A PROACTIVE SYSTEM FOR OIL SPILLS AND MARINE ENVIRONMENT MONITORING

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Signals and Images Lab
Institute of Information Science and Technologies
ISTI – CNR

Rationale and Objectives

The purpose has been to study and setup a **Marine Information System (MIS)** able to detect **small** oil spills in the context of EU FP7 project Argomarine

- Good amount of systems for detection of large oil spills
- Small oil spills are harder to recognize and can be very harmful in areas of great environmental value

Requirements ⟶ Objectives:

- Collect both raw and processed heterogeneous data ⟶ Definition of a common exchange (meta-)data format
- Store and manage data in a single structure ⟶ Definition of a model capable of transferring and managing these data
- Integration of heterogeneous data ⟶ Definition of a suite of algorithms for data correlation
- Improve the management of oil spill intervention ⟶ Definition of proactive system

Analysis: what kind of data?

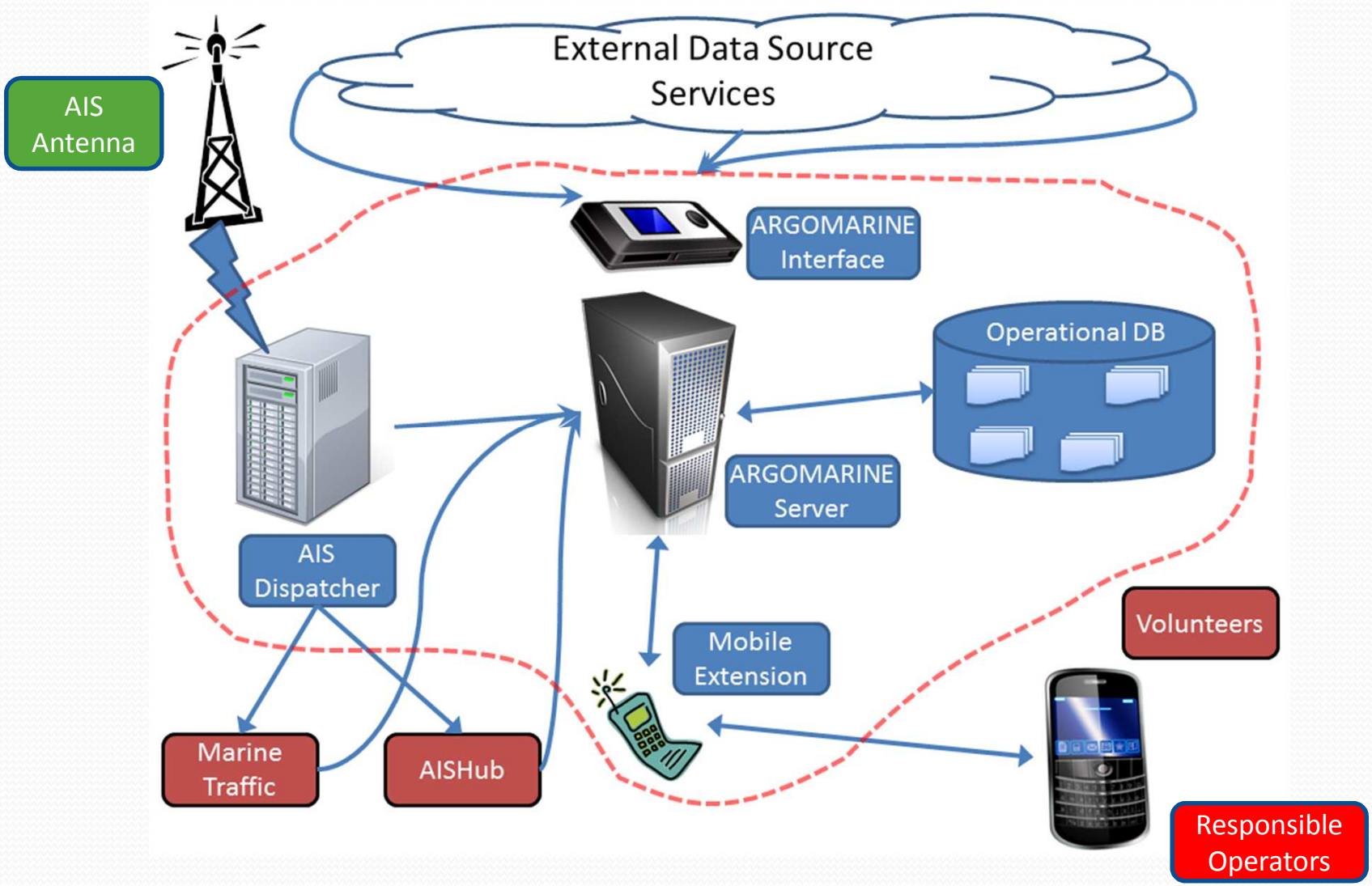
Babel of data:

- AIS data from several sources
- Satellite SAR images & processed oil-spill products
- Airborne hyperspectral data & processed oil-spill products
- Vessel detection from SAR images
- Outputs of oil-spill simulation models
- Drifting buoys data
- Real-time data from AUV + floating buoys (including eNose)
- Hydrophone vessel detection
- Oceanographic static buoys
- Volunteer alert through mobile phones

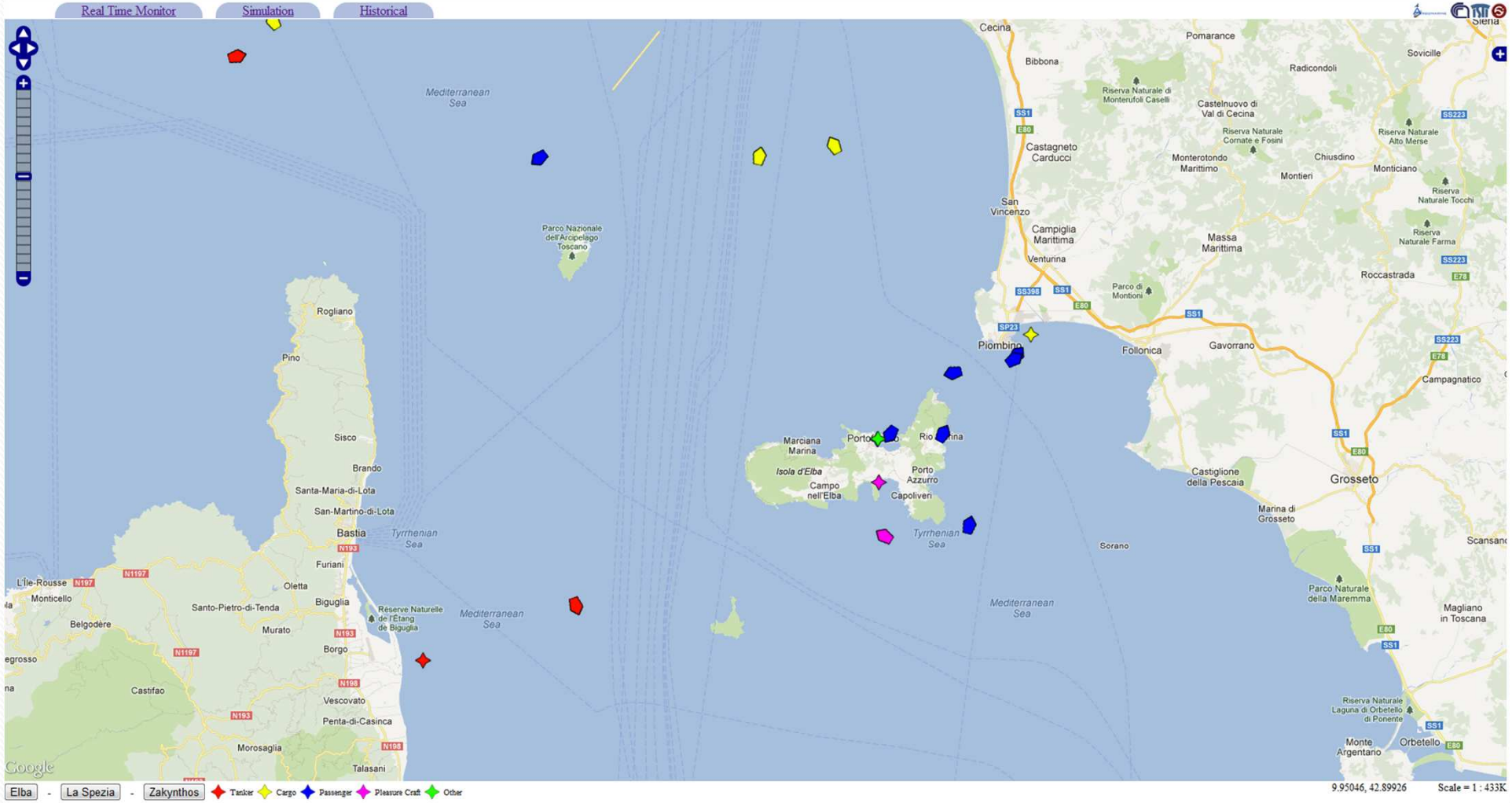
Services: what does it provide?

- **ICS** (Integrated Communication System) for data exchange
- **Data storage service**, through a spatial enabled database, capable of managing heterogeneous georeferenced data
- **WMS** for geodata distribution
- **Web-GIS Interface** for data representation
  - **Real Time** monitoring (different update times depending on source)
  - **Historical** data monitor (with archive data/products accesible)
- Real-time **Dynamic Risk maps (GeoMatrix)** of two study areas (PNAT & NMPZ)
- **Decision Support System (DSS)**
  - Automatic reasoning on the basis of the GeoMatrix status
  - Dispatching alerts to Operators
- Remote control of the **AUV missions**
- **Smartphone App** to allow volunteers to report oil spills

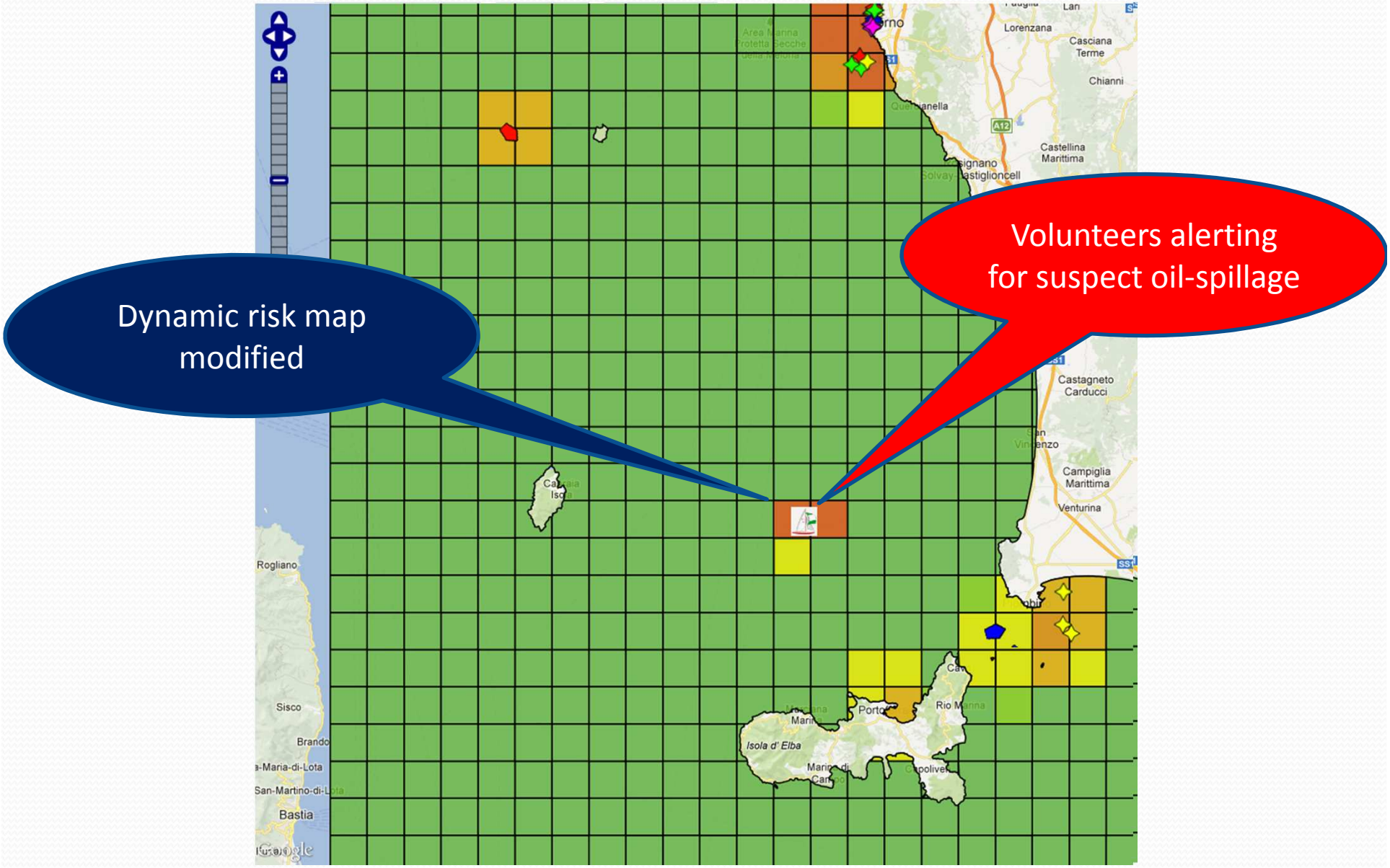
Hardware configuration: the data flow



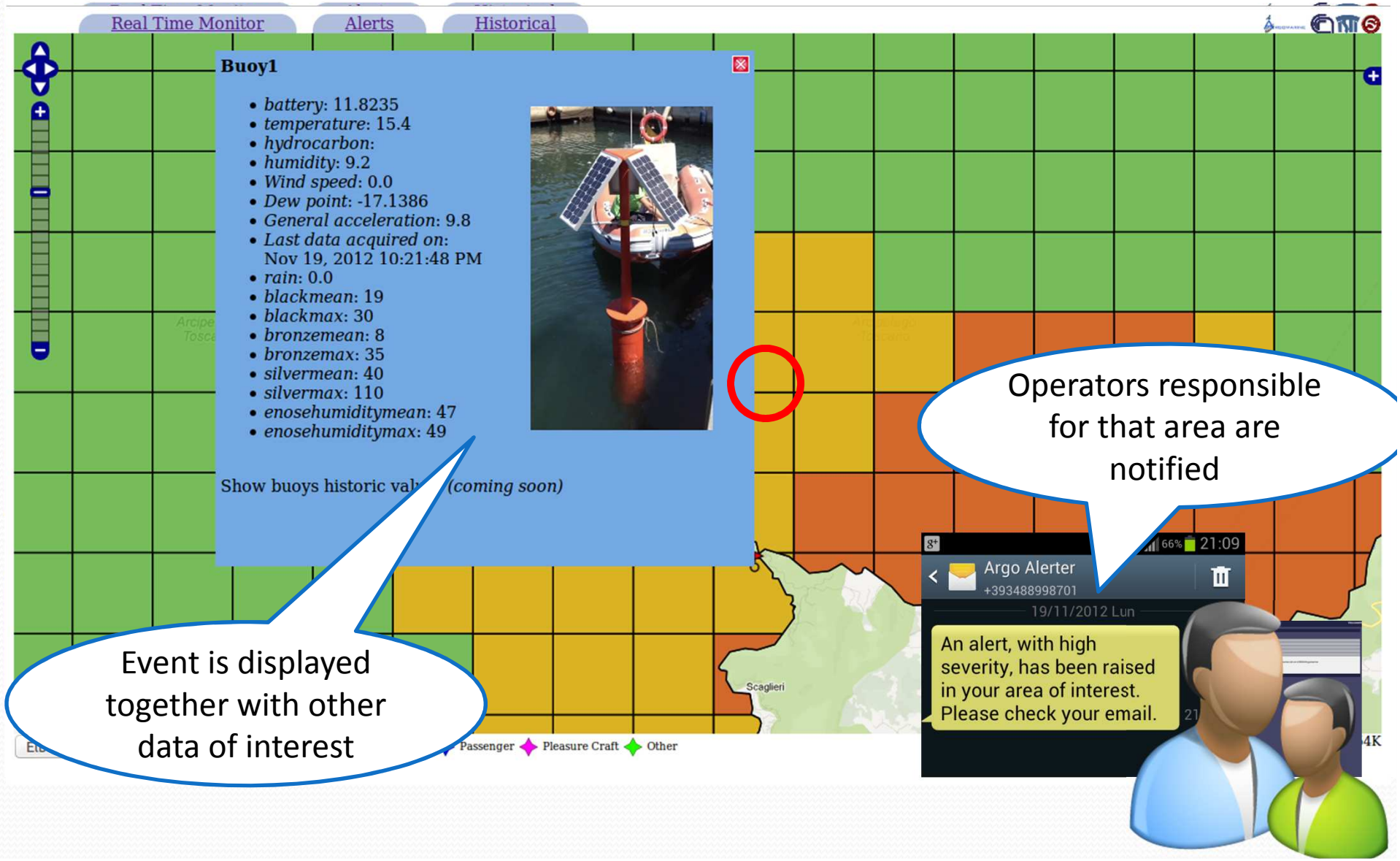
Visualization: how does it look?



Application case 1: DSS modifying Geomatrix



Application case 2: DSS - Argo Alert Services



Field Test Campaigns

MIS has been used and stress-tested under real-time conditions, during three test campaigns in EU FP7 project Argomarine:

- Zakynthos (December 2011)
- Capo Enfola - Elba (May-June 2012)
- Capo Enfola - Elba (November 2012)

Future steps for MIS

RITMARE (Italian Research for Marine sector)
2012-2016

SP7 - Interpoperable Infrastructure for RITMARE

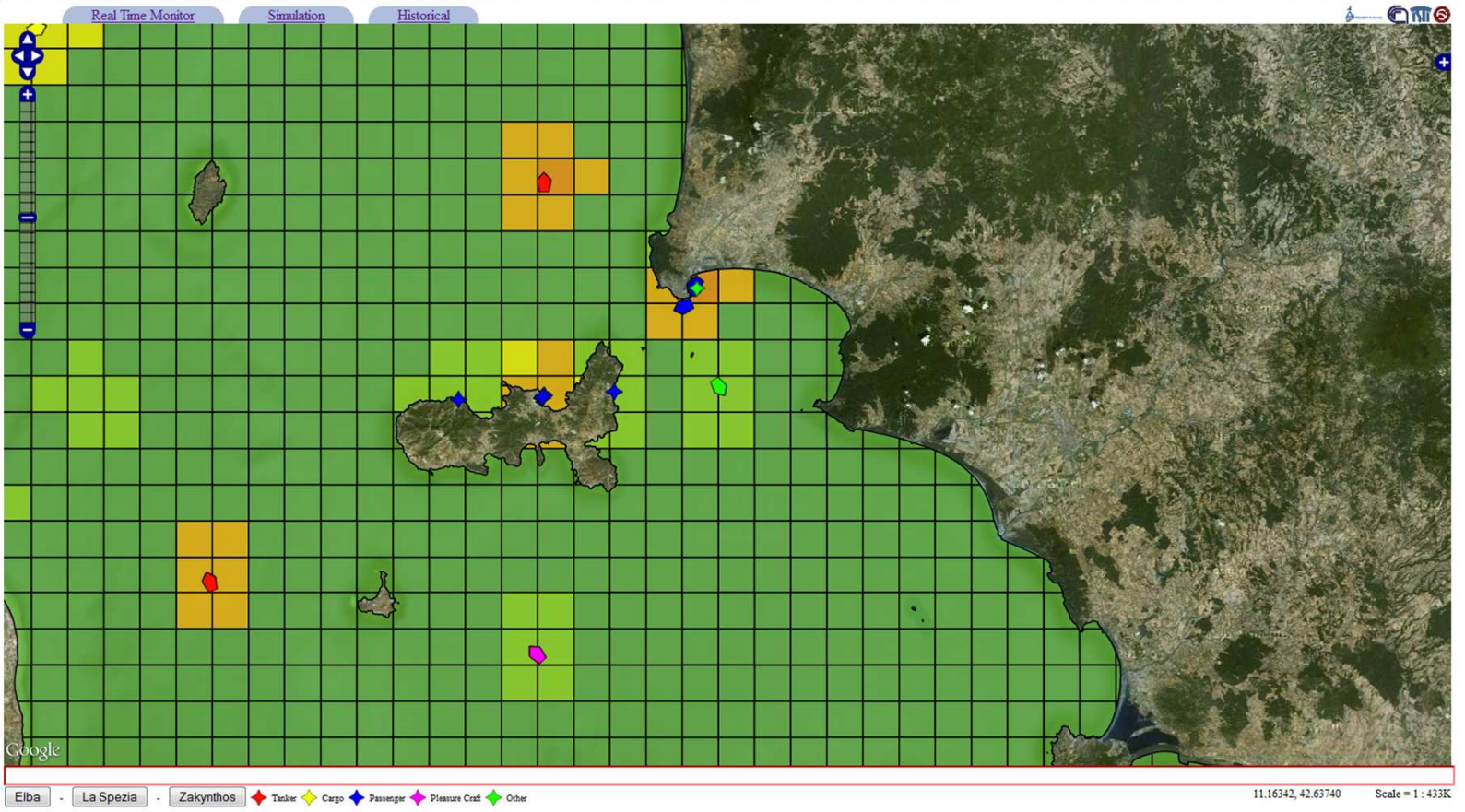
- **State of the Art** of existing marine infrastructures has been analyzed, in Italian and International context (january-june 2013), and Infrastructure requirements collected from Ritmare partners
  - **60 studied infrastructure solutions** in & out Ritmare consortium (including MIS)
  - **147 requirement** instance documents collected
- **PostGIS-Geoserver-Openlayers based-framework** has been discussed as candidate solution for Ritmare prototype data management infrastructure (Ritmare SP7) – MIS, CIGNO
- SDI **Prototype implementation** is now **in progress** according to specifications coming out from SoA and requirements analysis

Thank You

Real Time Monitor

Available layers:

- Base Layer
  - Google Streets
  - Google Physical
  - Google Hybrid
  - Google Satellite
  - Mapnik
  - CycleMap
- Overlays
  - Elba Risk Map
  - Zakhyntos Risk Map
  - Last Hyperspectral report
  - Spectral Radiometer Data
  - Last SAR Image
  - Last SAR oil-spill report
  - Last SUMO report
  - Buoy data
  - AIS data
  - AIS data from MarineTraffic
  - AIS data from NURC
  - AIS data detected (CNR-antenna)
  - AUV track
  - AUV vehicles
  - Hydrophones track
  - Hydrophone vehicles
  - Volunteers
  - Park Areas
  - Drifting Buoys
  - Static Oceanographic Data

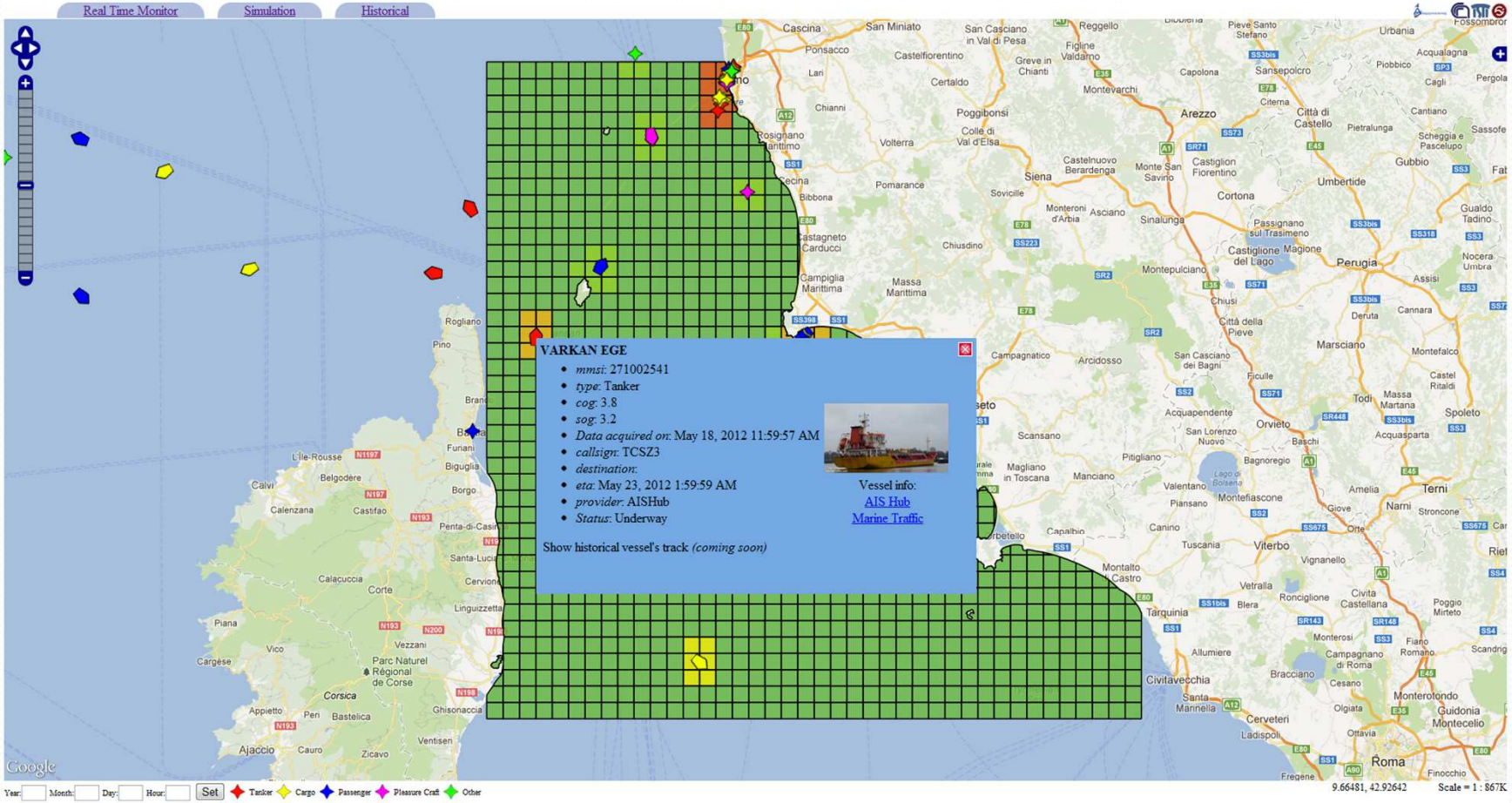


Dynamic risk map

Historical data monitor

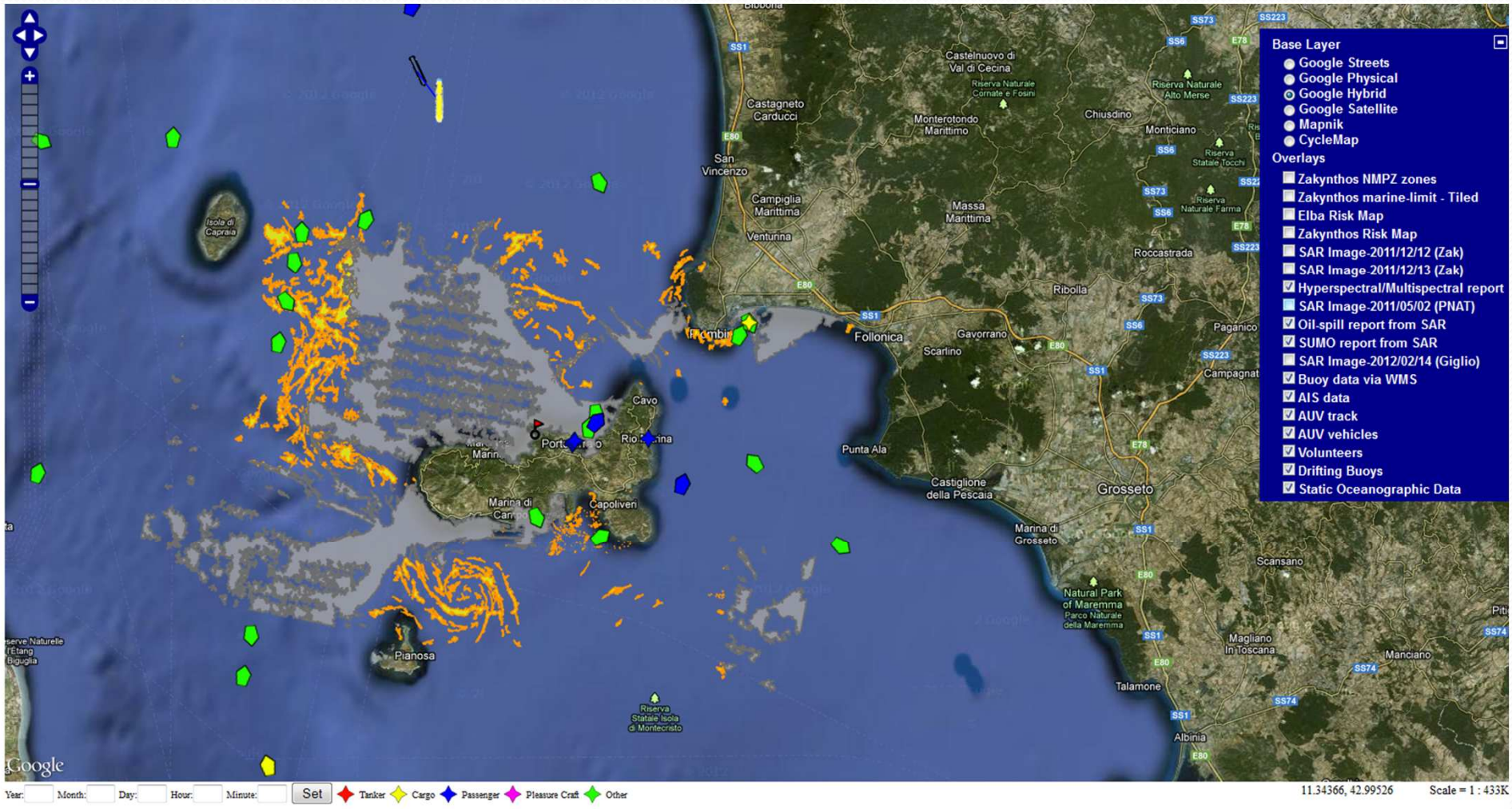
Example of visualization of data on: 2012/05/18 at 12:oo

All layers with consistent data at that time are shown

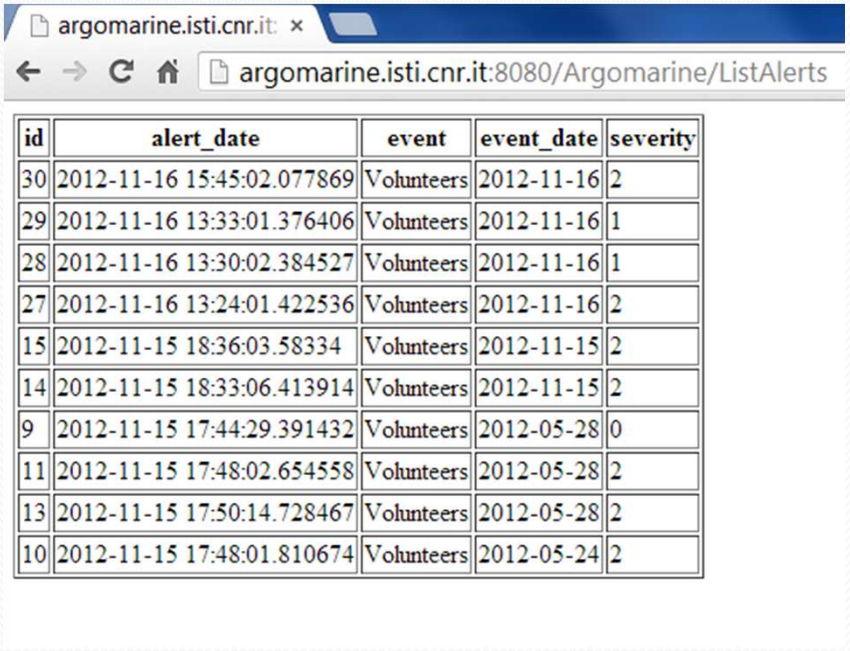


Babel of informative layers

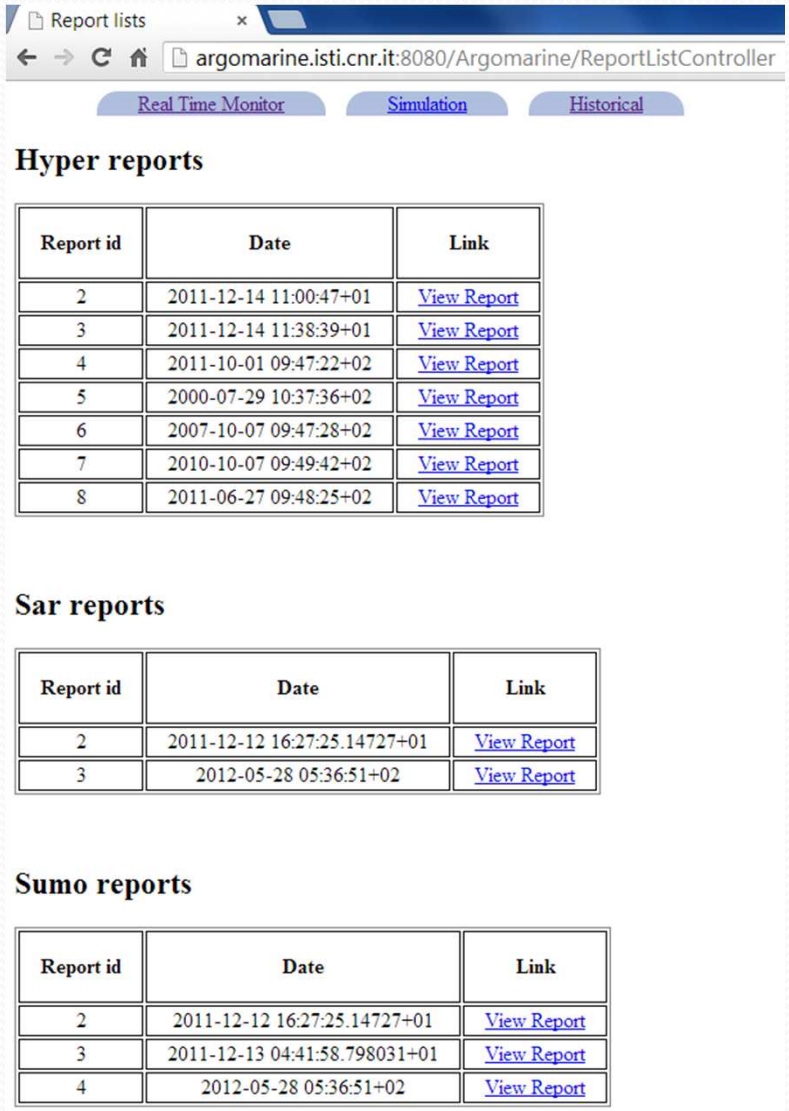
In this sample from a specific time: hyperspectral report, SAR report, Vessel detection report, floating buoy, AIS, AUV, volunteers, drifting buoys, oceanographic buoy



Alerts table and Reports list



id	alert_date	event	event_date	severity
30	2012-11-16 15:45:02.077869	Volunteers	2012-11-16	2
29	2012-11-16 13:33:01.376406	Volunteers	2012-11-16	1
28	2012-11-16 13:30:02.384527	Volunteers	2012-11-16	1
27	2012-11-16 13:24:01.422536	Volunteers	2012-11-16	2
15	2012-11-15 18:36:03.58334	Volunteers	2012-11-15	2
14	2012-11-15 18:33:06.413914	Volunteers	2012-11-15	2
9	2012-11-15 17:44:29.391432	Volunteers	2012-05-28	0
11	2012-11-15 17:48:02.654558	Volunteers	2012-05-28	2
13	2012-11-15 17:50:14.728467	Volunteers	2012-05-28	2
10	2012-11-15 17:48:01.810674	Volunteers	2012-05-24	2



Hyper reports

Report id	Date	Link
2	2011-12-14 11:00:47+01	View Report
3	2011-12-14 11:38:39+01	View Report
4	2011-10-01 09:47:22+02	View Report
5	2000-07-29 10:37:36+02	View Report
6	2007-10-07 09:47:28+02	View Report
7	2010-10-07 09:49:42+02	View Report
8	2011-06-27 09:48:25+02	View Report

Sar reports

Report id	Date	Link
2	2011-12-12 16:27:25.14727+01	View Report
3	2012-05-28 05:36:51+02	View Report

Sumo reports

Report id	Date	Link
2	2011-12-12 16:27:25.14727+01	View Report
3	2011-12-13 04:41:58.798031+01	View Report
4	2012-05-28 05:36:51+02	View Report

AIS station antenna set-up