On Early Warning and Open Geospatial

HELP - An Early warning dashboard System, built for the prevention, mitigation and assessment of disasters, with a flexible approach using open data and open source technologies

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Summary

- Nice to meet you
- 2 words on the Lab
- 2 words on GIS
- And finally the H.E.L.P. System (and approach)
2 words about me

- Lorenzo Amato
- National Council of Research
- Institute of Methodologies for Environmental Analysis
- geoSDI Laboratory
2 words about the geoSDI Lab

- **2005**
  - SDI Competence Center of The Civil Defence Dept. of Prime Minister Office

- **2007**
  - First Prototype of SDI for the Civil Defence using OGC standards

- **April 2009**
  - Operative usage of geoSDI prototype for the Abruzzo Earthquake Emergency Management

- **2009**
  - Start of Euromed PPRD South Project (Geo-Information Management Tools for Civil Protection in 14 Countries over the Mediterranean Sea)

- **2010**
  - Start of Geo-Platform Framework Opens Source Project
October 2010
Start of the Implementation of SITDPC (Geospatial Information System of the Civil Protection Dept.)

2012
Start of INTEGRO Military Research Programme (Italian National Interoperability Environmental Manager for defence Geospatial data)

2013
Agreement with UN World Food Programme (Palestine C.O.) for geoSDI technology delivery and support

2014
Start of the HELP Early Warning System Project with WFP

2015
Partner of Italian National Institute for Environmental Protection and Research (ISPRA) and 5 Universities for Ministerial projects on Geo-science and Citizen-science

2016
Member of the UN Open Geo Initiative Partners of Private Companies in geo-projects for Public Administration
2 words on GIS

**Proprietary GIS Software Age**
- Great! I can do nothing for free!

**Open Source GIS Age**
- 1982 GRASS
- 1994 OGC
- 2001 PostGIS
- 2002 QGis
- ...

- Great! I can do my MAPS with my DATA for free!

**Open GIS Services Age**
- 2002 GeoServer
- 2006 Openlayers
- 2006 OSGeo Foundation
- ...
- ...

- Great! I’m STANDARD on the WEB!

**TODAY**
- Great! I can do really more!

- Dealing with:
  - Open Data
  - Big Data
  - Open APIs
  - ...

- Billions of Open Maps!

- Billions of Open web-GIS!

- Billions of Services (we hope!!!)
And finally the H.E.L.P. System (and approach)

- The Early Warning System H.E.L.P.
  - IS an Information Management Tool
  - USES Open Source Solutions and Open Access Data
  - PROVIDES quick and intuitive visual evaluation of critical scenarios and alerts on several Risk Themes (Floods, Snow, Earthquake, Fires, etc).

- In other words, the EW System is supposed to give decision makers a very quick and early view on a potential emergency that will be managed. So as to activate all the Actions of the Emergency Response once the effectiveness of the warning is evaluated.
Probably you want to see it 😊

- WMS layers
- Weather Informations
- Computed Alerts
- Geospatial Analysis Results
But I want to talk about the approach!

**TODAY**

- **Dealing with:**
  - Open Data
  - Big Data
  - Open APIs
  - ...

- **Want to say:**
  - STOP to MAP production! (webGIS, layers overlap, standards, bla, bla, bla)
  - START to combine and process open access data from specialized sources to create useful services

Great! I can do really more!
The Approach

HELP has a **simple** and **flexible** but very **effective** logic to perform the early warning:

- **Watch**
  Watch to open data sources on risk themes (NASA satellite data, Weather Forecast, world wide seismic networks, etc)

- **Detect**
  Apply (programmable) “intelligence” to detect critical situations, exceeding of thresholds, population potentially involved by events, etc

- **Show**
  Highlight critical elements on the map and show computed data

- **Notify**
  Send alerts to emergency managers
How it works and technologies used

- USGS Earthquakes API
- Forecast.io Weather API
- Nasa Fires API
- Java Crawlers
- WPS
- GeoServer
- Risk Layers
- Elasticsearch
- HELP Services
- Elasticsearch connector
- HELP Dashboard

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12/10/16
How it works and technologies used

- JAVA crawlers
  - Connect to APIs of monitoring services to get information about events

USGS Earthquakes API
Forecast.io Weather API
Nasa Fires API

Java Crawlers

USGS
FORECAST.IO
NASA
How it works and technologies used

- JAVA crawlers
  - Call to a GeoServer WPS (Web Processing Service)
- GeoServer
  - Executes WPS to make geospatial analysis related to the detected event and using Risk Layers
- PostGIS
  - Is used as Vector Data Stores for Risk Layers
Examples of processing for Earthquakes

- The Crawler detects an event of Magnitude greater than a specified threshold inside the observed area
- It fires the Processor Module
- The process will calculate some aggregate data starting from the Population Data (and the Risk data in the future)
  - Compute How many people are potentially involved in 5Km R, 25km R, and 50km R from epicenter
  - Intersect the radius with other layers as the High-Medium-Low Risk Areas to have a more precise evaluation of potentially involved people
- The results are stored in the elasticsearch storage, so the EW Web Interface can quickly access them through the Help Service Module.
Examples of processing for Floods

- The Crawler detects a hard rain forecast (threshold overcome) in Flood Risk Areas
- It fires the Processor Module
- The process will calculate some aggregate data
  - Intersect the rain point with the Flood Risk Polygons to detect High Risk Areas involved
  - Intersect the results with historical data on flooded point (roads, underpasses, tunnels ...)
  - Cross with population layers to estimate number of people potentially involved
- The results are stored in the elasticsearch storage, so the EW Web Interface can quickly access them through the Help Service Module.
How it works and technologies used

- **JAVA crawlers**
  - Stores the event information and WPS results into **Elasticsearch** indexes
  - Send Email Alert Notification to Configured Emergency Manager

- USGS Earthquakes API
- Forecast.io Weather API
- Nasa Fires API
How it works and technologies used

- HELP Dashboard (Built with Google Polymer)
  - Call to HELP Services (built with Geo-Platform) to connect to Elasticsearch and show information

- USGS Earthquakes API
- Forecast.io Weather API
- NASA Fires API
- Java Crawlers
- WPS
- GeoServer
- Risk Layers
- Elasticsearch connector
- GeoPlatform
- Elasticsearch

HELP Dashboard
Now we can have a look!
Now we can have a look!
Email Alerts

WFP Earthquake Notification System

Earthquake Location: 9km ESE of Maltignano, Italy
Magnitude: 4.1

Population Involved:
- Circle with a radius of 15km: 6739.0
- Circle with a radius of 50km: 25493.0

Link to EWARE.

Dear EWARE User,

Listed below are custom alerts sent to you by EWARE system.

<table>
<thead>
<tr>
<th>Alert Time</th>
<th>Type</th>
<th>Location</th>
<th>Accumulation</th>
<th>Level</th>
<th>Potentially affected population</th>
<th>Direct Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/10/16</td>
<td>SNOW</td>
<td>BOLZANO-SOBZEN</td>
<td>1.706 cm/hr</td>
<td>Snow Risk 59.6%</td>
<td>19.06K</td>
<td>[Direct Link]</td>
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<tr>
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<td>SNOW</td>
<td>DONORO</td>
<td>0.07 cm/hr</td>
<td>Snow Risk 5.9%</td>
<td>82.01K</td>
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<tr>
<td>12/10/16</td>
<td>SNOW</td>
<td>VERBANO-CUSIO-OSSOLA</td>
<td>0.879 cm/hr</td>
<td>Snow Risk 81.0%</td>
<td>113.5K</td>
<td>[Direct Link]</td>
</tr>
<tr>
<td>12/10/16</td>
<td>SNOW</td>
<td>VALLE D'AOSTA</td>
<td>0.365 cm/hr</td>
<td>Snow Risk 82.0%</td>
<td>113.5K</td>
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<tr>
<td>12/10/16</td>
<td>WIND</td>
<td>CARBONIA-OPLEIAS</td>
<td>32.46 km/h</td>
<td>Gale, fresh gale</td>
<td>102.04K</td>
<td>[Direct Link]</td>
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<tr>
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<td>RAIN</td>
<td>VICENZA</td>
<td>5.5205 mm/hr</td>
<td>High Risk</td>
<td>109.63K</td>
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<td>RAIN</td>
<td>LA SPEZIA</td>
<td>5.2033 mm/hr</td>
<td>High Risk</td>
<td>94.72K</td>
<td>[Direct Link]</td>
</tr>
<tr>
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<td>NOVARA</td>
<td>5.542 mm/hr</td>
<td>High Risk</td>
<td>82.01K</td>
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<tr>
<td>12/10/16</td>
<td>RAIN</td>
<td>GENOVA</td>
<td>5.8014 mm/hr</td>
<td>High Risk</td>
<td>94.72K</td>
<td>[Direct Link]</td>
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<td>12/10/16</td>
<td>RAIN</td>
<td>BIELLA</td>
<td>5.621 mm/hr</td>
<td>High Risk</td>
<td>94.72K</td>
<td>[Direct Link]</td>
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<tr>
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<td>RAIN</td>
<td>VERCelli</td>
<td>5.6134 mm/hr</td>
<td>High Risk</td>
<td>82.01K</td>
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<tr>
<td>12/10/16</td>
<td>RAIN</td>
<td>TRENTO</td>
<td>4.7546 mm/hr</td>
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<td>102.04K</td>
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<td>BERGAMO</td>
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<td>SAVONA</td>
<td>4.6020 mm/hr</td>
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<td>ALESSANDRIA</td>
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<td>82.01K</td>
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<td>MILANO</td>
<td>4.3203 mm/hr</td>
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<td>82.01K</td>
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<td>MONZA E DELLA BIANZA</td>
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<td>High Risk</td>
<td>82.01K</td>
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<td>RAIN</td>
<td>PSA</td>
<td>4.252 mm/hr</td>
<td>High Risk</td>
<td>39.57K</td>
<td>[Direct Link]</td>
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<td>RAIN</td>
<td>PAIA</td>
<td>4.1634 mm/hr</td>
<td>High Risk</td>
<td>82.01K</td>
<td>[Direct Link]</td>
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<td>12/10/16</td>
<td>RAIN</td>
<td>ASTI</td>
<td>4.1790 mm/hr</td>
<td>High Risk</td>
<td>82.01K</td>
<td>[Direct Link]</td>
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<tr>
<td>12/10/16</td>
<td>RAIN</td>
<td>VALLE D'AOSTA</td>
<td>4.13 mm/hr</td>
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<td>82.01K</td>
<td>[Direct Link]</td>
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<td>12/10/16</td>
<td>RAIN</td>
<td>SONDRIO</td>
<td>4.0437 mm/hr</td>
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<td>[Direct Link]</td>
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<td>12/10/16</td>
<td>RAIN</td>
<td>TRIPANI</td>
<td>3.9503 mm/hr</td>
<td>Gale, fresh gale</td>
<td>33.76K</td>
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<td>IMPERIA</td>
<td>3.6599 mm/hr</td>
<td>High Risk</td>
<td>12.54K</td>
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<td>3.8058 mm/hr</td>
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<td>82.01K</td>
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<td>RAIN</td>
<td>LIVORNO</td>
<td>3.8599 mm/hr</td>
<td>High Risk</td>
<td>39.57K</td>
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<td>RAIN</td>
<td>COMO</td>
<td>3.8583 mm/hr</td>
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<td>82.01K</td>
<td>[Direct Link]</td>
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<td>VERSEE</td>
<td>3.8152 mm/hr</td>
<td>High Risk</td>
<td>82.01K</td>
<td>[Direct Link]</td>
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<td>LODI</td>
<td>3.8678 mm/hr</td>
<td>High Risk</td>
<td>82.01K</td>
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<tr>
<td>12/10/16</td>
<td>RAIN</td>
<td>LUCCA</td>
<td>3.4733 mm/hr</td>
<td>Moderate Risk</td>
<td>41.08K</td>
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<td>PISTOIA</td>
<td>3.3401 mm/hr</td>
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<td>41.08K</td>
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<td>12/10/16</td>
<td>RAIN</td>
<td>BRESCIA</td>
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<td>Moderate Risk</td>
<td>102.04K</td>
<td>[Direct Link]</td>
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<td>RAIN</td>
<td>CUNEO</td>
<td>3.1156 mm/hr</td>
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<td>94.72K</td>
<td>[Direct Link]</td>
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<tr>
<td>12/10/16</td>
<td>RAIN</td>
<td>PRATO</td>
<td>3.0404 mm/hr</td>
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<td>39.57K</td>
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<td>RAIN</td>
<td>Siena</td>
<td>3.0922 mm/hr</td>
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<td>39.57K</td>
<td>[Direct Link]</td>
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<tr>
<td>12/10/16</td>
<td>RAIN</td>
<td>TORINO</td>
<td>2.987 mm/hr</td>
<td>Moderate Risk</td>
<td>82.01K</td>
<td>[Direct Link]</td>
</tr>
</tbody>
</table>
Thank You

And let's Work to create Billions of Services !!!

www.geosdi.org
http://help.geosdi.org