3.5「降雨による地すべり予測・警戒システム」

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SANF: A National Warning System to Forecast Rainfall Induced Landslides

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MOTIVATION

In Italy, landslides have caused 17,610 casualties (deaths, missing persons, injured people) between 843 and 2012, …

… of which at least 6,505 between 1950 and 2012.

Casualties due to landslides were 36 in 2011, and 17 in 2012.

Giampilieri, 1 Ottobre 2009

GOALS

- **Scientific goal …**

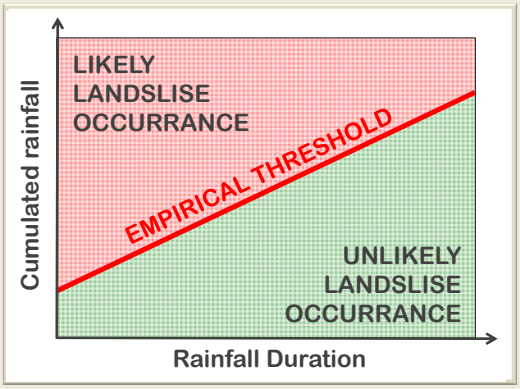
  … study of the conditions that trigger rainfall-induced landslides and the definition of empirical rainfall thresholds.

- **Operational goal …**

  … design of a national warning system to forecast the possible occurrence of rainfall induced landslides.

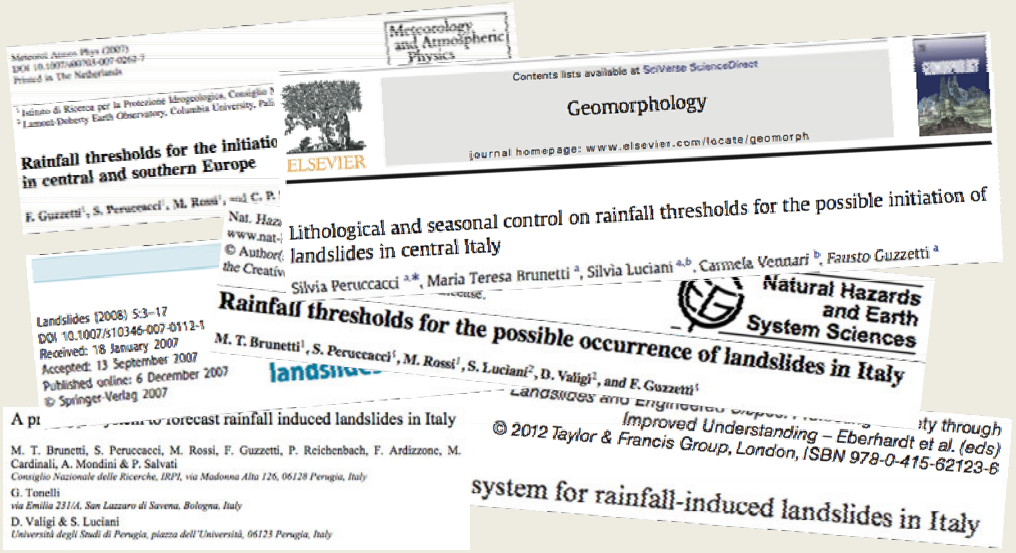
RAINFALL THRESHOLD

For rainfall-induced landslides, a **threshold** may define the amount of rainfall that, when reached or exceeded, is likely to trigger landslides.



- **Empirical** thresholds are obtained analyzing past rainfall events that have resulted in landslides.

RESEARCH & DEVELOPMENT



LANDSLIDE CATALOGUE

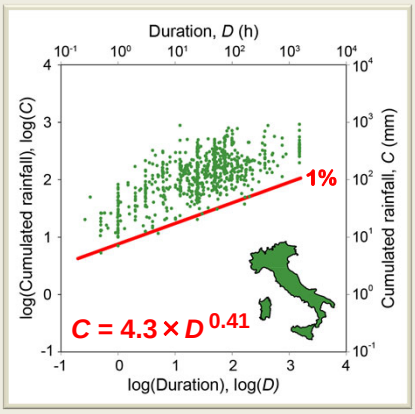
- Catalogue of more than 2300 rainfall events that have resulted in landslides in Italy.

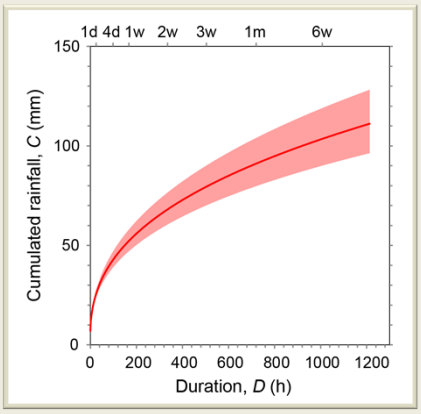
INFORMATION SOURCES

- National, regional and local newspapers.
- Blogs and on-line sources.
- Reports of local Fire Brigades.
- Reports of CCISS (agency that provides traffic and travel information).

NATIONAL THRESHOLDS

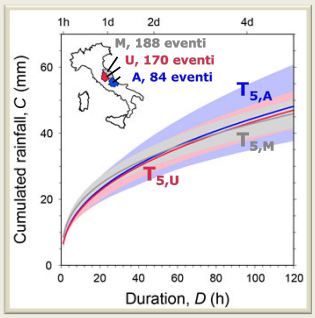
- Reproducible Cumulated event rainfall–rainfall duration (*CD*) thresholds, including the parameter uncertainty



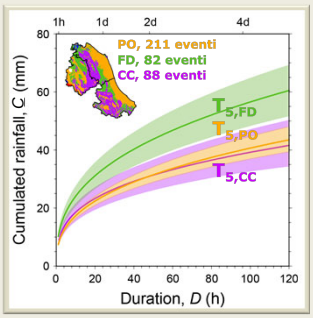


THRESHOLDS FOR CENTRAL ITALY

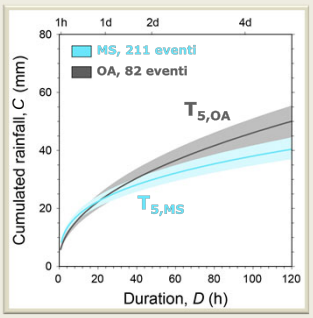
Regional thresholds



Lithological thresholds



Seasonal thresholds



442 rainfall events that triggered 573 landslides between February 2002 and August 2010.

150 rain gauges.

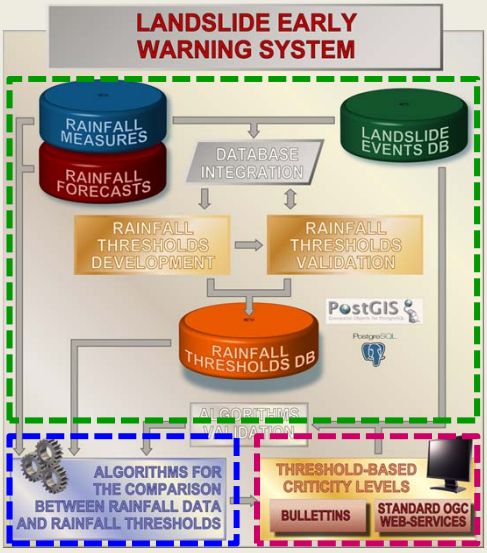
SYSTEM LOGICAL FRAMEWORK

The system compares **rainfall measurements** and rainfall **estimates** with empirical rainfall **thresholds**.

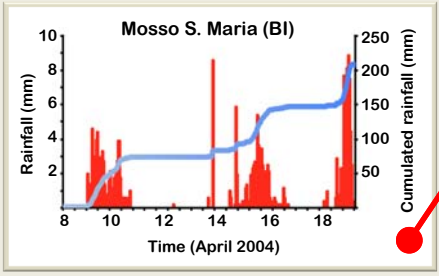
Input and Storage

Analysis

Output and Delivery



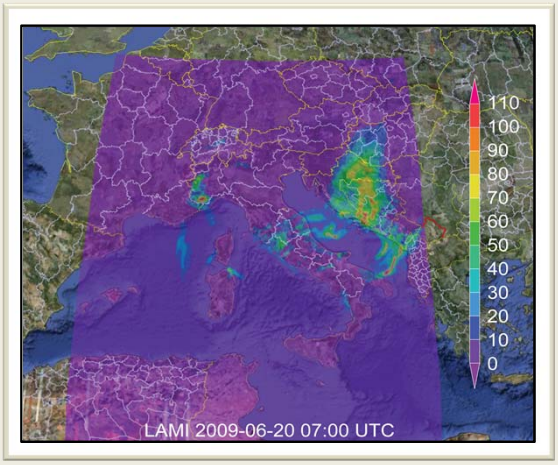
RAINFALL MEASUREMENTS



Every 6 hours, rainfall measurements obtained from 1950 rain gauges in Italy are stored in the system.

RAINFALL FORECASTS

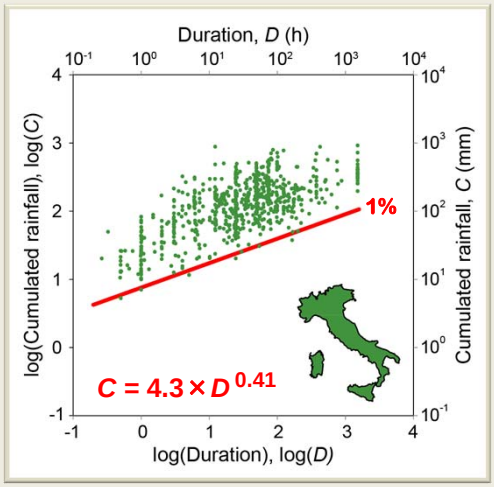
Every 12 hours, 72-hour rainfall forecasts produced by a Local Area Model (LAMI) are stored in the system.



NATIONAL THRESHOLD

The system uses a single *CD* empirical threshold.

The threshold corresponds to a 1% exceedence probability level.



CRITICAL LEVELS

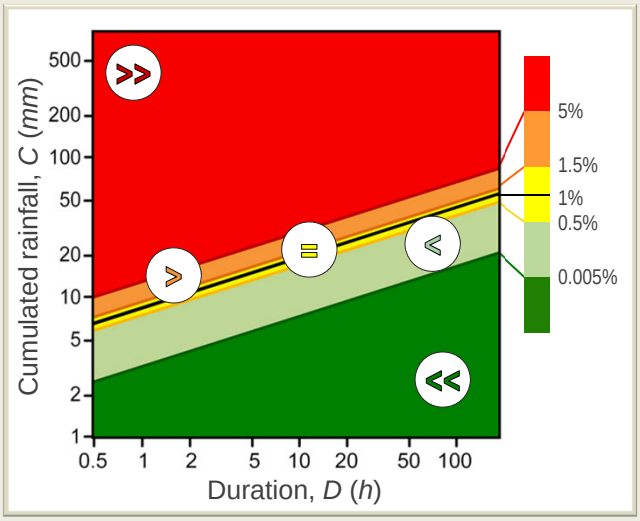
Well above the threshold

Above the threshold

On the threshold

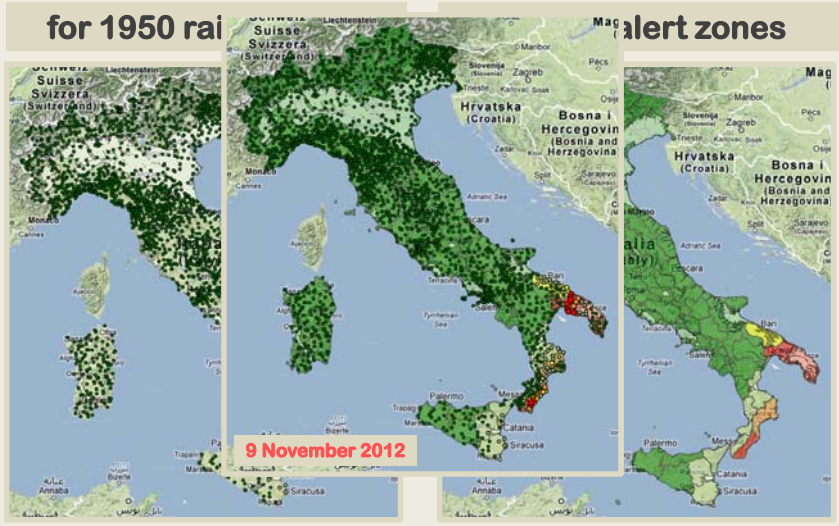
Below the threshold

Well below the threshold

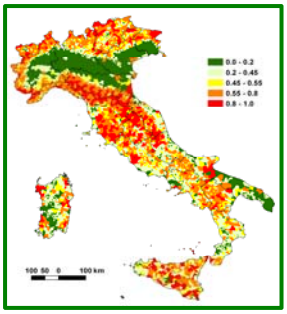


A FORECAST

for 1950 rai … alert zones



CONSIDERING SUSCEPTIBILITY

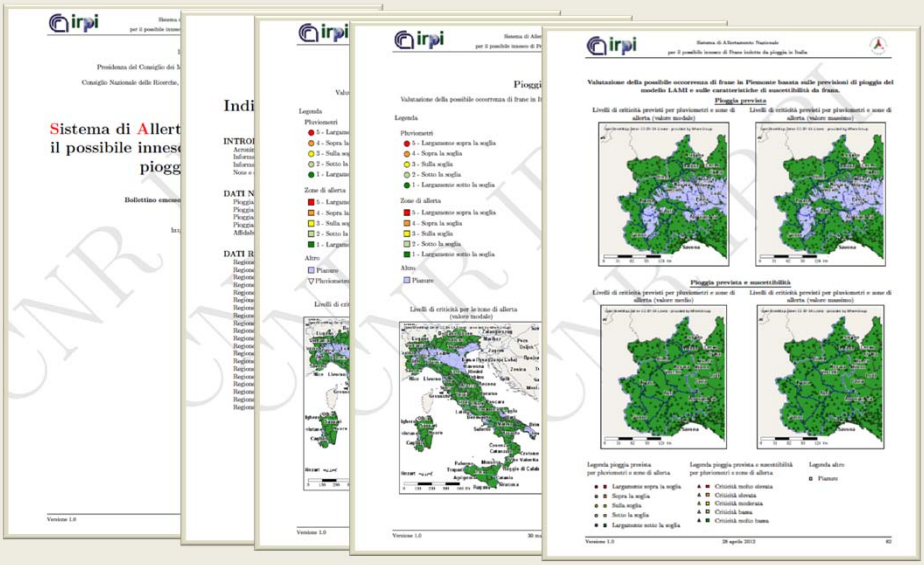
RAINFALL FORECAST		LANDSLIDE SUSCEPTIBILIY		COMBINED FORECAST
	×		=	

CONSIDERING SUSCEPTIBILITY

RAINFALL FORECAST

COMBINED FORECAST

BULLETTIN



WEB SITE

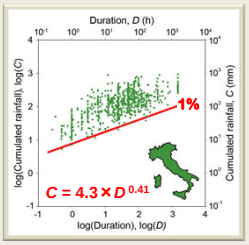
ADVANCEMENTS NEEDED

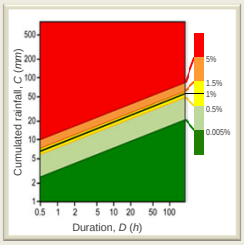
Several problems affect the system …

… possible solutions:

- More frequent forecasts
- Use of new regional / local thresholds
- Integration of different rainfall forecasts
- Better integration of landslide susceptibility
- Integration with vulnerability criteria

… thank you.





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