Two case history of EMS data application: earthquake in central italy and flooding in Piedmont region

Luca Lanteri*, Rocco Pispico*, R. Cremonini**

*Arpa Piemonte, Geological and Natural Risk Dipartiment
**Arpa Piemonte, Previsional Department

Contact: sigeo@arpa.piemonte.it

ARPA - The Regional Agency for the Protection of the Environment of Piedmont *is a public authority with independent administrative, technical-juridical status. It operates under the oversight of the Regional Government to ensure compliance with the policy guidelines in the fields of* ***forecasting, preventive actions and preservation of the environment***

Geological and Natural Risk Department - about 15 technician

Previsional Metereological Department - about 35 technician

Our activities

- ***Prediction and prevention of anthropic and natural risks***
- ***Activities of conformity control on installations***
- ***Water, soil and air quality monitoring***
- ***Reports on the environment conditions***
- ***Weather forecast service***

In case of heavy rain event, ARPA has 24/7 service to control weather forecast and hydrological status of slopes and rivers

In italy Copernicus activation is in charge to National Department of Civil Protection (Autorized user)

Analisys, definition and updating of natural processes framework (landslides, flooding, avalanche etc...)

Bardonecchia, Crollo loc. Melezet, 2009

Manage of monitoring landslides networks

Novalesa, Rocciamelone landslide, 2010

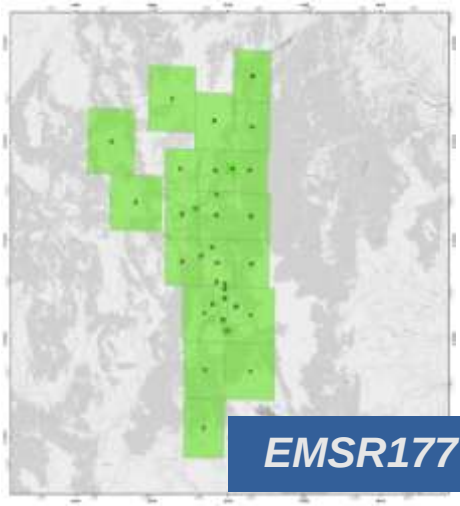
Survey and data collection after flooding events

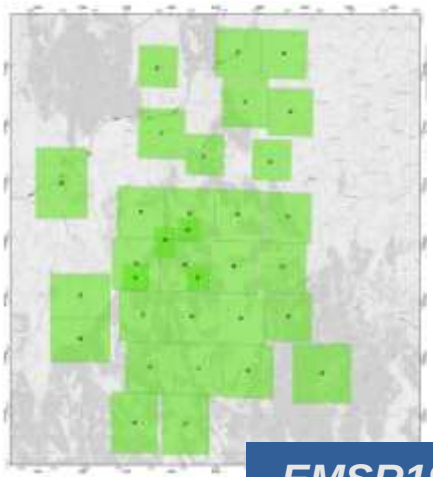
Dora Baltea, flooding 2000

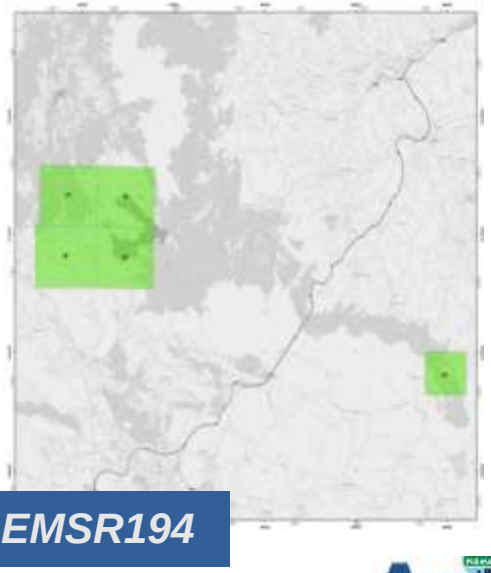
Support to National Department of Civil Protection to manage survey on building status after eartquake of 24 august in central Italy

The 24th August 2016 an earthquake occurred in the centre of Italy involving a very large territory including four Regions (Lazio, Abruzzo, Umbria) and Municipalities.

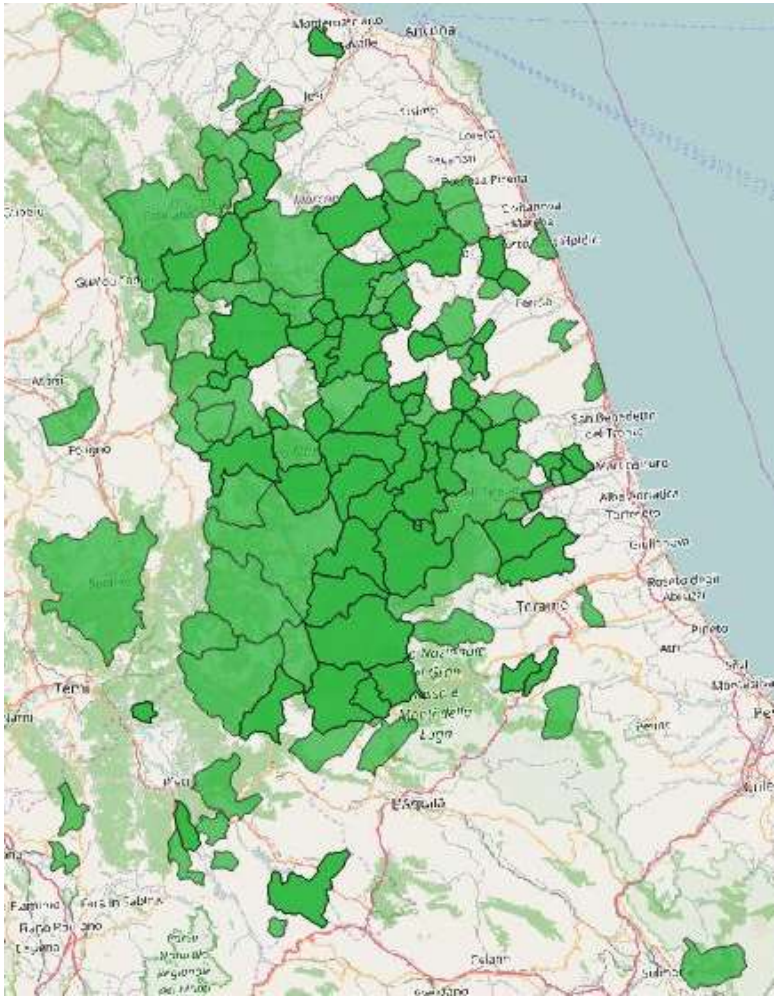
After the main shock several others, in particular 26th of October and 18 January 2017, occurred in the areas producing casualties and damages on structures and infrastructures.







Use of products: Centre Italy earthquake



- ***Region and ARPA developed ERIKUS an open source software based on QGIS and Postgres/Postgis technologies in order to aid the manage of field building status survey after the earthquake and to manage the data.***

- ***We provide support directly to the municipalityes for the installation, training and maintenance of ERIKUS and to DPCN status to data collection, manage and spreading.***

Since the end of august 2016 more than 190 municipalities collect data with ERIKUS

	Need	*Scheduled Time*	*Purpose*
-------	*------*	*7 days*	*first-emergency*
first phase:	*Organize the field survey on buildings*	*Up to 6 month*	*emergency*
second phase:	*Data managment, validation and organization*	*1 years*	*post-emergency*
third phase:	*Provide a more detailed and organized data for reconstruction phase*	*future*	*knowledge, pianification*

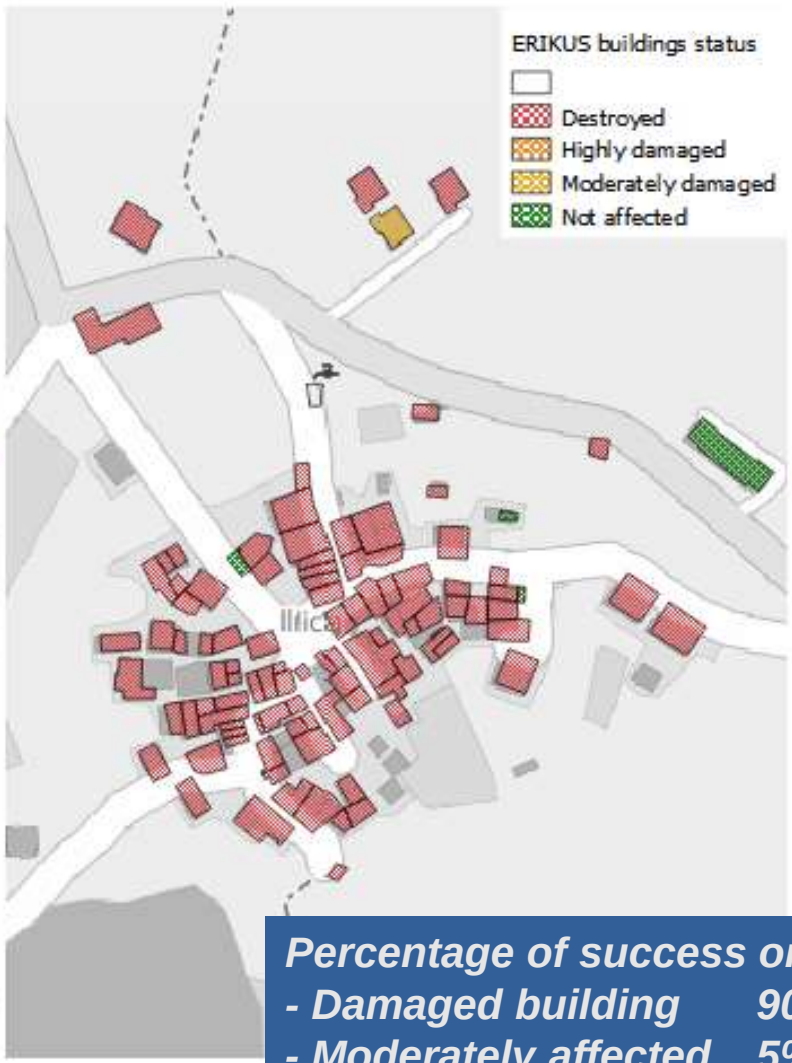
Use of products: Centre Italy earthquake

- ***Municipality Coordination Center (COC) use Tile Map Service as the most updated base cartography (where available) for QGIS (ERIKUS project)***

- ***Experimentation to compare grading information from EMS with field survey (AEDES and FAST forms) in perspective for future events***

Use of products: 24 august earthquake. Data comparison

Illica - Accumoli

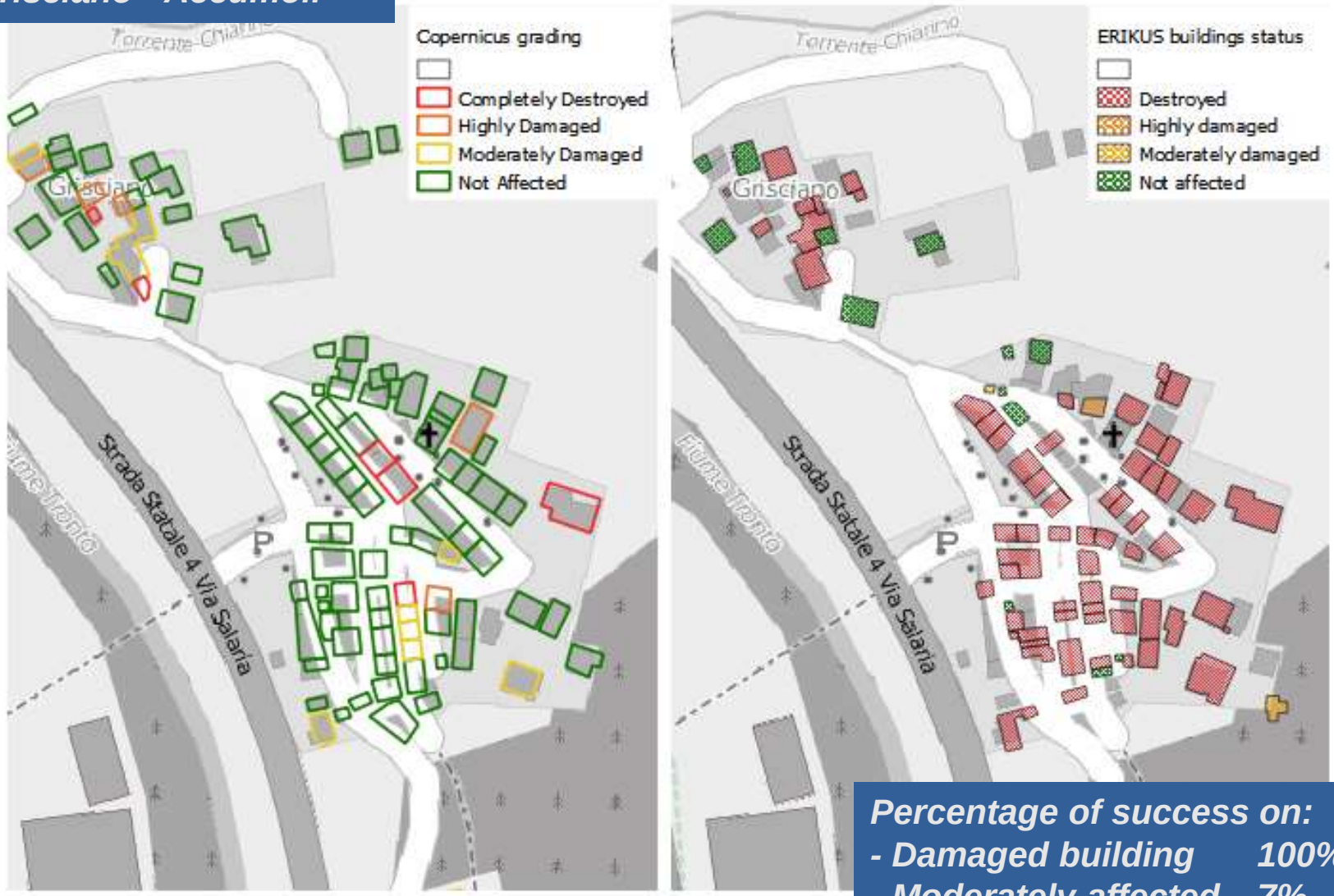


Percentage of success on:

- Damaged building	*90%*
- Moderately affected	*5%*
- Not affected	*30%*
TOTAL SCORE	***65%***

Use of products: 24 august earthquake. Data comparison

Grisciano - Accumoli



Percentage of success on:

- Damaged building	*100%*
- Moderately affected	*7%*
- Not affected	*25%*
TOTAL SCORE	***28%***

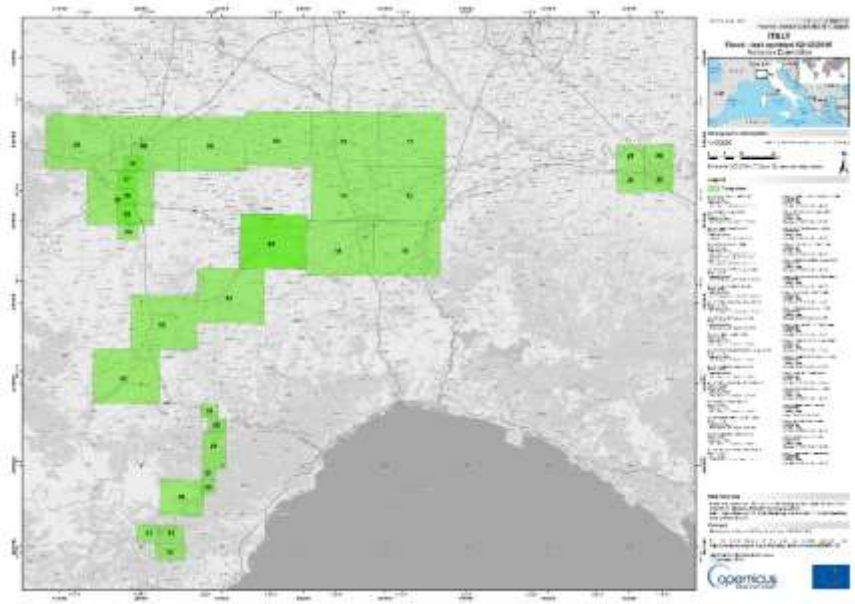
On whole dataset
TOTAL SCORE 25%

		COPERNICUS					
		Completely Destroyed – Highly Damaged	Moderately Affected – Moderately Damaged - Negligible to slight damage	Not Affected	NA – Unknown	Total	
ERIKUS	Completely Destroyed – Highly Damaged	532	493	1380	418	**2823**	18,85%
	Moderately Affected – Moderately Damaged - Negligible to slight damage	4	24	45	73	**146**	16,44%
	Not Affected	4	30	325	203	**562**	57,83%
	NA – Unknown	428	30	1279	314	**2051**	15,31%
	Total	**968**	**577**	**3029**	**1008**		
		54,96%	**4,16%**	**10,73%**	**31,15%**		

55%

31%

Use of products: 21-26 november 2016 flood



Starting from November 22nd, heavy rainfalls are involving the territory of North West of Italy, in particular the Regions of Piemonte and Liguria. The bad weather conditions and the persistence of precipitations have caused the increasing of hydrometric levels of all the rivers in particular in the basin of Po river.

	Need	*Scheduled Time*	*Purpose*
first phase:	*rapid damage assessment and collection of information for a briefly regional report*	*15 day*	*emergency*
second phase:	*reconstruct a more detailed framework of the event*	*1 year*	*knowledge, pianification*

Arpa & Regional Amministration worked together in field survey

On 24 november the National Department of Civil Protection triggered the national and european monitoring services In order to monitoring Po, Tanaro Bormida and other minor river flooding:

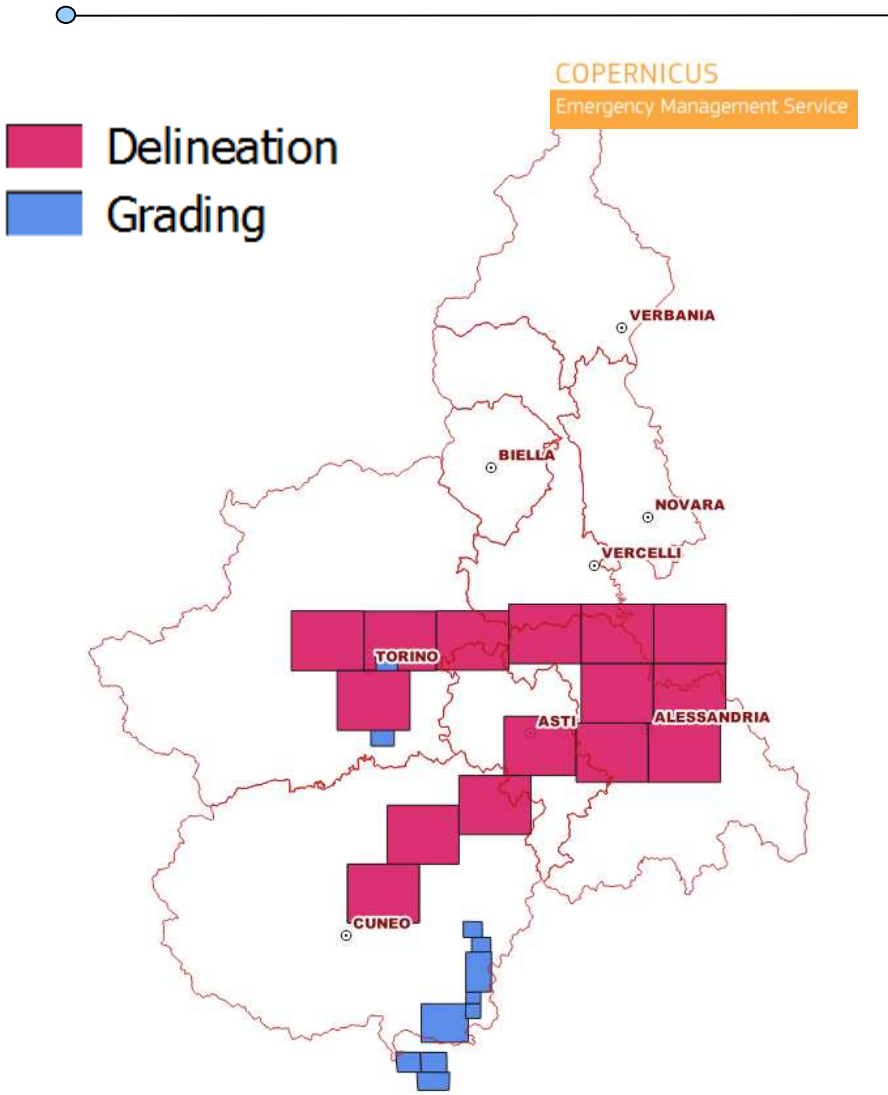
- ***Copernicus Emergency Management Service (EMS) - European level***

- ***The Italian Spatial Agency (ASI) with CIMA Foundation - National level***

Copernicus had provided two product into EMSR192 activation:

Delineation *maps provide an* ***assessment of the event extent*** *(and of its evolution if requested). Delineation maps are derived from satellite post-disaster images. They vary depending on the disaster type and the delineation of the areas impacted by the disaster.*

Grading maps *provide an* ***assessment of the damage grade****. Grading maps are derived from post-event satellite images. Grading maps include the extent, magnitude or damage grades specific to each disaster type. They may also provide relevant and up-to-date information that is specific to affected population and assets, e.g. settlements, transport networks, industry and utilities.*

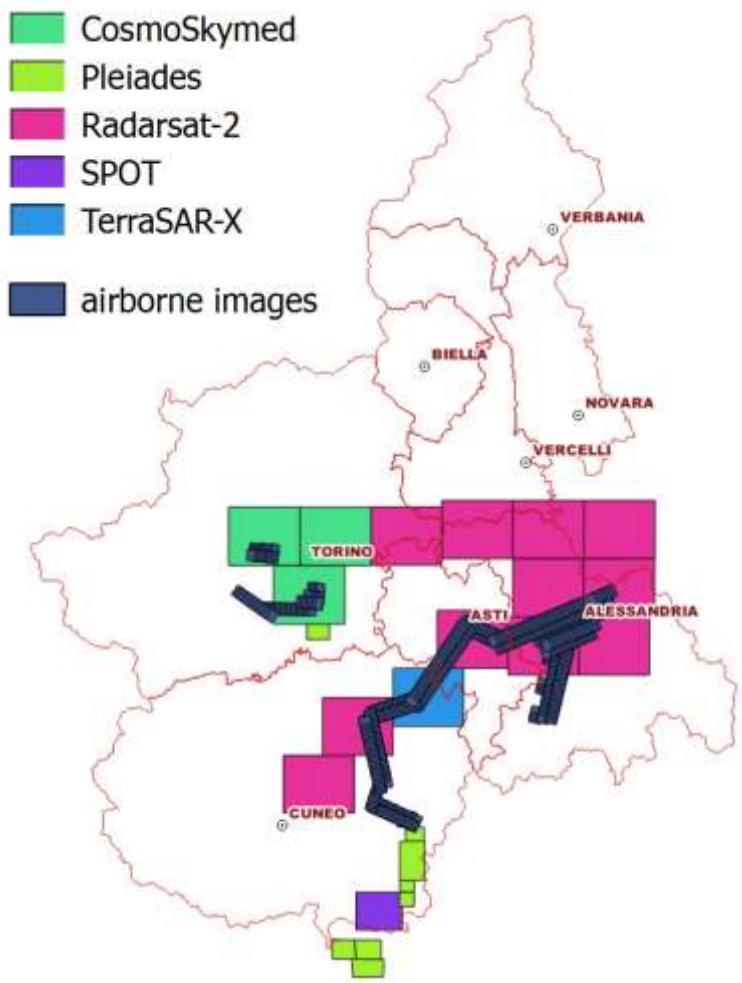


Data derived from different satellites:

***Delineation** - mainly using semiautomatic procedure from radar images (Radarsat-2 and Cosmo Skymed)*

***Grading** – evaluation of damages from very high resolution optical images (Pleiades, SPOT)*

On 30.11.2016 and 01.12.2016 Piedmont Regione made an airborne photographic survey on Tanaro, Bormida and Chisola rivers

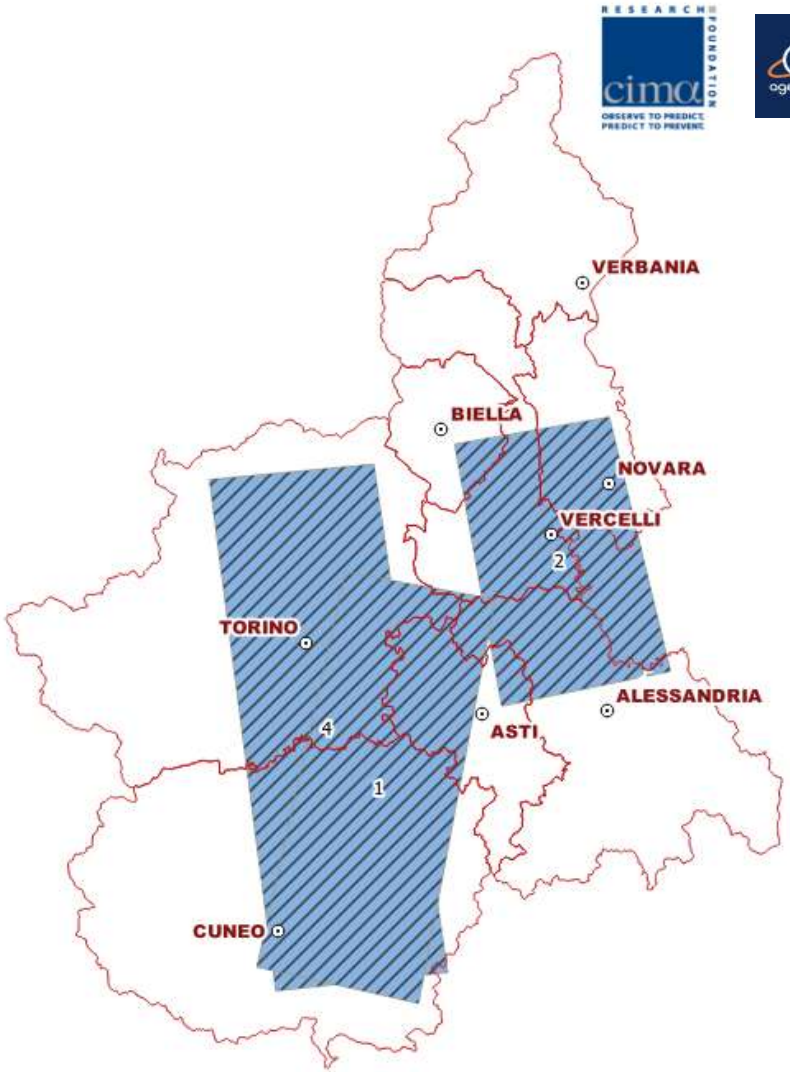


*CIMA (International Centre on environmental monitoring) produced an assesment of the flooded area starting from **RADARSAT-2** images using a **semiautomatic elaboration***

Dataset 1 – 2016.11.25 17:20

Dataset 2 – 2016.11.26 05:20

Dataset 4 - 2016.11.26 17:15



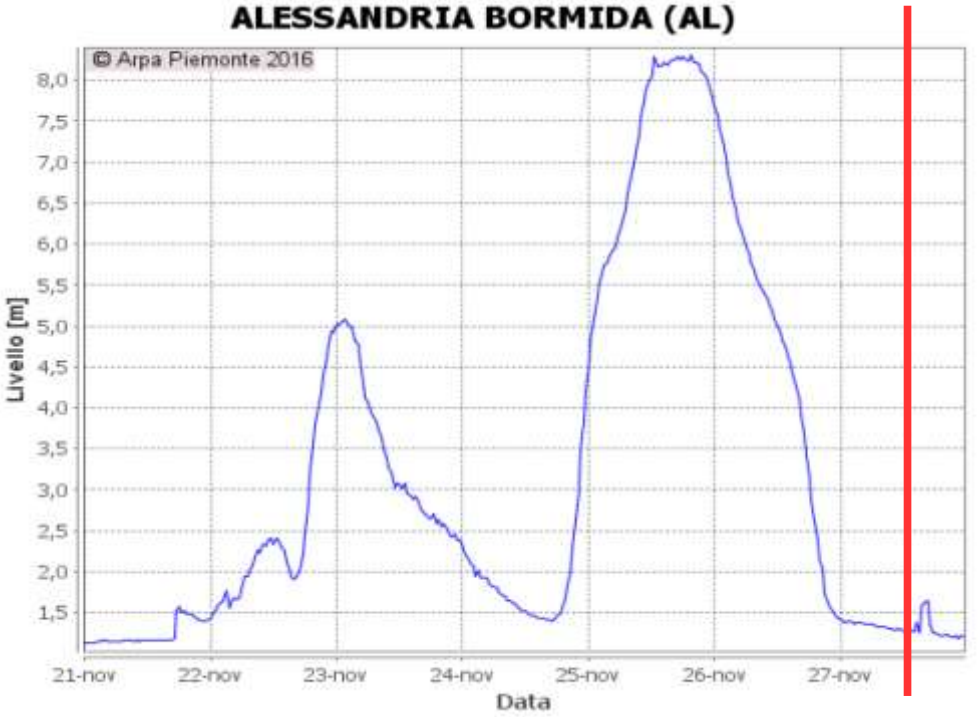
Location: Bormida Valley

Map type: Delineation

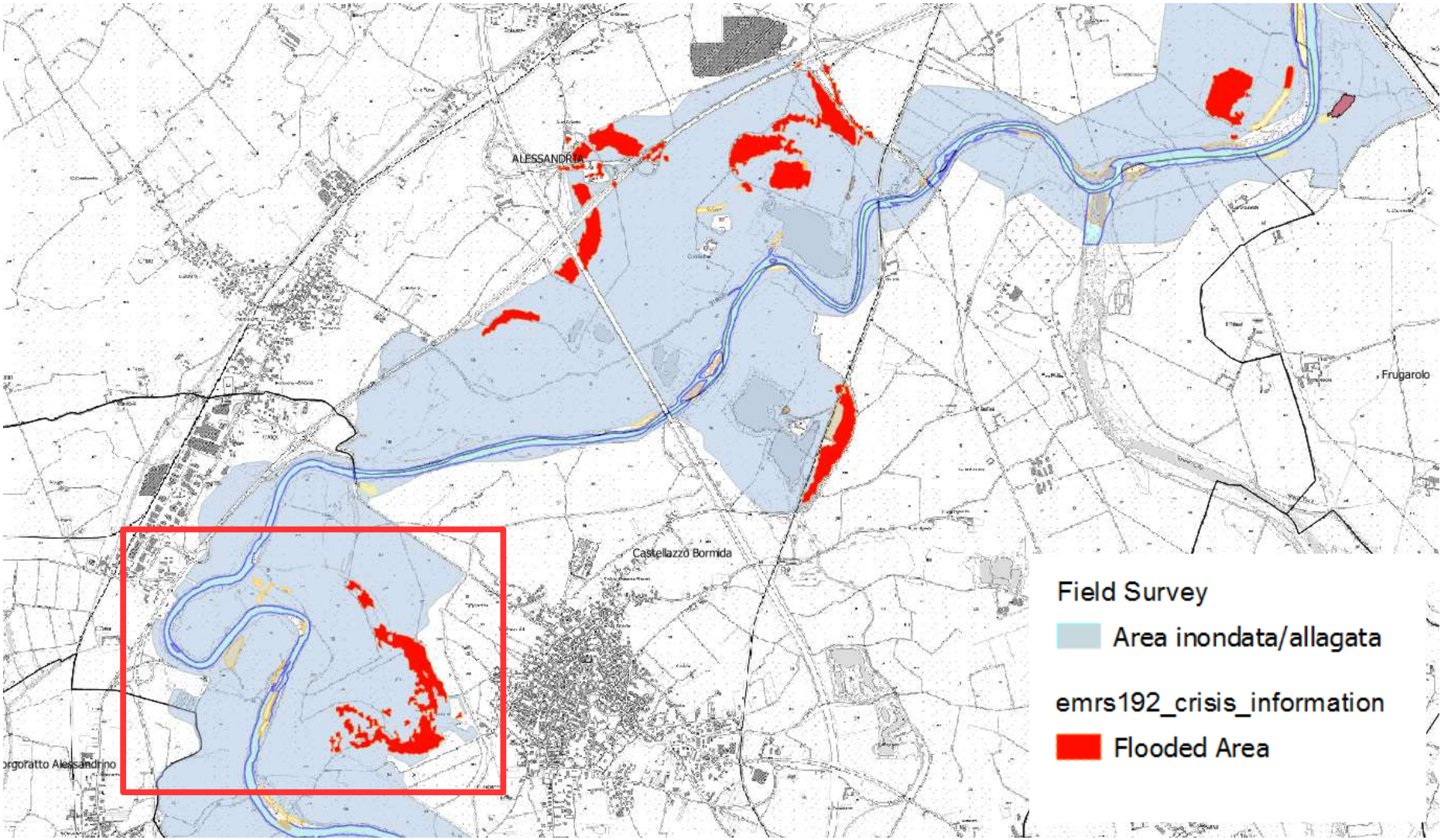
Platform: Radarsat-2

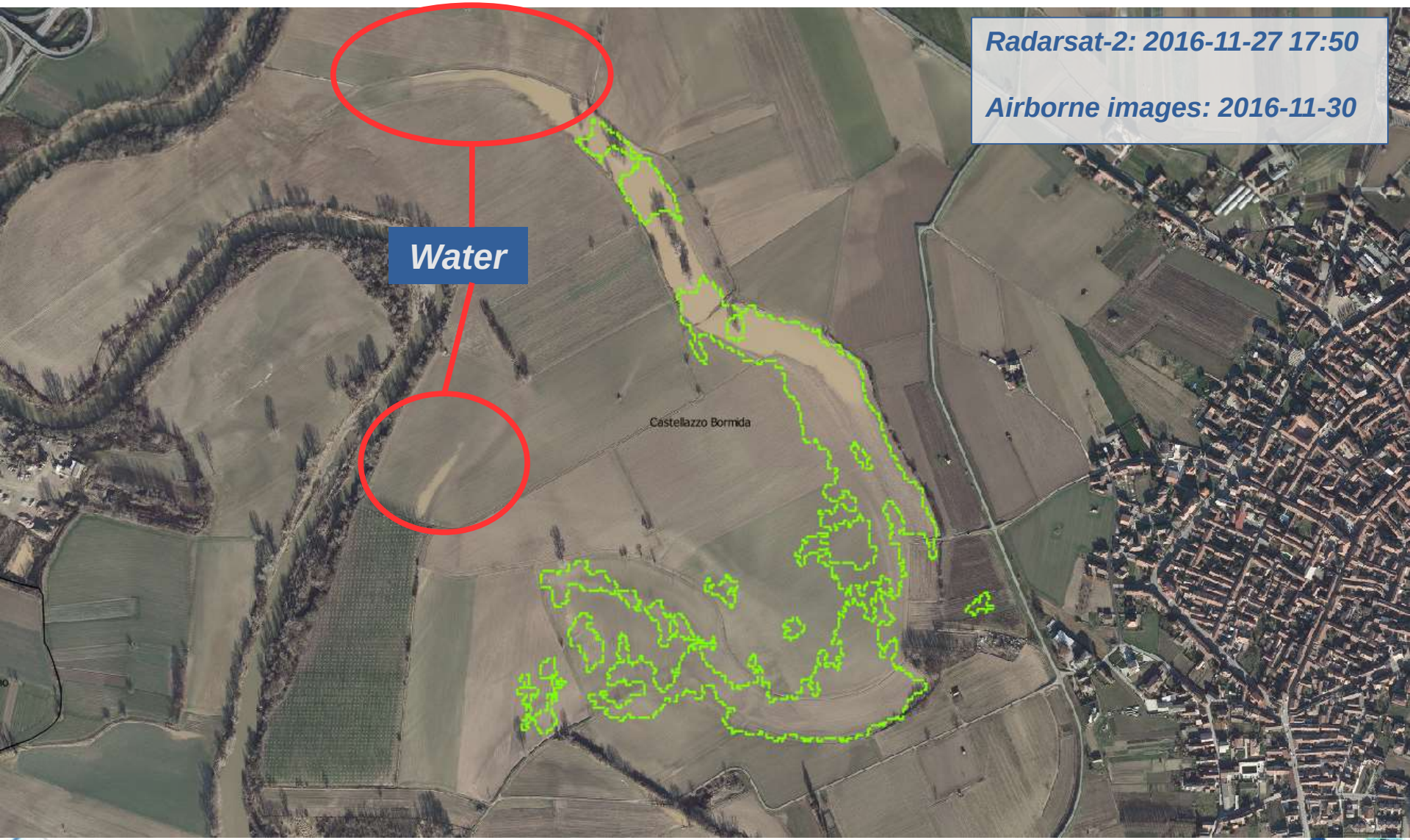
Imagery date: 2016-11-27 16:37

Other data:
Airborne photo
Field survey



Use of products: 21-26 november 2016 flood




Radarsat-2: 2016-11-27 17:50
Airborne images: 2016-11-30
Water
Castellazzo Bormida

Analyzed area: from Sezzadio to Alessandria (about 18km)

Flooded area:

Field survey	***21,39 sq km***
EMS	***5,82 sq km***

EMS/Field survey = 27,2%

- ***Low flooded area detected***
- ***Area with water 4 days after no detected***

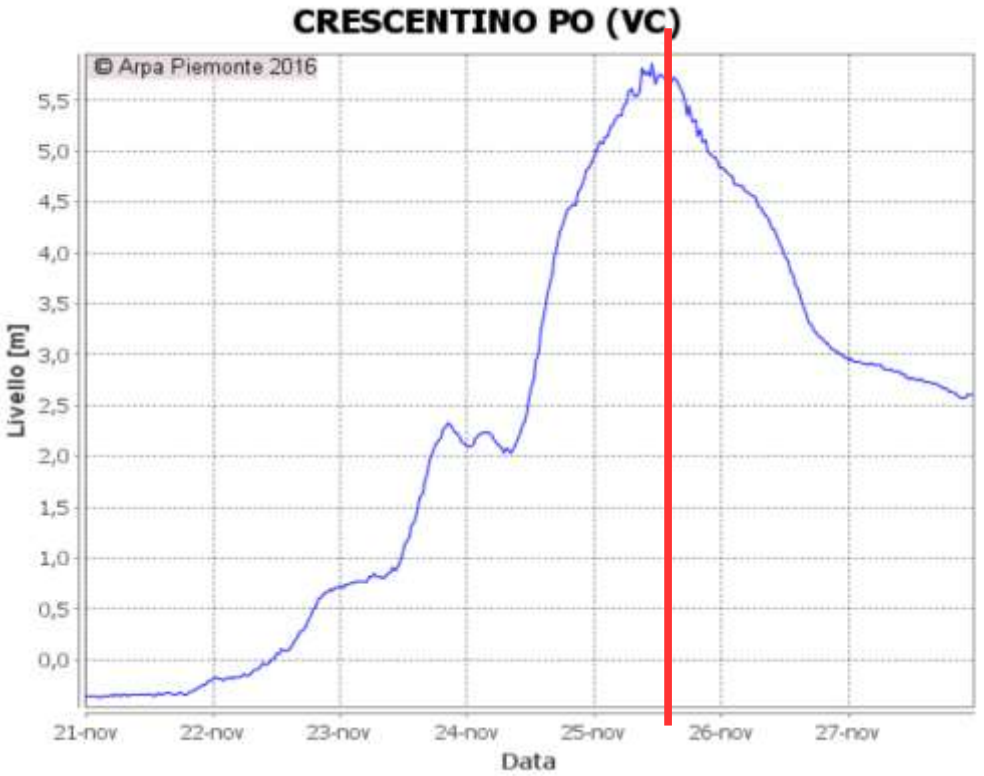
Location: Po Valley, from castagneto to crescentino

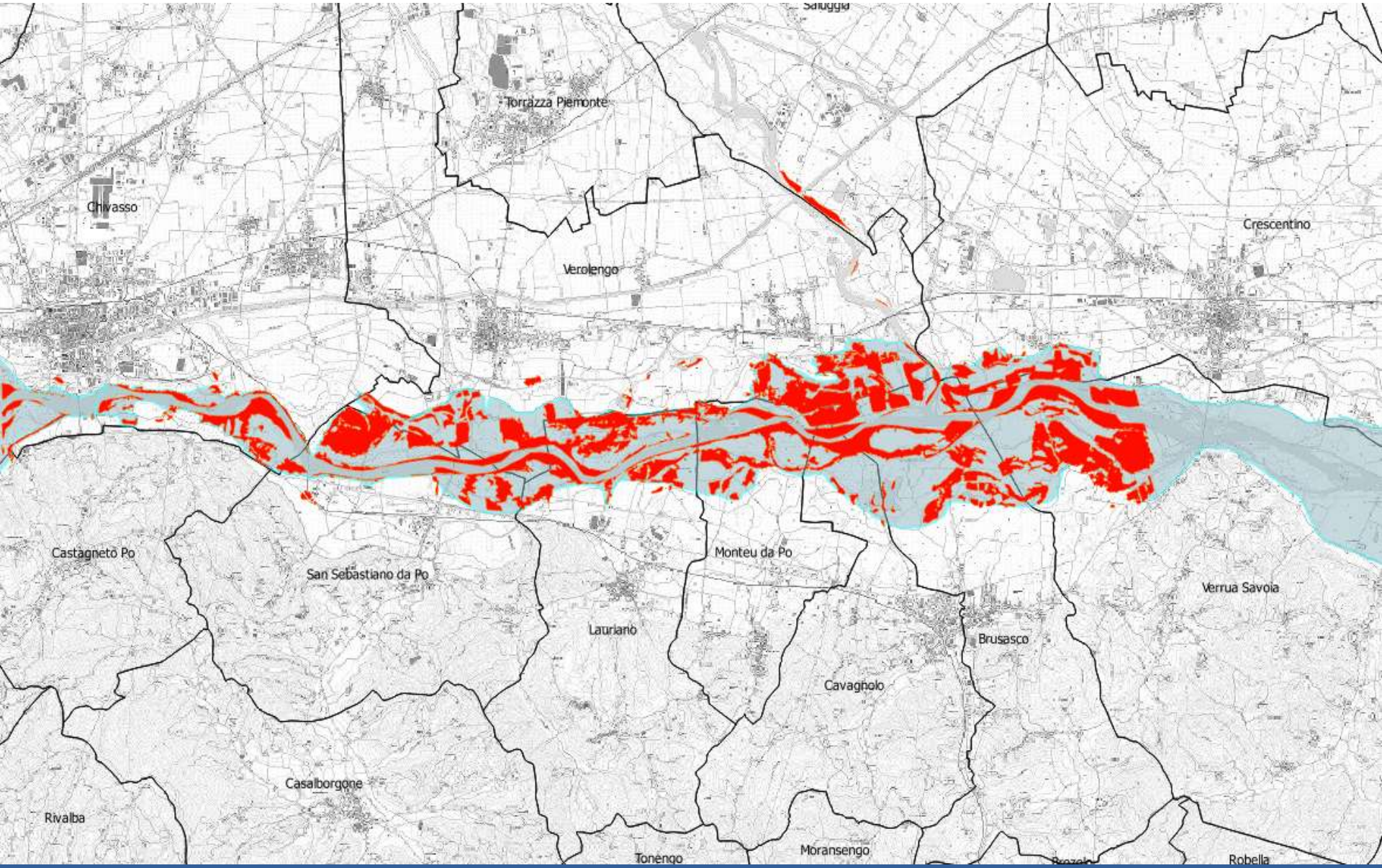
Map type: Delineation

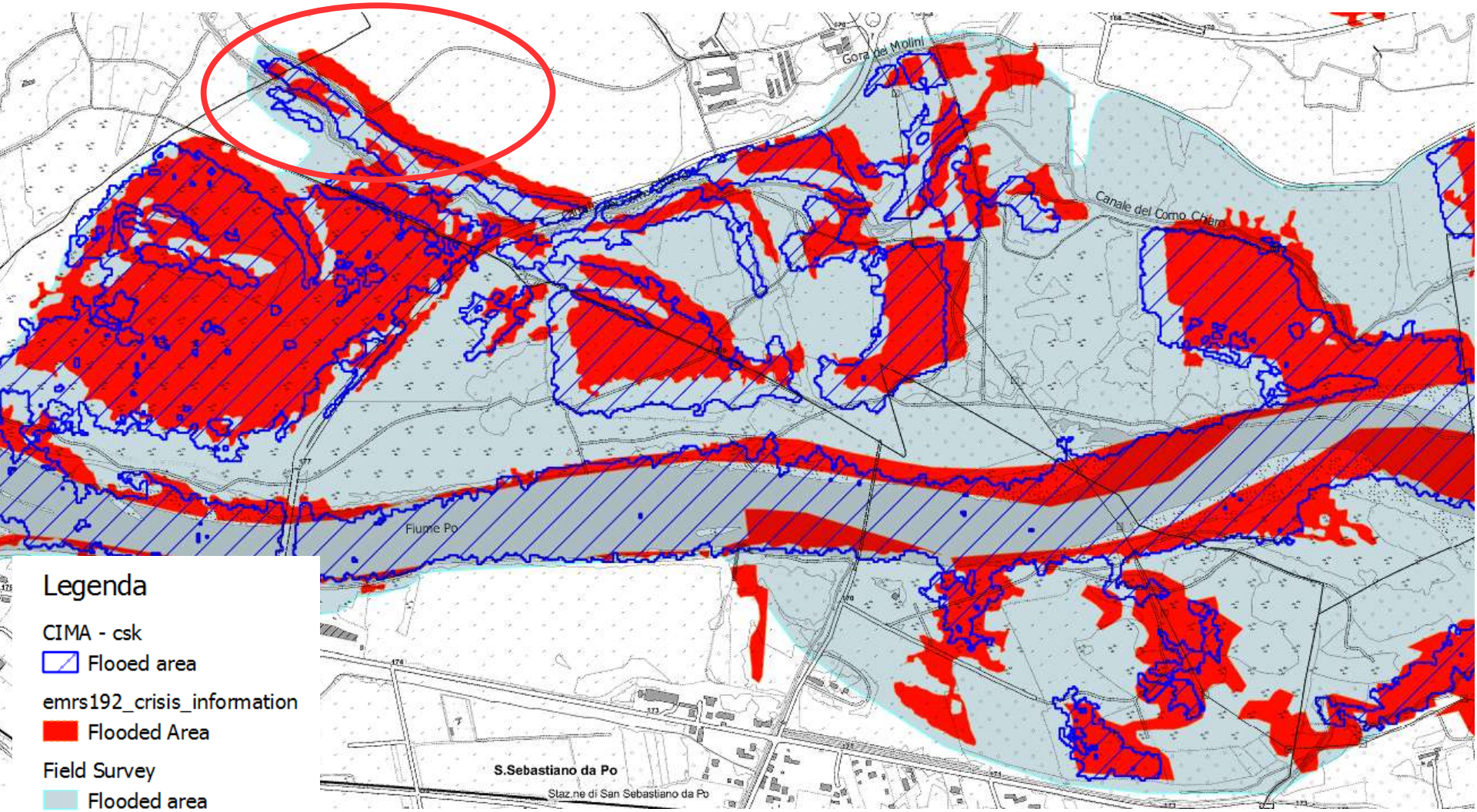
Platform: Radarsat-2

Imagery date: 2016-11-25 16:37

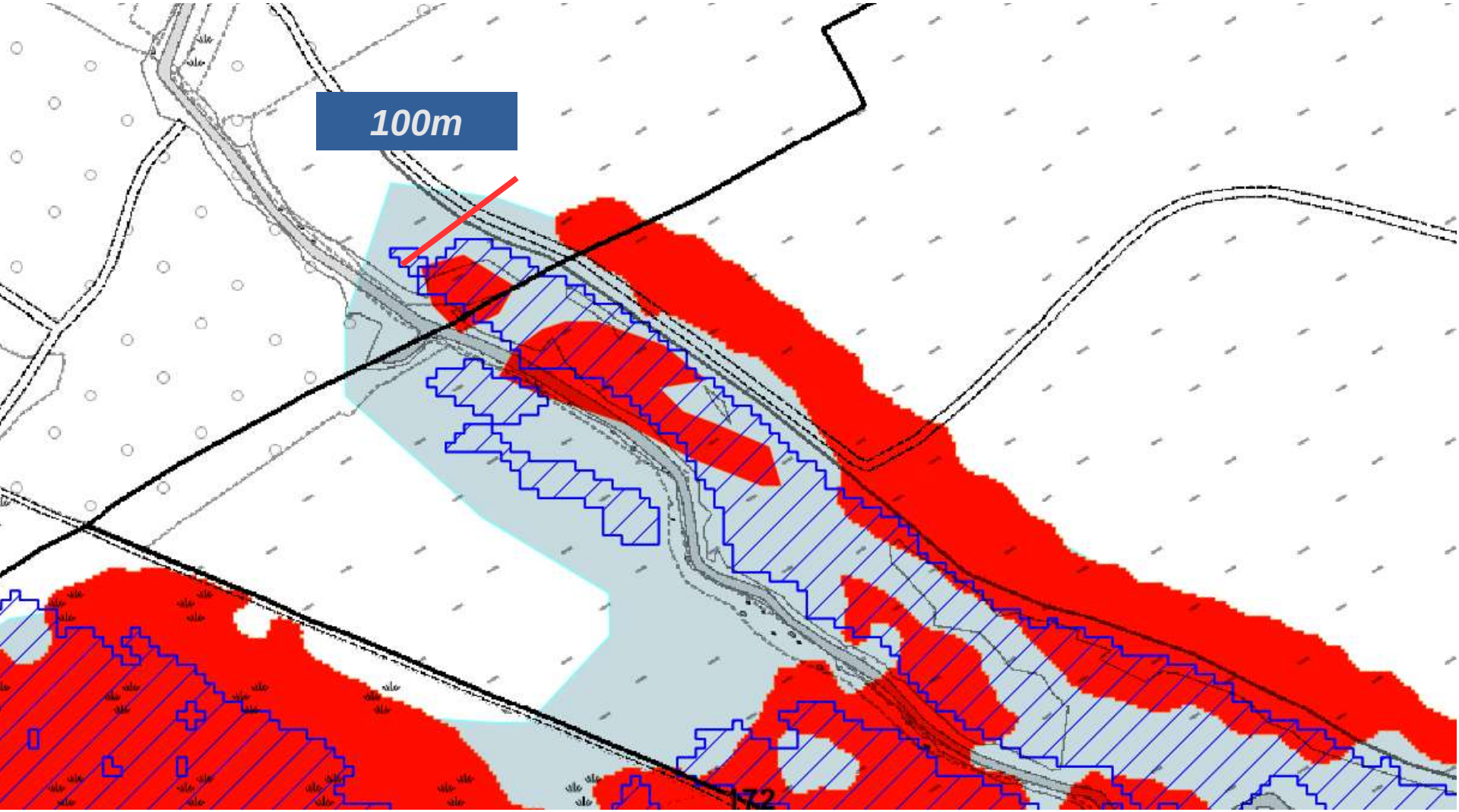
Other data:
CIMA flooded areas
Field survey




Torrazza Piemonte
Chivasso
Verolengo
Crescentino
Castagneto Po
San Sebastiano da Po
Monteu da Po
Verrua Savoia
Lauriano
Brusasco
Cavagnolo
Casalborgone
Rivalba
Tonengo
Moransengo
Robella


Gora dei Molini
Canale del Como Chiero
Fiume Po
S.Sebastiano da Po
Staz.ne di San Sebastiano da Po
Legenda
CIMA - csk
Flooed area
emrs192_crisis_information
Flooded Area
Field Survey
Flooded area

Use of products: 21-26 november 2016 flood



Po flooded area from Castagneto to Verrua Savoia (about 13 km)

Field survey	*18,8 sq km*
EMS	*7,7 sq km*

EMS/Field survey 40,9%

Georeferencing differerence about 100m

Cima and EMS elaborations have a good match (same area identified as flooded)

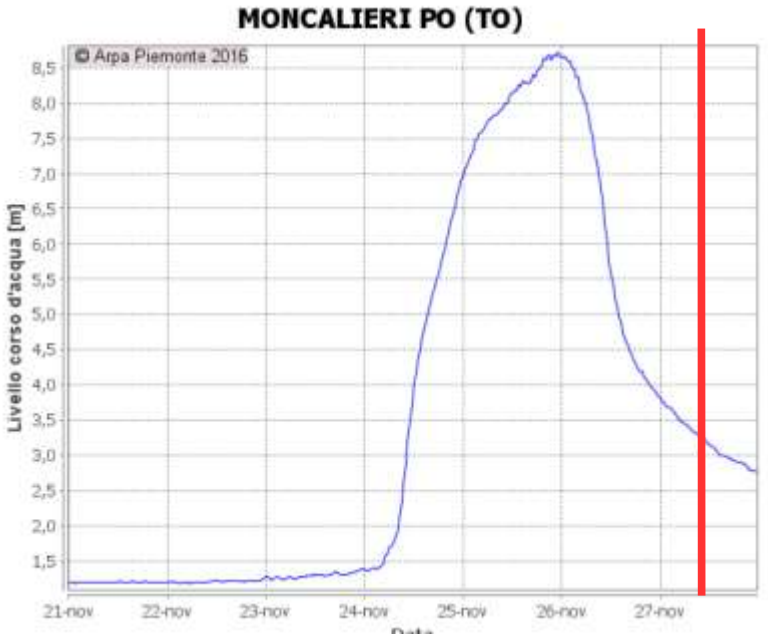
Both have a good match with field survey

Location: Chisola-Po confluence (Moncalieri & Turin Municipalities)

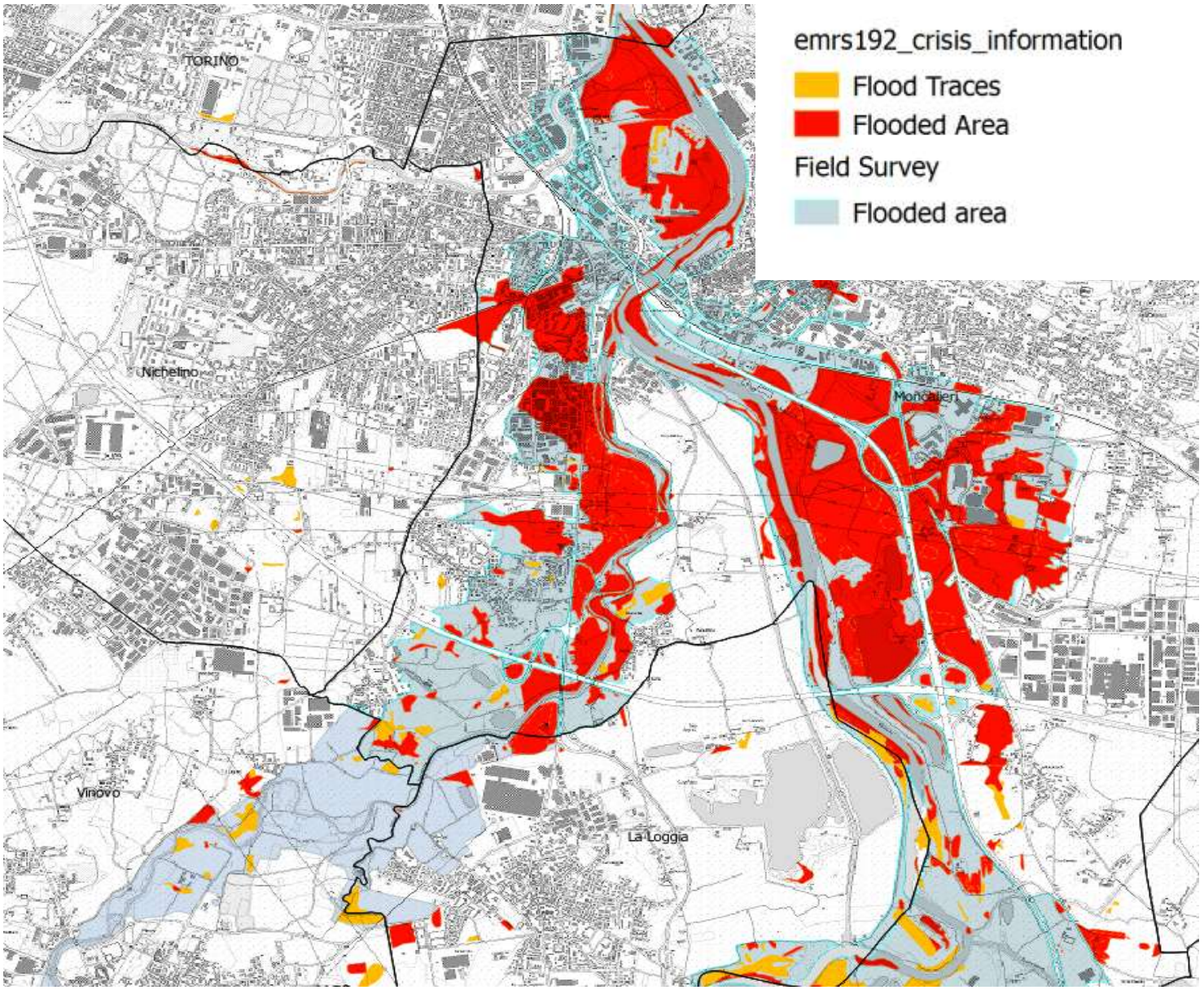
Map type: Grading

Platform: Pleiades (very high resolution optical data)

Imagery date: 2016-11-27 16:37



Use of products: 21-26 november 2016 flood



Chisola - PO Flooded at N of Highway

Field survey	***9,2 sq km***
EMS	***5,3 sq km***

EMS/Field survey
57,6%

High match form EMS, CIMA and Arpa survey

No false positives (all areas indicated as flooded confirmed by field survey)

- ***Copernicus EMS is very useful data in our work***
- ***In this two cases we work on wide areas. Satellite data is the right tool to quickly cover large areas. Consider extending the imagery acquisition area as much as possible.***
- ***The availability of raw data are fundamental (TIFF, WMS, TMS, and WFS), maintaining imagery and vector data separated***
- ***Avability of very high resolution optical data (SPOT, Pleiades and airborne imagery) are a remarkable added value in our work***

- ***Arpa can contribuite to provide detailed field data that can be used for validation in order to improve future analisys***

- ***Arpa Technicians have a in-depth knowledge of the hazards and natural processes affecting the Piedmont territory, so they can provide an expert reading key to understand EMS data***

- ***Arpa and Regional Cartographic Department detain many others "base and tematic" data available for integration into Copernicus data***

THANKS FOR THE ATTENTION

Contatti: sigeo@arpa.piemonte.it

A special thanks to:
- *Simone Dalmasso (JRC) for kindly support to our work*
- *All Regional & Arpa collegues of* "flood working group"
- *All friends of* "ERIKUS working group"