



A PROACTIVE SYSTEM FOR OIL SPILLS AND MARINE ENVIRONMENT MONITORING

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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?

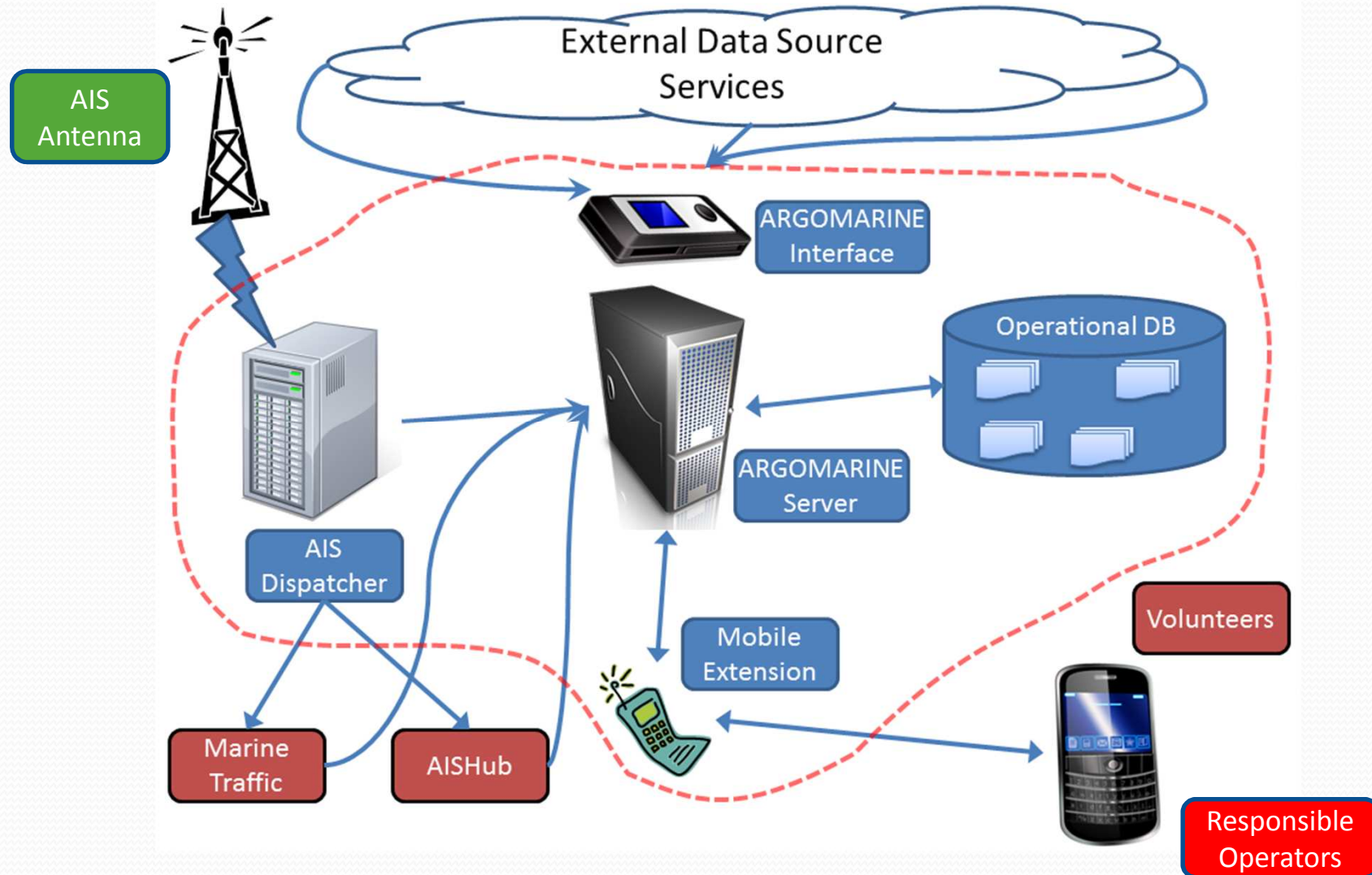
Babel of data:

- 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

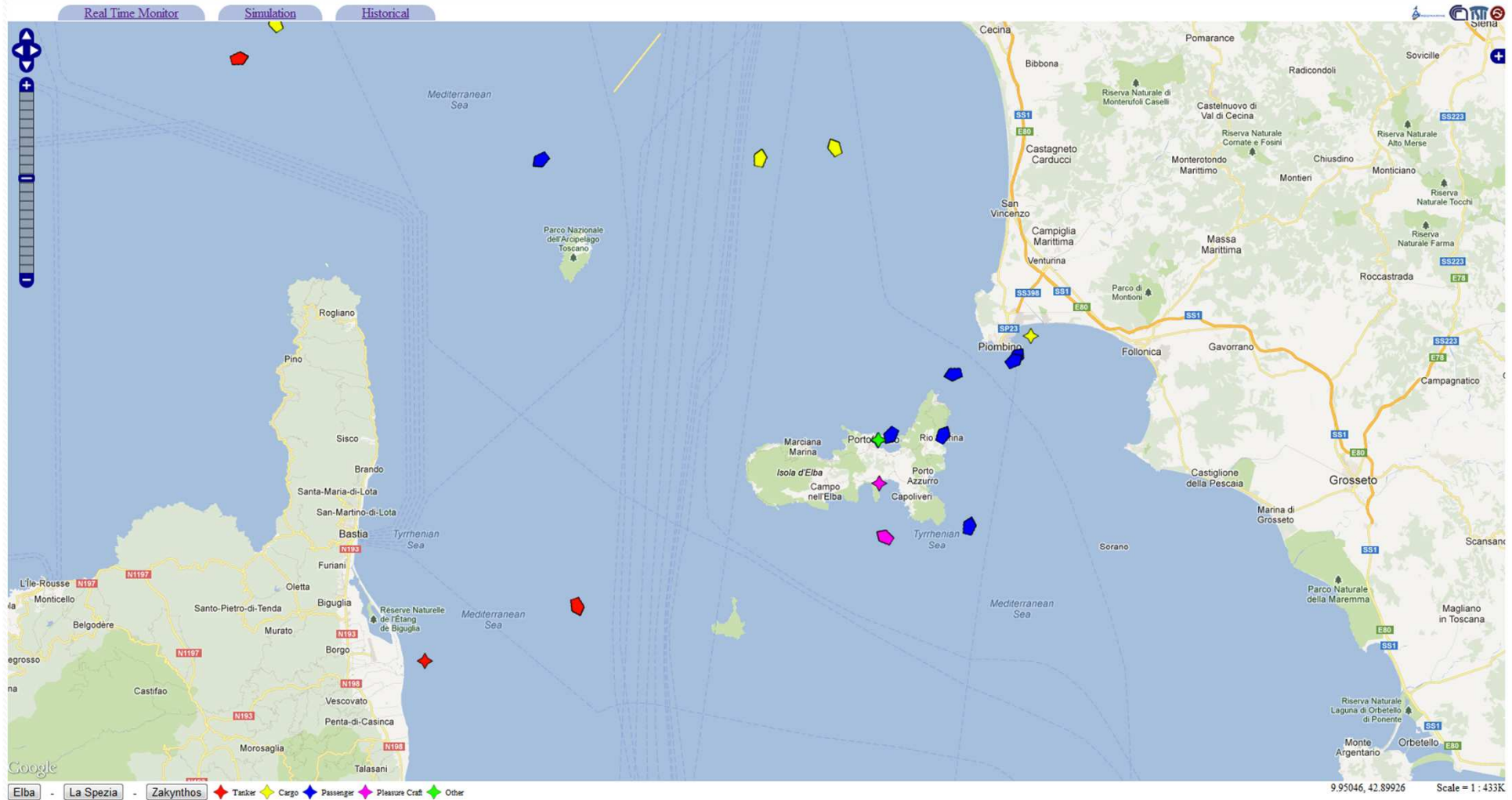
Services: what does it provide?

- **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

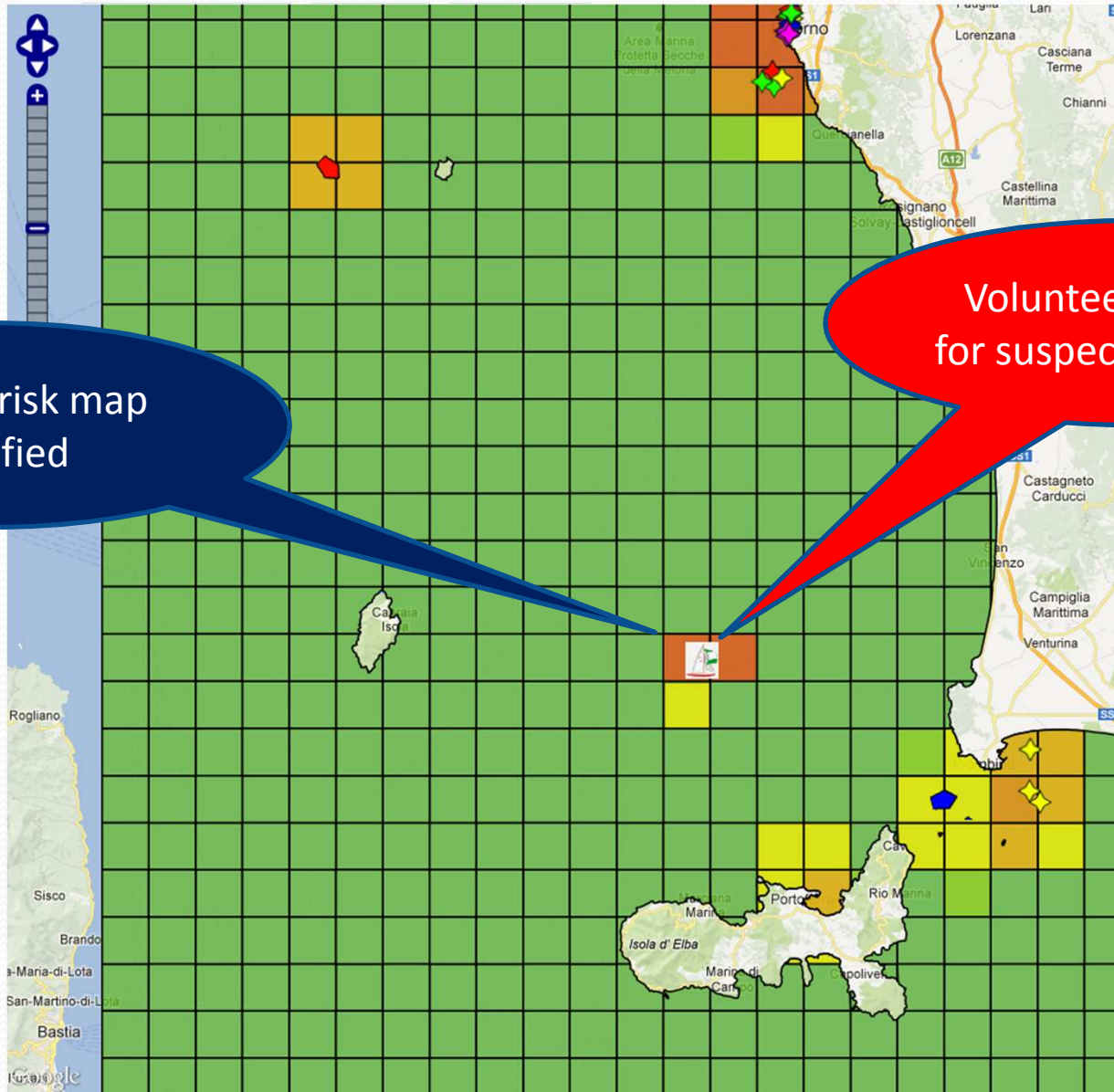
Hardware configuration: the data flow



Visualization: how does it look?



Application case 1: DSS modifying Geomatrix



Dynamic risk map modified

Volunteers alerting for suspect oil-spillage

Application case 2: DSS - Argo Alert Services

The screenshot displays a web interface for monitoring maritime data. At the top, there are three tabs: 'Real Time Monitor', 'Alerts', and 'Historical'. The main area features a map of the Mediterranean Sea with a grid overlay. A popup window titled 'Buoy1' is open, showing a list of sensor data and a photograph of the buoy. A red circle on the map highlights a specific location. A speech bubble points to this location, stating 'Operators responsible for that area are notified'. Another speech bubble points to the popup window, stating 'Event is displayed together with other data of interest'. In the bottom right corner, a mobile notification for 'Argo Alerter' is shown, indicating a high-severity alert has been raised in the user's area of interest.

Buoy1

- battery: 11.8235
- temperature: 15.4
- hydrocarbon:
- humidity: 9.2
- Wind speed: 0.0
- Dew point: -17.1386
- General acceleration: 9.8
- Last data acquired on: Nov 19, 2012 10:21:48 PM
- rain: 0.0
- blackmean: 19
- blackmax: 30
- bronzemean: 8
- bronzemax: 35
- silvermean: 40
- silvermax: 110
- enosehumiditymean: 47
- enosehumiditymax: 49

Show buoys historic values (coming soon)

Operators responsible for that area are notified

Event is displayed together with other data of interest

Argo Alerter
+393488998701
19/11/2012 Lun
An alert, with high severity, has been raised in your area of interest. Please check your email.

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 - Interoperable Infrastructure for RITMARE



Consiglio Nazionale delle Ricerche



*Ministero dell'Istruzione,
dell'Università e della Ricerca*

- **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

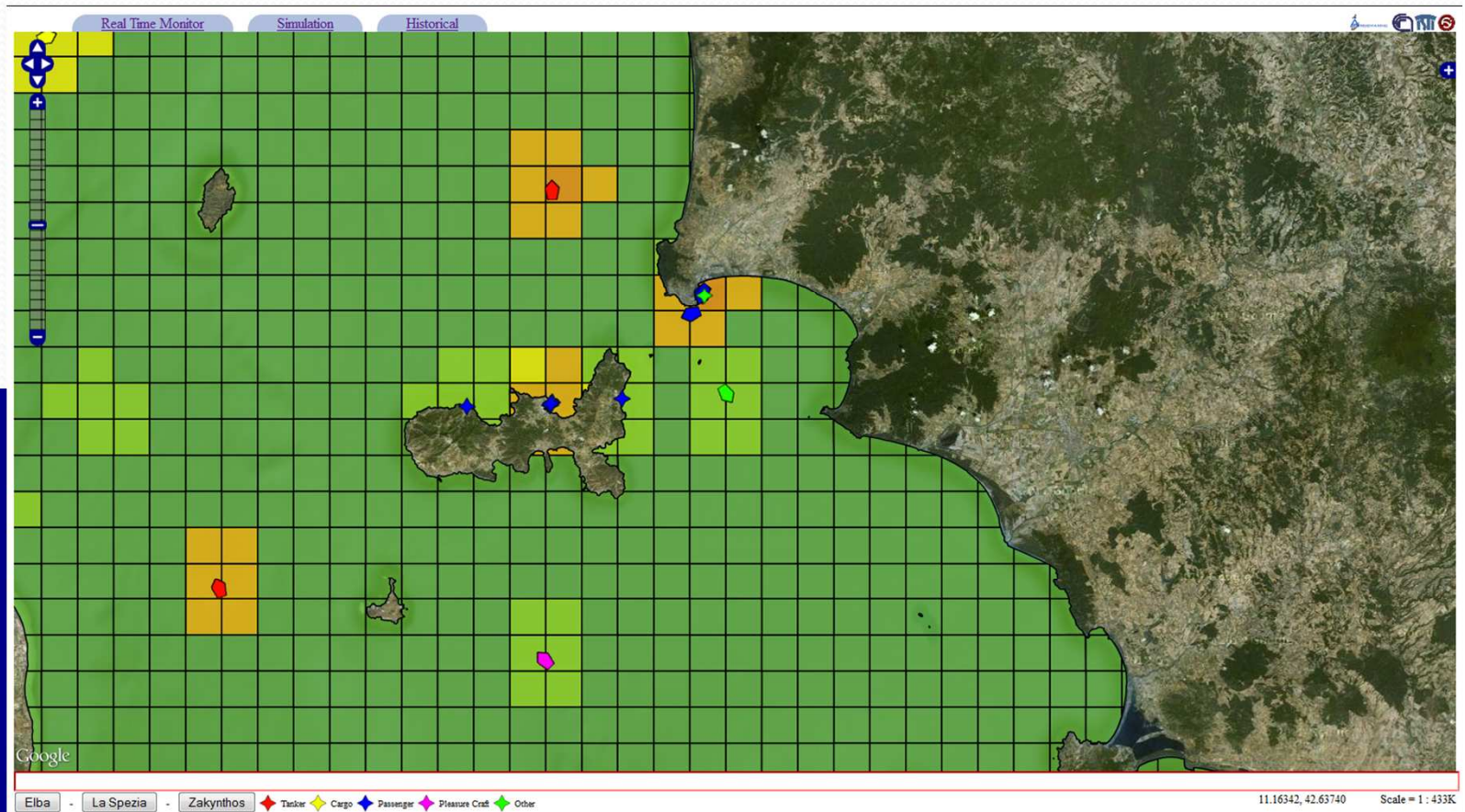
Available layers:

Base Layer

- Google Streets
- Google Physical
- Google Hybrid
- Google Satellite
- Mapnik
- CycleMap

Overlays

- Elba Risk Map
- Zakynthos 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

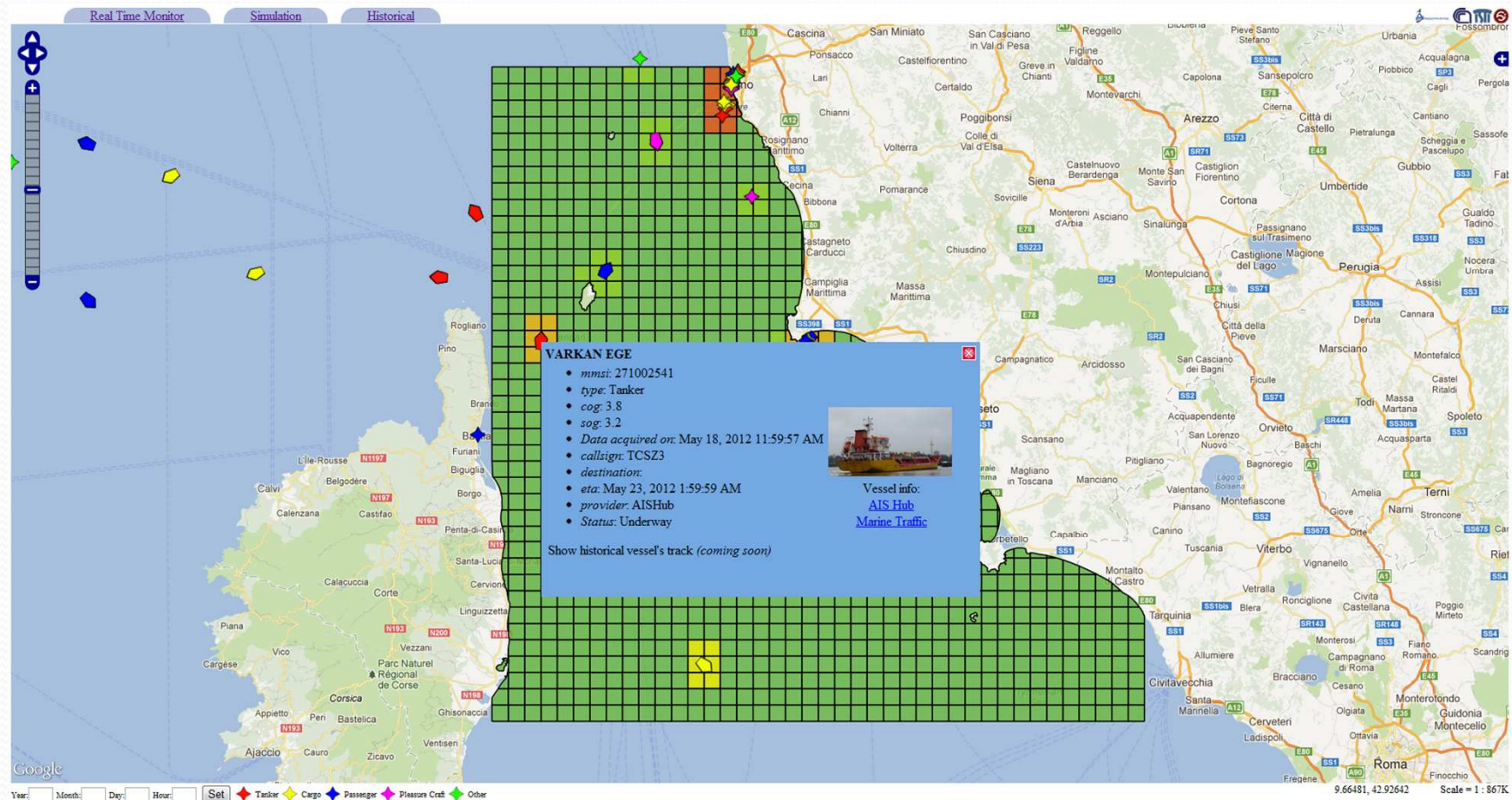


Dynamic risk map

Historical data monitor

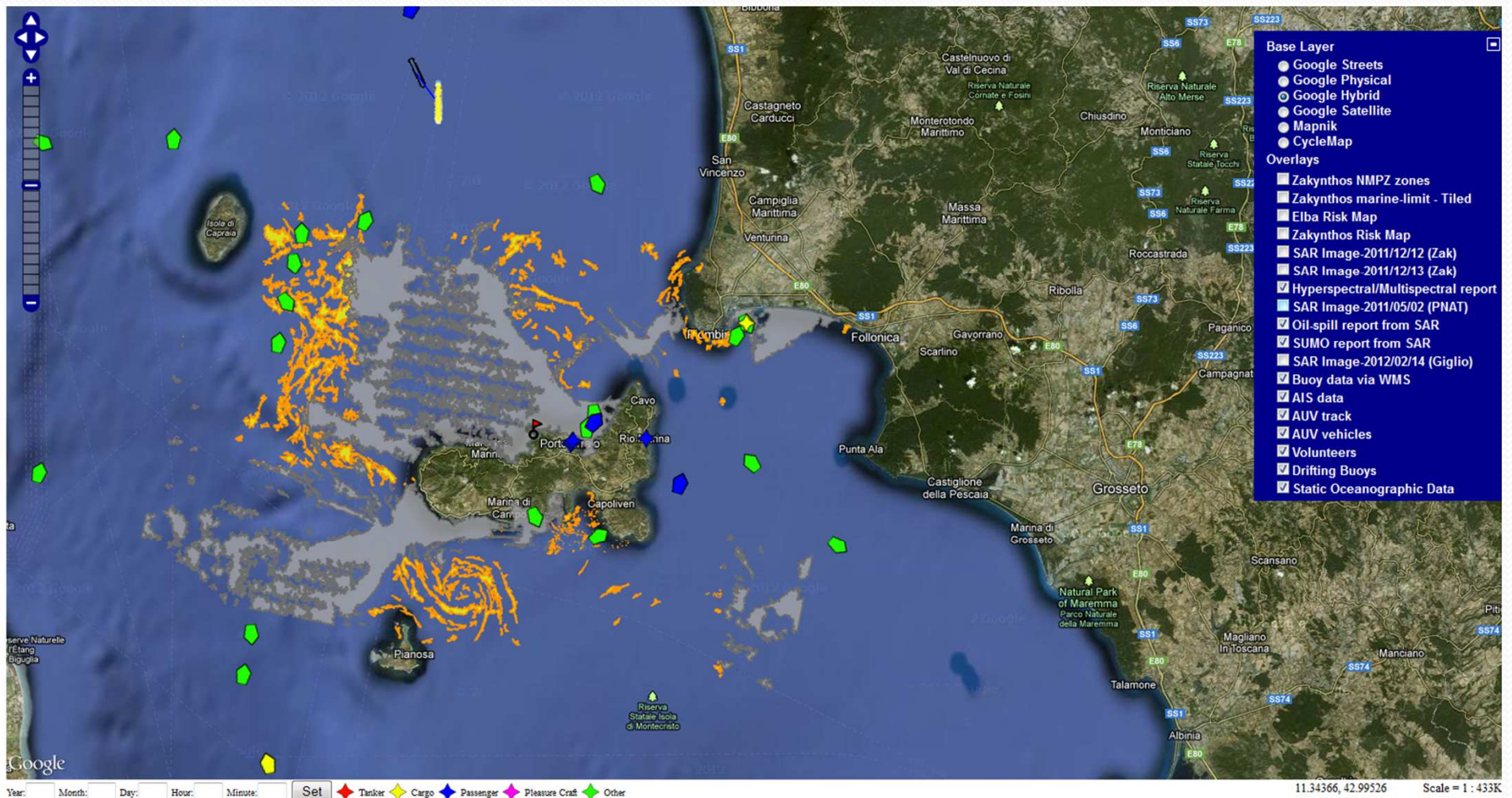
Example of visualization of data on: 2012/05/18 at 12:00

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

argomarine.isti.cnr.it x

← → ↻ 🏠 argomarine.isti.cnr.it:8080/Argomarine/ListAlerts

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

Report lists x

← → ↻ 🏠 argomarine.isti.cnr.it:8080/Argomarine/ReportListController

Real Time Monitor Simulation Historical

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

