Measuring Extreme Events and Disasters
Case study: Italy

Objective: case studies provide a general overview of disaster-related data management in the country, including an analysis of strengths and weaknesses, opportunities and threats.

1. Overview of major national disaster risks
   • Types, frequency, magnitude, impacts, etc.
   • Recent disaster, and related data availability and information requirements

2. The institutional set-up to manage disaster risks
   • Mandate of the different institutions and role of NSO

3. Information management and data flows
   • Main purposes and main users of disaster-related information
   • Types and quality of information needed in different phases of disaster risk management
   • Use of different tools: Earth observation, use of other types of big data, statistical surveys, etc.
   • Institutional roles in the information management
   • Strengths and weaknesses, opportunities and threats

4. Future work, planned outcomes and recommendations
Italy is a country with high risk of natural disasters. Even this summer the country has been hardly hit by disastrous events:

**Focus on:**
- Geophysical: earthquakes
- Geophysical: landslides
- Hydrological: floods
- Climatological: forest fires
- Risk connected to Climate Change (heat wave, drying, extremely rainy days)

**Vulnerability determinants:**
- geological, morphological, hydrographical characteristics
- significant anthropization of the territory
- effects of climate change

**Integration of data is crucial:**
- data on occurrence and severity of extreme events and disasters
- data on territory, population, environmental, infrastructure
- risk analysis (Hazard, Exposure, Vulnerability)

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**Mandate of the different institutions and role of NSO**

**Official Statistics are available but scattered all over several institutions,** adopting different approaches and produced - during the years - for different purposes.

A review the institutions involved for several categories of risk conducted by the UNECE TF MEED (April’16) investigated the role of NSOs and the development of countries for MEED statistics:

- **Istat, Ispra, INGV, MATTM, MiBACT & competence centers,**
- **Regional geological surveys, CNR, Hydrographic districts, CFS,**
- **CREA, Italian Glaciological Committee**

**Statistics availability:**
- **On occurrence:** statistics are available for geophysical hazards, such as earthquake, mass movement, volcanic activity, for hydrological hazards, such as floods, landslide, wave action, even if differently organized among institutions and different type of risk; databases are not enough aligned at the moment
- **On impacts:** suffer of lack of coverage and homogeneity

→ **Official Statistics could be helped by a common reference framework:**
- the UNECE task force MEED, the SENDAI framework and the SDGs represent an important incentive to strengthen official statistics in an integrated systematic manner

**Istat with other institutions Ispra INGV MATTM MiBACT DPC #casaitalia #italiasicura ...**

is participating at national platforms aimed to implement what international frameworks suggests, increasing homogeneity and standardization of methodologies and terminology in order to produce international comparable official statistics and the required indicators with the integration of data from all institutions involved
Following the tragic series of earthquakes occurred in central Italy in August 2016, Casa Italia was established by the Italian Government as a mission structure dedicated to prevention and security against natural risks.

**Purpose:** realization of a broad plan for the care of the national building stock, of the Italian territory and of its urban areas, with the final aim of improving the safety of citizens and of public and private assets.

The primary task: defining the national policies for the promotion of prevention from natural risks outlining the organization of the structure that will take on the task of implementing these policies.

**The action of Casa Italia is structured into four major areas of intervention:**

1. data alignment and integration
2. experimentation with innovative solutions for prevention
3. definition of financial needs and financing instruments
4. adoption of an information and training policy

In the following, we focus on area (1), data alignment and integration.

Quality of living was identified as of primary importance for the mission of Casa Italia, with a particular emphasis on policies for the promotion of security of residential buildings against natural risks (seismic, hydrogeological, volcanic and meteorological).

The key idea is that of a multi-hazard approach to risk, focusing on the security of places where people live rather than on the individuals.

**Integrating and enhancing together with Istat the information on natural risks already available:**

ISTAT, INGV, ISPRA, ENEA, CNR, MIBACT, …

Unified and integrated vision of the natural risks insisting on Italian territory, with reference to the three factors that compose the risk, i.e., hazard, vulnerability, exposure.

Database that (a) were elaborated by official and national research institutes, (b) had coverage of the entire national territory, and (c) had a spatial resolution sufficient to allow identification and comparison of local specificities (municipality).

The available information is rich but highly fragmented and dispersed and not always homogeneous.

Establishing a national database is a first key element to foster an integrated and multi-hazard vision of the natural risks and social vulnerability of the Italian Municipalities with the aim to design national policies for the mitigation of risks, and the identification of priority interventions.

The information (data and summary indicators) can be visualized on interactive maps. Future developments will aim at refining the space resolution, moving to the scale of the single building. This requires an intense activity of data integration and fusion, associated with non-trivial statistical and computational issues.

The first product of this broad collaboration is the Map of Risks for Italian Municipalities.
Istat and Casa Italia: Risk Map

Istat and Casa Italia provide an integrated information framework on natural hazards in Italy. High quality variables and indicators at the municipal level, allowing a comprehensive view of the risks of exposure to:
- Earthquakes, Volcanic eruptions
- Landslides and Floods

Integration of data from various institutional sources:
- Istat (Italian National Institute of Statistics)
- INGV (National Institute of Geophysics and Vulcanology)
- ISPRRA (Italian National Institute for Environmental Protection and Research)
- MiBACT (Ministry of Cultural Heritage and Activities and Tourism)

For each municipality, the data on seismic, hydrogeological and volcanic risk are accompanied by demographic, housing, territorial and geographical information.

http://www.istat.it/it/mappa-rischi

Expert Forum for producers and users of climate change-related statistics (3-5 October 2017, Rome - FAO)
Data availability: Hydrogeological - Floods and Landslides

The ISPIRA 233/2015 Report provides a complete overview of the landslide and flood hazard across the national territory and contains risk indicators related to population, industry and services, Cultural Heritage

It provides an official framework for landslide and flood risk in Italy, producing also data on victims and an important tool to support national mitigation policies by identifying intervention priorities, allocation of funds and programming mitigation measures.

The hazard data is derived from the national ISPRA mosaics of the - Landslide hazard zones of the River Basin Plans (PAI): harmonization of the PAI legends in 5 classes: very high hazard P4, high P3, medium P2, moderate P1 and AA attention zones
- Flood hazard zones according the Legislative Decree 49/2010 (transposition of the 2007/60/EC Flood Directive) mapped by the River Basin Authorities: it refers to the 3 flood hazard scenarios defined by the legislation: high P3 with return period between 20 and 50 years (frequent floods), medium P2 with return period between 100 and 200 years (low frequency floods) and low P1 (low probability of floods or extreme event scenarios).

The ISPRA 233/2015 Report provides a complete overview of the landslide and flood hazard across the national territory and contains risk indicators related to population, industry and services, Cultural Heritage

- online publication of maps on the ISPRA Geoportal
- on the Italia Sicura platform
- recently also in the new platform Risk map of Italian municipalities made by Casa Italia

Expert Forum for producers and users of climate change-related statistics (3-5 October 2017, Rome - FAO)

Data availability: Earthquakes 1/4

Earthquakes source: INGV
INGV products: several platforms – data bases, with different pourposes
Information useful for all phases: pre-during–post event

On real time earthquake list
Earthquakes (>=2 mag)

The Italian Seismic Bulletin
Starting from 2015 The Italian Seismic Bulletin (BSI) is published every 4 months. It contains additional data and information on the events occurred and data are validated at an higher level!
Last May – August 2016

The Parametric Catalogue of Italian
Earthquakes 2015 (CPTI15)
Provides homogeneous macroseismic and instrumental data and parameters, for Italian earthquakes with maximum intensity ≥ 5 or magnitude ≥ 4.0 in the period 1000-2014

The catalogue of strong earthquakes from 461 B.C. to 1997 in Italy and Mediterranean Area 760 B.C. to 1500

Expert Forum for producers and users of climate change-related statistics (3-5 October 2017, Rome - FAO)
Beyond the technical parameters, the **CATALOGUE OF STRONG EARTHQUAKES** contains important information on impacts, such as the major earthquake effects, but not always compiled and 'textual'. More efforts are required to make this information 'statistically useful'.

> Beyond the occurrence of earthquakes per year and by region, there are not systematically data collected on the impacts on population, dwellings, infrastructure, agriculture, etc. This information should be strengthen and statistically organized.

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**Data availability: Earthquakes 2/4**

**CATALOGUE of STRONG EARTHQUAKES**

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**Data availability: Earthquakes 3/4**

Every year Istat publish the number of the seismic movements (≥ 4.0) by magnitude class in Italian Statistical Yearbook (ASI 2016) [http://www.istat.it/it/archivio/194422](http://www.istat.it/it/archivio/194422). Seismic movements with magnitude equal or higher than 4.0 per magnitude class:

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<th>Year</th>
<th>4.0-4.4</th>
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Source: Istituto nazionale di geofisica e vulcanologia (INGV)

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**Data availability: Earthquakes 4/4**

In the summary of historical statistics (2011) time series of 60 years reconstructed: 1950-2009 [http://www3.istat.it/dati/catalogo/20120118_00/cap_1.pdf](http://www3.istat.it/dati/catalogo/20120118_00/cap_1.pdf). Every year Istat publish the number of the seismic movements (≥ 4.0) by magnitude class in Italian Statistical Yearbook (ASI 2016) [http://www3.istat.it/dati/catalogo/20120118_00/cap_1.pdf](http://www3.istat.it/dati/catalogo/20120118_00/cap_1.pdf). Seismic movements with magnitude equal or higher than 4.0 per magnitude class:

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Source: Istituto nazionale di geofisica e vulcanologia (INGV)
Characteristics of the territories affected by the earthquake
August 24, October 26/30 2016, January 18th 2017

Tables of data and statistical indicators from various sources and surveys, referring to the last available year.

Provide an overview of the socio-economic situation of the territories before the seismic event.

The thematic areas covered are:

- Territory
- Water resources
- Population and buildings
- Agriculture
- Industry and services
- Territorial economic accounts
- Cultural heritage and tourism

Data from several surveys + Cartographic elaborations from data from the Digital elevation model + space spatial statistics for the altitude bands identified by GIS + business map database Tom Tom

Data availability: Earthquakes

ESTIMATING EARTHQUAKE DRIVEN LEISURE AND CULTURAL TOURISM LOSSES AROUND THE CRATERE AREAS IN CENTRAL ITALY

Recent earthquakes in central Italy not only produced serious damage to seismic crater areas but also caused indirect damages in distant areas not, or slightly, affected by the seismic activity.

Risk perception of the events, also influenced by media communication, has in fact determined a sort of “homogeneous risk region” in collective imagination.

This perceived geography caused considerable damage to local economies, particularly in the field of tourism and culture.

The purpose of this exercise is to carry out a preliminary estimate of the above cited indirect losses suffered by economic operators in the municipalities not directly affected by earthquake damage in the Umbria, Marche, Abruzzo and Lazio regions (NUTS2).

Methodology of analysis
Georeferencing and Integration of:
- data on magnitude of earthquakes (Ingv)
- data on tourist arrivals (Istat)
- data on museums, monuments and archaeological sites (Istat).

In order to ensure an updated representation of the situation, interviews were also conducted with some of the most performing museums in the area.

Technique of analysis
7 polygonal buffers were identified at geometric distances of 5 to 50 km from the seismic crater. Prevalent direction of tourists decrease was highlighted and confirmed for visitors of museums. The comparison with the very different direction of earthquake shock epicenters and the seismic risk map, found no rational reason for the losses, unless the location in the same NUTS2.

Conclusions
The analysis carried out, while still preliminary, shows a significant gap between the perception of the risk and its assessment and quantification. It also shed light on the importance of considering a pool of different data in the calculation of economic - both direct and indirect - losses due to seismic events. It also confirm the power and the usefulness of cartographic representation of data.
Data availability: Indices on Extreme Climate Events

International methodological framework
Expert Team on Climate Change Detection and Indices (ETCCDI)
- provides international coordination/collaboration on CC detection, Indices relevant to CC detection, specific methodologies
- encourages modelled data and observations comparison at different spatial scale
- http://etccdi.pacificclimate.org/list_27_indices.shtml

Indices based on Temperature and Precipitations
- Summer days
- Tropical nights
- Warm days
- Warm nights
- Warm spell duration
- Frost days
- Cool days
- Cool nights
- Cold spell duration
- Rainy days
- Very intense precipitation days
- Extremely intense precipitation days
- Consecutive days with rain
- Consecutive days without rain
- Precipitation on very rainy days
- Precipitation on extremely rainy days
- Annual total precipitation in wet days

Risk connected to Climate Change:
heat wave, drying, extremely rainy days...

Data Availability: Forest Fires

Every year Istat provides the number of forest fires by Regions
- Number
- Surface covered
  - wooded
  - not wooded


Source: Corps Forestale dello Stato, Settore AIB e Protezione Civile

Expert Forum for producers and users of climate change-related statistics
(3-5 October 2017, Rome - FAO)
#ItaliaSicura – National Plan

## SafeSchools

Schools security:
- extraordinary maintenance
- compliance to antiseismic regulation
- removal of asbestos
- rem. of architectural barriers

## The NATIONAL PLAN of WORKS and INTERVENTIONS and THE FINANCIAL PLAN FOR THE REDUCTION of HYDROGEOLOGICAL RISK

italiasicura.governo.it/site/home/dissesto/documento1041.html

## Civil Protection National Service: mission

The Civil Protection National Service aims at safeguarding human life and health, goods, national heritage, human settlements and the environment from all natural or man-made disasters, through a complex system of structures and competences.

### Risk: Seismic, Volcanic, Hydro-geological, Forest fires, Technological Industrial and nuclear, Environmental

### Operations aimed at fulfilling the basic needs of the population affected by the event based on previously elaborated emergency policy plans

### Intervention aimed at restoring normal life conditions

### Analysis of causes aimed at identifying risk typologies and areas affected by risks

### Forecasting

### Prevention

### Emergency relief

### Recovery

Expert Forum for producers and users of climate change-related statistics
(3-5 October 2017, Rome - FAO)
NATIONAL COORDINATION FOR THE PURPOSE OF DISASTER RISK REDUCTION

ITALIAN PLATFORM GOVERNANCE

Following the HFA 2005-2015 (in line with the Sendai framework 2015-2030) Prime Minister’s Decree n. 66/2008 calls the Civil Protection Department to coordinate Ministers and other relevant institutions on disaster risk reduction policies in coordination with UNISDR

Sendai / SDGs indicators implementation for EED

Monitor and report on progress in achieving key goals and targets of international policy frameworks:

- the Sendai Framework
- the Sustainable Development Goals (SDGs) of the 2030 Agenda

Goal 1. End poverty in all its forms everywhere
Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable
Goal 13. Take urgent action to combat climate change and its impacts
SDG 1.5.1 (repeat of 11.5.1 and 13.1.1): Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population

A1 (compound) - N. of deaths and missing persons attributed to disasters, per 100,000 population
B1 (compound) - N. of directly affected people – people injured or ill, with damaged/destroyed dwellings, whose livelihoods were disrupted or destroyed - attributed to disasters, per 100,000 population

SDG 1.5.2 Direct economic loss attributed to disasters in relation to global gross domestic product (GDP)

C1 (compound) - Direct economic loss attributed to disasters in relation to global gross domestic product - agricultural loss, productive assets, housing sector, critical infrastructure, cultural heritage

D1 (compound) - Damage to critical infrastructure – health and educational facilities, critical infrastructure-attributed to disasters (N.)
D5 (compound) - N. of disruptions to basic services - health and educational services, other basic services - attributed to disasters

SDG 1.5.3 (repeat of 11.b.1 and 13.1.2) Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015-2030

E1 - Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015-2030

SDG 1.5.4 (repeat of 11.b.2 and 13.1.3) Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies

E2 - Percentage of local governments that adopt and implement local disaster risk reduction strategies in line with national strategies

UN-ECE TF Climate Change Related Statistics Indicators (CCRSI)

<table>
<thead>
<tr>
<th>Area Sub-area No. Indicator</th>
<th>Tier</th>
<th>Sendai Framework indicator</th>
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</thead>
<tbody>
<tr>
<td>Physical Conditions 16 Annual average surface temperature</td>
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<td></td>
</tr>
<tr>
<td>17 Percentage of land area suffering from unusual wet or dry conditions (Standard Precipitation Index)</td>
<td>1</td>
<td></td>
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<tr>
<td>Water resources 18 Water storages: freshwater withdrawal in a proportion of available freshwater resources</td>
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<td>SDG Indicator 6.4.1 (tier 1)</td>
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<tr>
<td>19 Total carbon, nitrogen, phosphorus and sulfur in the soil</td>
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<tr>
<td>20 Carbon stock in soil</td>
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<tr>
<td>21 Proportion of land that is degraded over total land area</td>
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<tr>
<td>Extreme Events and Disasters 22 Number of deaths and missing persons attributed to hydro-meteorological disasters, per 100,000 population</td>
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<td>SDG Indicator 1.5.1 (tier 2), 11.5.1 (tier 2) and 13.1.2 (tier 2) Sendai Framework Indicator: A-1</td>
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<td>24 Direct economic loss attributed to hydro-meteorological disasters in relation to GDP</td>
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<td>Human settlements and human health 25 Number of people whose destroyed dwellings were attributed to hydro-meteorological disasters</td>
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<td>SDG Indicator B-4</td>
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<td>26 Distribution of cases of vector borne diseases</td>
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<td>27 Mean related mortality</td>
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<tr>
<td>Agriculture, forestry and fisheries 28 Direct agricultural loss attributed to hydro-meteorological disasters</td>
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</tbody>
</table>

Expert Forum for producers and users of climate change-related statistics (3-5 October 2017, Rome - FAO)
SDGs indicators in Italy

- SDGs first release in December 2016, updated and integrated May 2017
- 100 SDGs indicators are covered out of the 173 available: 49 Tier I, 33 Tier II, 16 Tier III, 2 not classified
- 45 indicators are identical to those internationally defined
- 55 similar or partial or context (i.e. where not all data are available, or where available data do not exactly meet the specifications required)
- 38 Indicators of Sustainable and Equitable Well-being (BES)

The implementation process is still in progress

Indicators on EED a challenge and an opportunity

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(3-5 October 2017, Rome - FAO)

Conclusions: Istat Road Map to Disaster Risk Reduction (DRR)

**Increasing information need:** from data produce statistics that are comparable over time and across borders, produced in accordance with international standards

**Integration and multipurpose approach from different perspectives:**
- multihazard: hydrological, meteorological, geophysical, climatological, organic, chemicals, sociocultural, technological, biological...
- all determinants of risk (Hazard, Exposure, Vulnerability)
- different phases of disaster risk management (DRM)
- impact information and not only on occurrence
- all statistical domain involved: economic+social+environmental
- different ‘type’ of data sources: integrated archives, big data, geostatistical info

> ALIGN ALL RELEVANT COMPONENTS

**NSS** has to work on these challenges that can become an opportunity

Istat and Sistan is supporting the process to develop and implement the global frameworks, contributing to the definition of the set of indicators, implementing an analysis of the statistical information demand and the recognition of existing statistis

Istat and Sistan continue the work in order to implement the indicators, giving priority to indicators that are in common framework (MEED/CCRS/SENDAI/SDGs)

Istat coordinates the provision of official statistics produced by the various institutional agencies participating in the National Statistical System (Sistan)
Thanks

Angela Ferruzza
Giovanna Tagliacozzo

Department of statistical production
Directorate for territorial and environmental statistics
Flowchart Terminology Extreme Events and Disasters

- Greenhouse gases
  - Red Tide
  - Epidemic
  - Infections
  - Bacterial disease
  - Fungal disease
  - Parasitic disease
  - Prion epidemic
  - Viral epidemic
- Forest fire
  - Airburst
  - Energetic particles
  - Geomagnetic storm
  - Riot radio shock wave
- Avalanche
  - Landslide
  - Earthquake
  - Earth movement
- Lava flow
  - Lava lake
  - Pyroclastic flow
- Tsunami
  - Flood
  - Storm surge
- Cyclone
  - Tropical storms
  - Hurricanes
  - Gale force
  - Storm
  - Freezing rain
  - Hail
  - Drought
  - Floods
- Haze, smoke
  - Fog
  - Snow
  - Ice
  - Sandstorm
  - Cyclone
  - Gale force
- Air pollution
  - Dust storm
  - Haze
  - Haze
  - Smoke

R2. Which organizations/institutions/agencies are involved in the measurement of the occurrence of the following hazards?

- Expert Forum for producers and users of climate change-related statistics (3-5 October 2017, Rome - FAO)
**Expert Forum for producers and users of climate change-related statistics**

(3-5 October 2017, Rome - FAO)

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- [https://ebiblio.istat.it/digibib/annuario/statisticaitaliano/RAV0040597ASI1939.pdf](https://ebiblio.istat.it/digibib/annuario/statisticaitaliano/RAV0040597ASI1939.pdf)