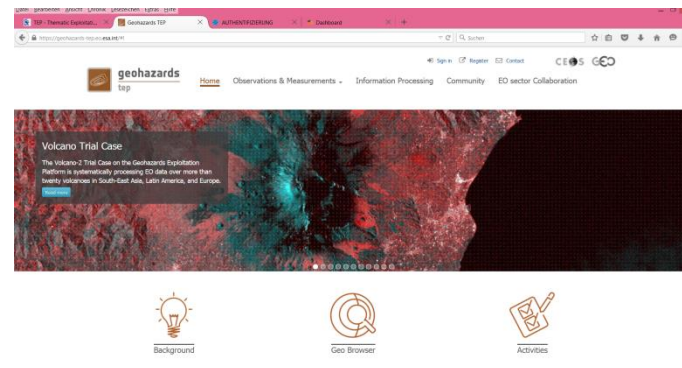
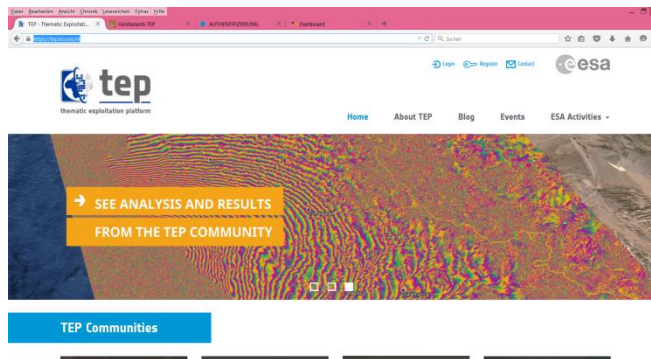


Open Data Sources for Remotely Sensed Imagery

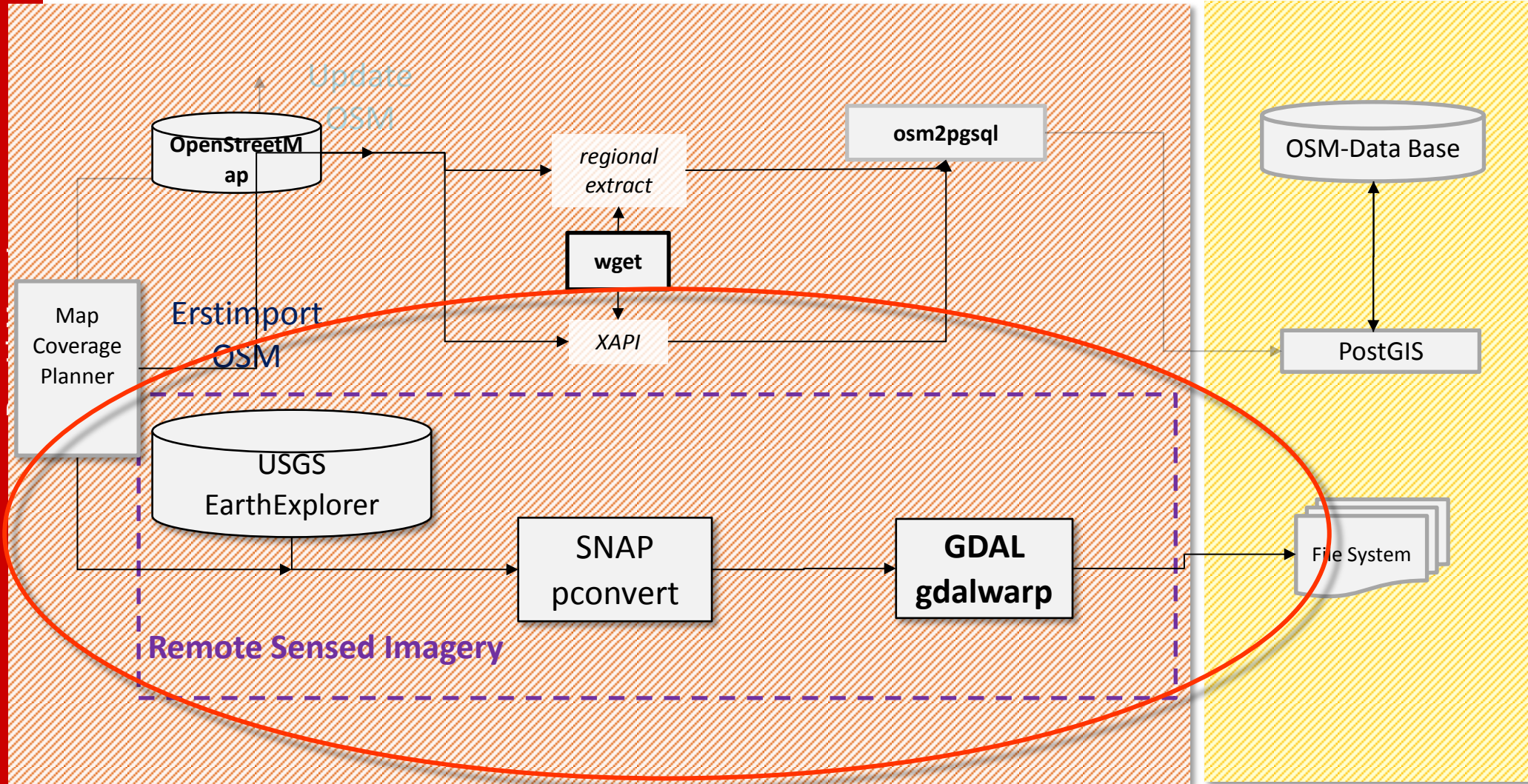
- USGS EarthExplorer, <https://earthexplorer.usgs.gov/>

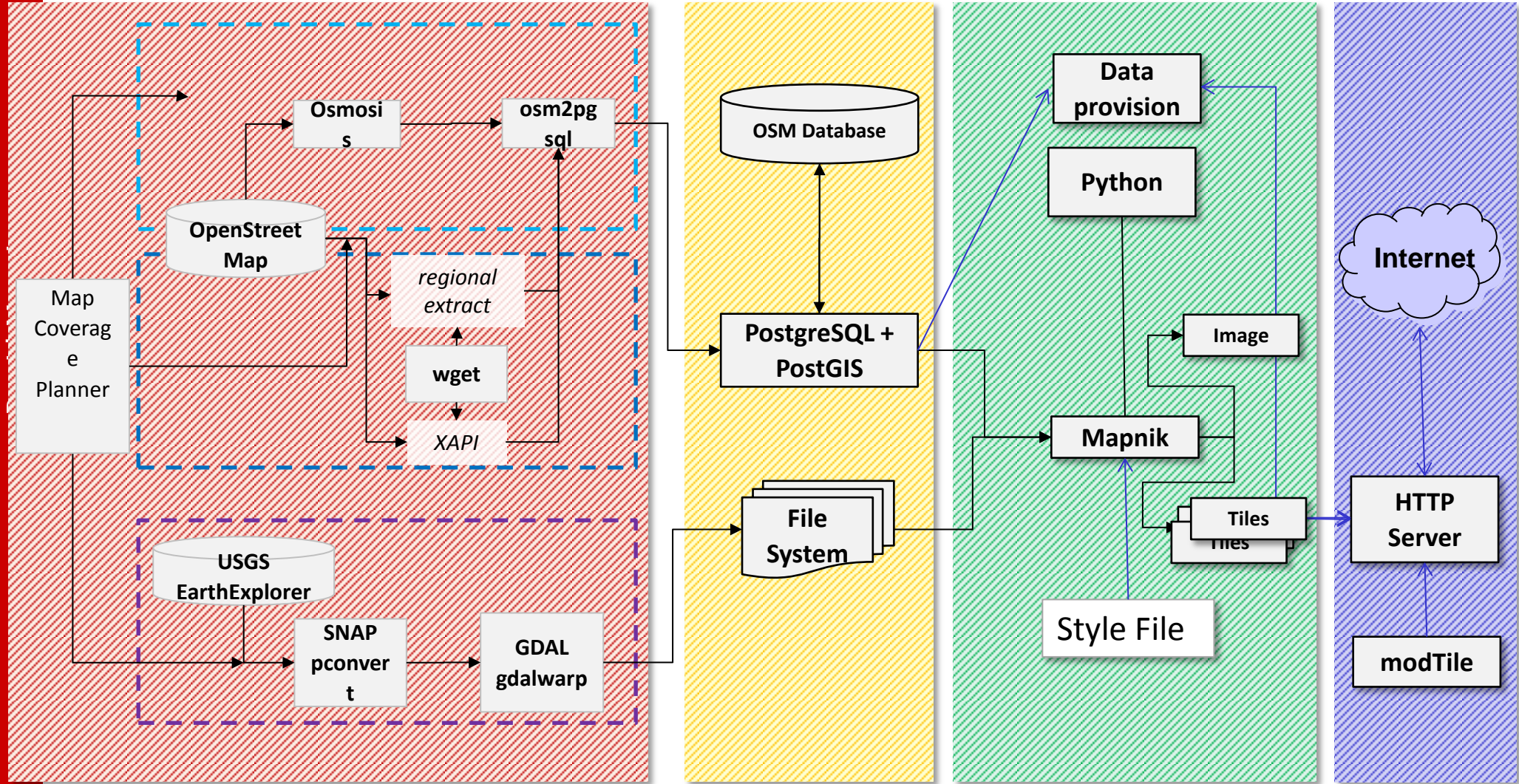


- ESA's Thematic Expolitation Platform, <https://tep.eo.esa.int/>
see Salvatore Pinto's talk, FOSS4G 2017



Our approach – „disasterGIS“





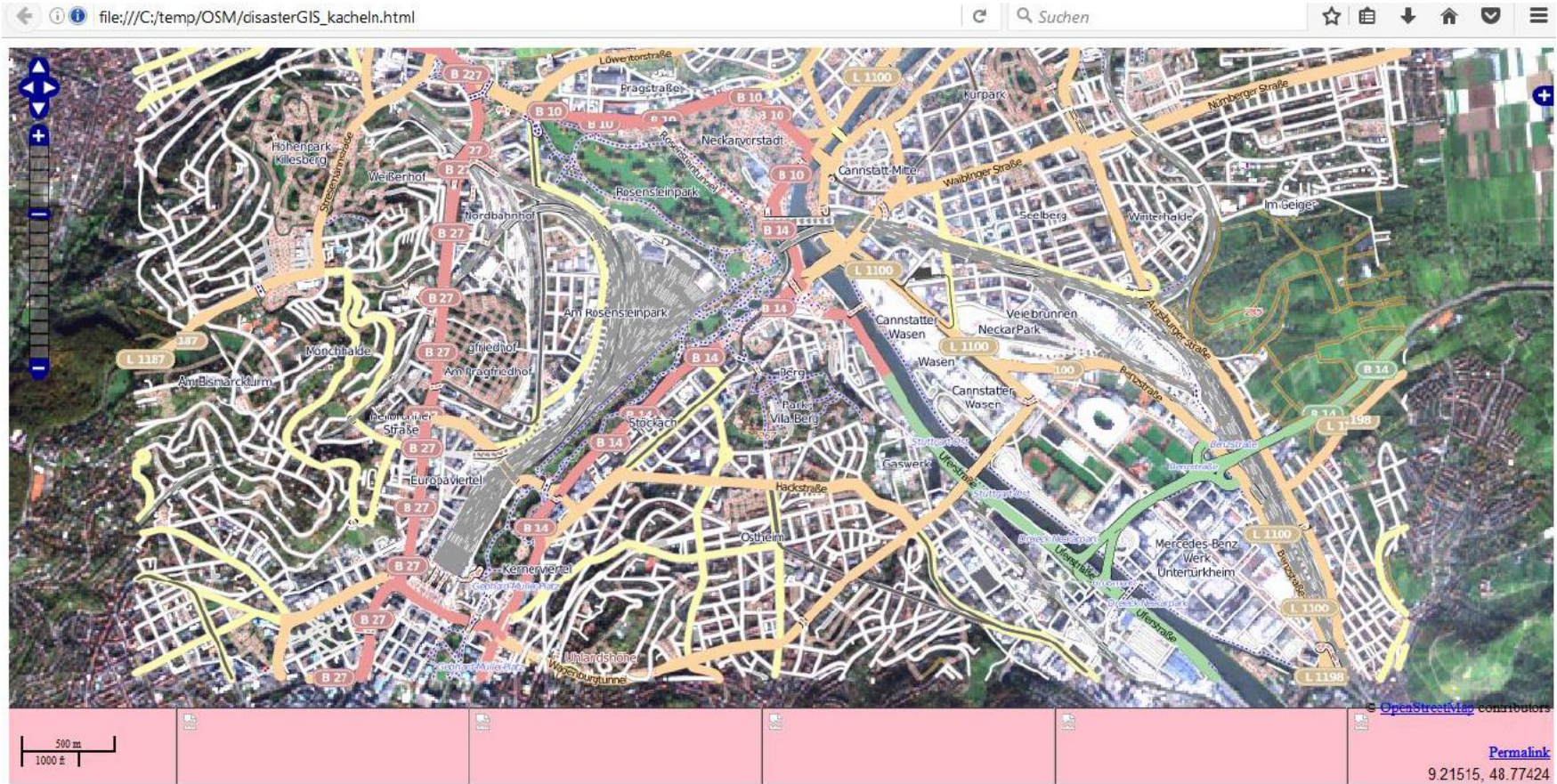
Data Import Tier

Data Tier

Application Tier

Web Tier

Output – Example of Stuttgart

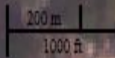


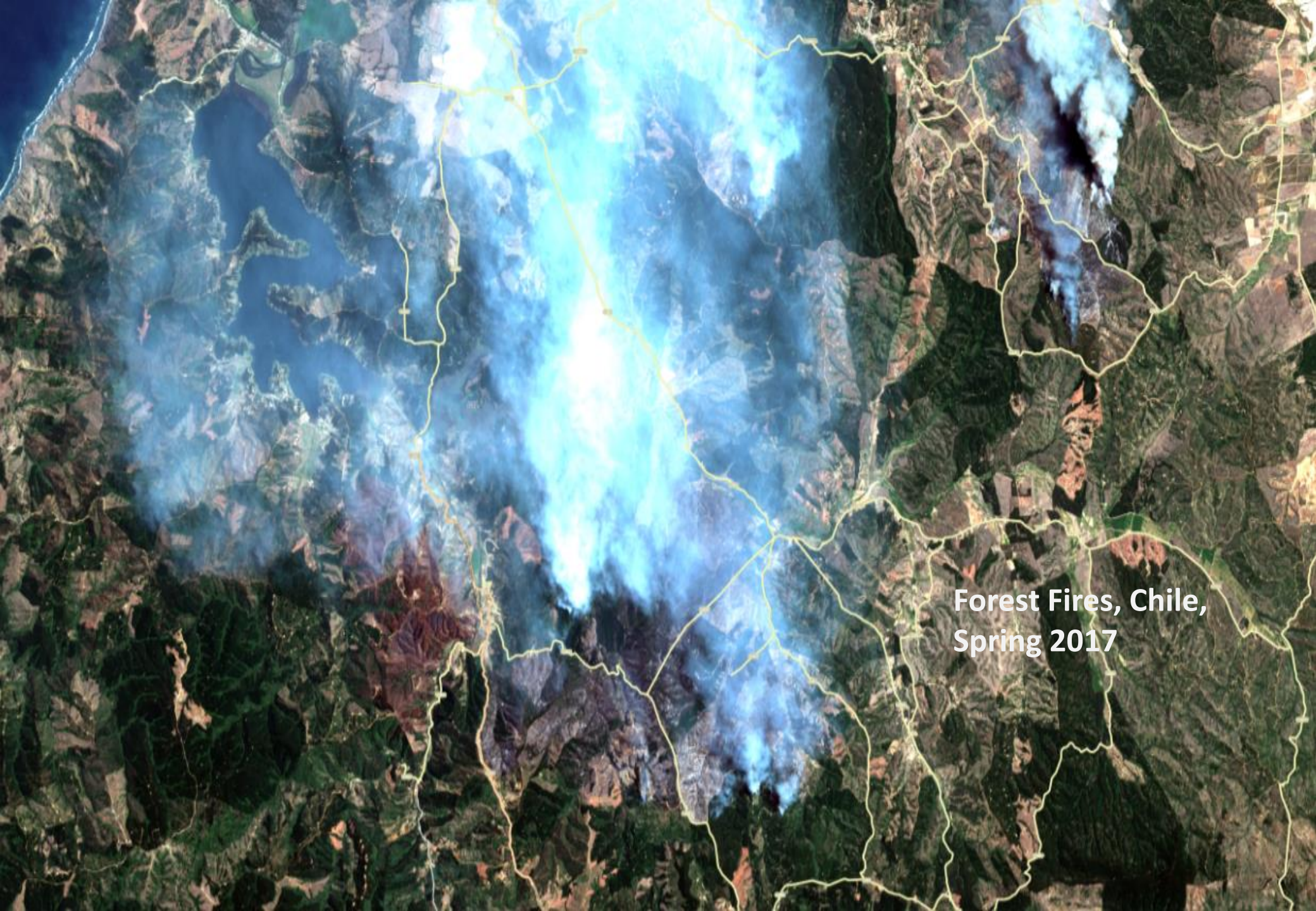


Flood event,
India



Flood event, after zoom in





**Forest Fires, Chile,
Spring 2017**



Forest Fires,
Peru, after
zoom in

Summary

- Open Source, open data
- Quite complex architecture, but yet **easy to deploy**/to install, also for developing countries, small public agencies and NGOs
 - “Domestic actors have the primary role” [1]– the approach enables local actors to collect and provide geospatial information
- Automated, **rapid workflow**:
 - 7 minutes
 - +
 - download time for vector and raster data (depending on area extent and network connectivity)
- **Reference Map** created – including vector data as well as remotely sensed imagery
- However:
 - limited spatial resolution and accuracy (approx. 10m)
 - Satellite imagery can be cloud-covered

[1] International Federation of Red Cross and Red Crescent Societies (2011): IDRL Guidelines Guidelines for the domestic facilitation and regulation of international disaster relief and initial recovery assistance