



POLITECNICO
MILANO 1863

Challenges & gains of post-event data collection

Flood Impacts Observation – Montpellier, France, 5-7 November 2019

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Objective and outline of the presentation

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To **share lessons learnt** from the experience gained by the Interdepartmental group on flood damage (GRID) of Politecnico di Milano **on ex-post data collection and analysis** in Italy

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Outline:

1. Problems in available data on past flood events
2. The RISPOSTA procedure for the ex-post collection of flood (damage) data
3. Advantages of using RISPOSTA
4. Challenges in implementing RISPOSTA

Example I: analysis of data for calibrating/validating depth-damage functions (residential buildings)

Tiber alluvial fan (Umbria)



Riverine flood on 25-28, November, 2005

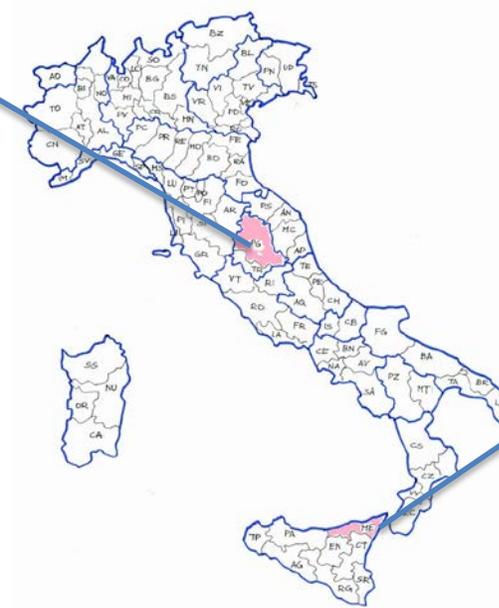
Estimates by technicians
(35 residential buildings)

Barcellona Pozzo di Gotto (Sicily)



Flash flood on 22nd, November, 2011

Report by affected citizens
(577 residential buildings)



Example I: analysis of data for calibrating/validating depth-damage functions (residential buildings)

| | Required data (for every affected item) | Available data | |
|---------------|---|--|---|
| | | Barcellona | Umbria |
| Hazard | <ul style="list-style-type: none"> • Water depth at building location | <ul style="list-style-type: none"> • Water depth at building location (<u>52 of 577 affected items</u>) • Extent of flooded area | <ul style="list-style-type: none"> • Water depth at building location (<u>22 of 35 affected items</u>) • Extent of flooded area |
| Exposure | <ul style="list-style-type: none"> • Buildings surface • Buildings economic value | | <ul style="list-style-type: none"> • Buildings surface (<u>16 of 35 affected items</u>) |
| Vulnerability | <ul style="list-style-type: none"> • Explicative vulnerability parameters (context specific) | <ul style="list-style-type: none"> • Typology of building (<u>all 577 affected buildings</u>) | <ul style="list-style-type: none"> • Presence of basement • Number of stories • Use of basement • Level of maintenance (<u>all 35 affected buildings</u>) |
| Damage | <ul style="list-style-type: none"> • Monetary value • Location | <ul style="list-style-type: none"> • Location (i.e. address) • Types of damage | <ul style="list-style-type: none"> • Monetary value • Location (i.e. address) • Types of damage |

Example I: analysis of data for calibrating/validating depth-damage functions (residential buildings)

| | Required data (for every affected item) | Available data | |
|---------------|---|---|--|
| | | Barcelona | Umbria |
| Hazard | • Water depth at building location | • Water depth at building location (52 of 577 affected items) • Extent of flooded area | • Water depth at building location (22 of 35 affected items) • Extent of flooded area |
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| Damage | • Monetary value • Location | • Location (i.e. address) • Types of damage | • Monetary value • Location (i.e. address) • Types of damage |

Challenges in the use of data:

- Limited information on the monetary value of damage
- Limited information on damage explicative variables
- Estimation of hazard variables by means of hydrologic/hydraulic modelling is time consuming & not always feasible
- Estimation of exposure and vulnerability variables is hampered by the lack of updated (past) thematic data
- Original data (in papery form) were not accessible/ lost → summary sheets
- Different reliability and level of details of the datasets
- Qualitative data

} Lack of standardisation

Example I: analysis of data for calibrating/validating depth-damage functions (residential buildings)

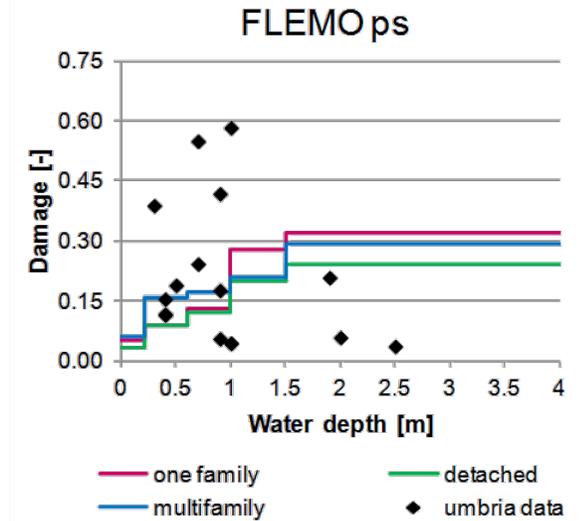
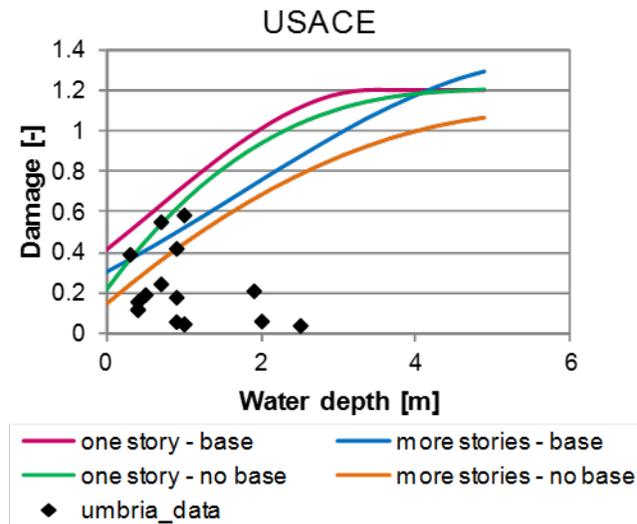
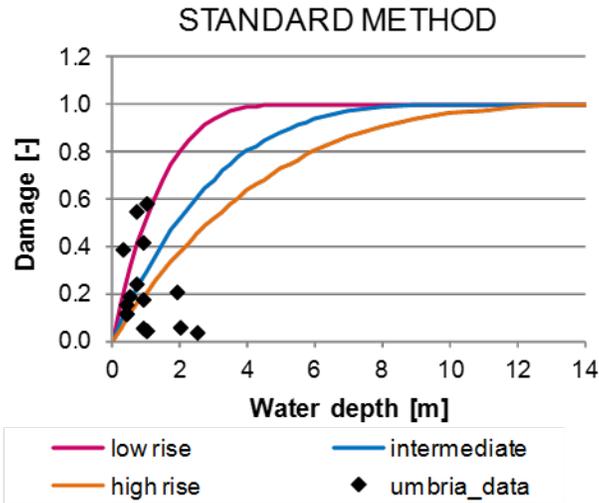
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 - Different reliability and level of details of the datasets
 - Qualitative data
- } Lack of standardisation

Available data were inadequate to calibrate/validate depth-damage curves

Example I: analysis of data for calibrating/validating depth-damage curves (residential buildings)



| | Total data | Usable data |
|-----------------|------------|-------------|
| Andrè et al. | 4000 | 358 (9%) |
| Molinari et al. | 612 | 16 (3%) |

- Complete data were too scattered to identify a trend
- Complete data (16 in total) were few for the validation of existing curves or the definition of new ones

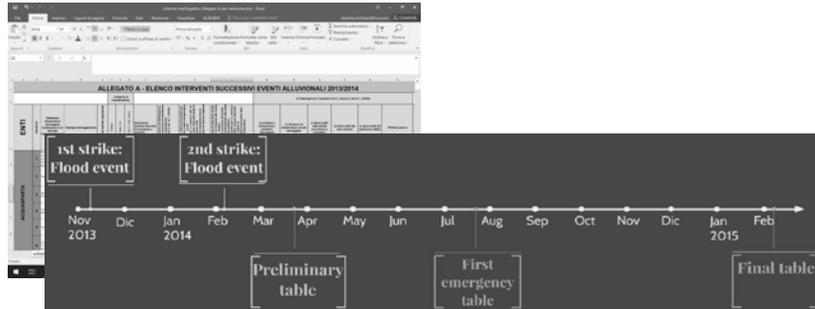
Example II: analysis of data for the reconstruction of the flood impact scenario (all public and private exposed items)

Case study: Umbria floods in nov 2013 & feb 2014

Available data: regional reporting sheets for the request of national compensation at different times after the event (data collected by the regional Authority from municipalities/utility companies)

| ALLEGATO A - ELENCO INTERVENTI SUCCESSIVI EVENTI ALLUVIONALI 2013/2014 | | | | | | | | | | |
|--|--|---|-------------------------|--------|--|--|--|------------------------------------|--------------------------------------|----------------|
| ENTI | PROGETTI | Categorie di interventi | Categorie di interventi | | A) Fabbricati per il ripristino (art.3, comma 2, lett. b) L. 225/02) | | | | | |
| | | | FFVVA | USP/UT | 1) Strutture ed infrastrutture private danneggiate | 2) Strutture ed infrastrutture private danneggiate | 3) danni subiti dalle attività economiche e produttive | 4) danni subiti dai beni culturali | 5) danni subiti dal patrimonio edile | TOTALE punto 4 |
| ACQUASPARTA | 1) Vano colabato in Via Mercati lungo strada priv. Sanzio, esterna dalla strada adiac. | Colabato vano colabato | | | | | | | € 150.000,00 | € 150.000,00 |
| | 2) Via IV Novembre | Appartamento - colabato vano di soggiorno | | | | € 170.000,00 | | | | € 170.000,00 |
| | 3) Strada comunale di Via Felice Marone | Muro di sostegno | | | | € 80.000,00 | | | | € 80.000,00 |
| | 4) Str. Coll. Via P. Senni | Muro di sostegno | | | | € 120.000,00 | | | | € 120.000,00 |
| | 5) Strada P. Bianco | Muro di sostegno | | | | € 20.000,00 | | | | € 20.000,00 |
| | 6) S.S. n. 410 in km 11+000 (capello Acquasparta) | Pavimento di asfalto con base di calce (150 cm) (compreso riparo di cantiere, manodopera) | | | | € 80.000,00 | | | | € 80.000,00 |

Example II: analysis of data for the reconstruction of the flood impact scenario (all public and private exposed items)



Challenges in the use of data:

Lack of standardisation in the reporting phase (between events and even for the same event)

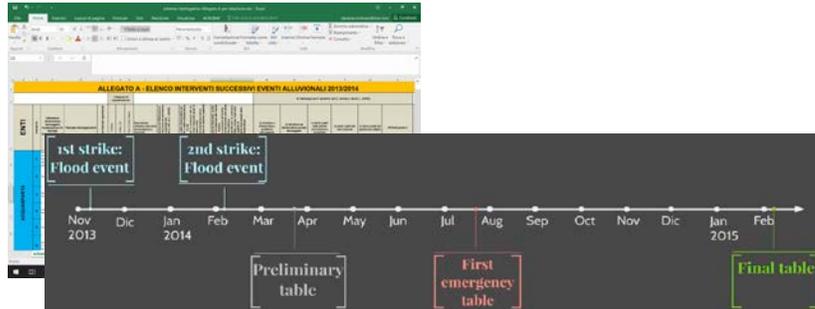
- Problems in correlating requests in the source tables (i.e. following a damage) and, then, in the right estimation of damage

| Preliminary table | |
|--|--|
| Stakeholder | |
| Damage description, location, type of intervention | |
| Type of damage | |
| Number of evacuated families | |
| Category classification | Landslide Roads Infrastructure |
| Brief description of intervention | |
| Cost of intervention | Priority letter a) Priority letter b) Priority letter c) Priority letter d) |
| General total | |

| First Emergency Table | |
|---|--|
| Stakeholder | |
| State of intervention | Finished Ongoing Planned |
| Localization | |
| Designation risk infrastructure/situation | |
| Category classification | Landslide Road infrastructure Structure/Infrastructure |
| Brief description of intervention | |
| Type intervention | a) b) c) |
| Duration | |
| Cost of intervention | Overall estimate Already incurred |
| General total | |

| Final table | | |
|--------------------------|--|---|
| Event date | | |
| Municipality/stakeholder | | |
| Province | | |
| District | | |
| Address | | |
| Use | | |
| Project | Declarator Actuator Intervention title State intervention | |
| | Priority | a) b) c) |
| | Financing | Estimated cost Co-financing Funds |
| Insurance | Not compensable Compensable Insurance premium payment | |

Example II: analysis of data for the reconstruction of the flood impact scenario (all public and private exposed items)



Challenges in the use of data:

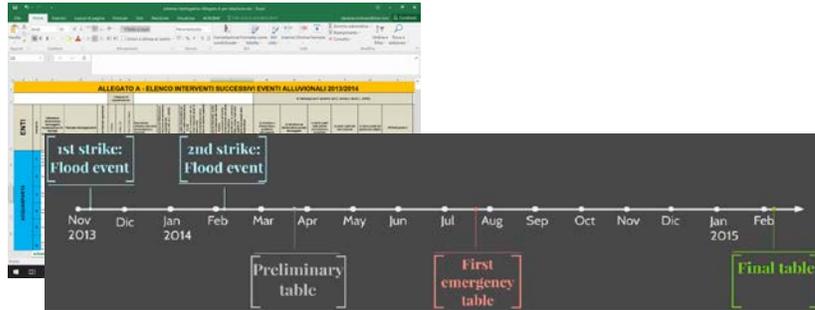
Lack of standardisation in the reporting phase (between events and even for the same event)

- Problems in correlating requests in the source tables (i.e. following a damage) and, then, in the right estimation of damage

Do we know at the end what was the monetary damage?

- Qualitative description
- Monetary damage vs. cost of intervention
- Money allocated for improving pre-event situations vs. money allocated for avoiding next to come threats (resilient reconstruction)
- Not always easy to distinguish damage due what exact stress (enchained or parallel events)

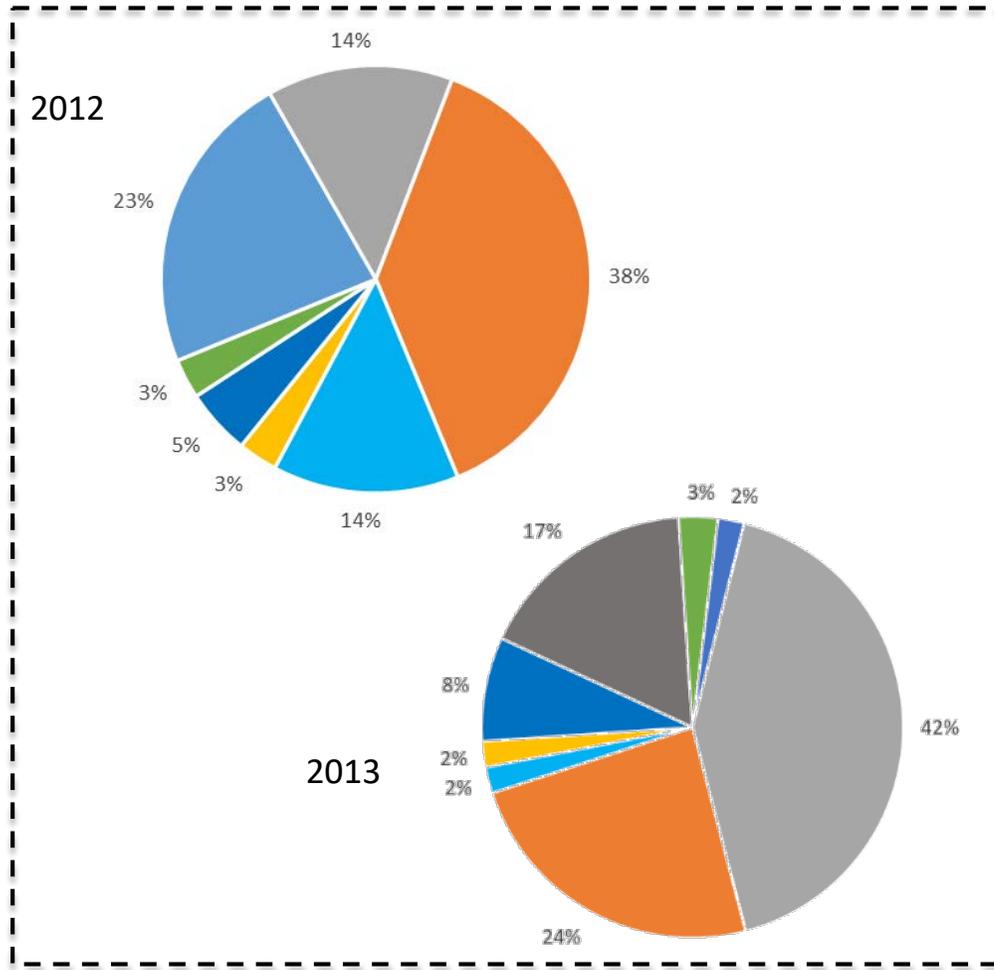
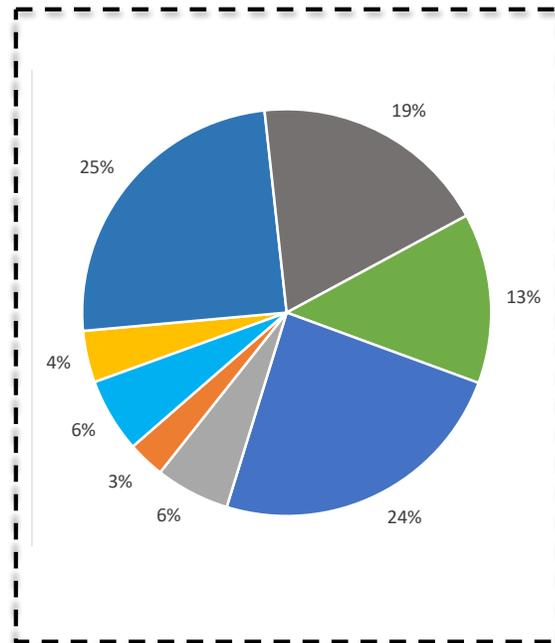
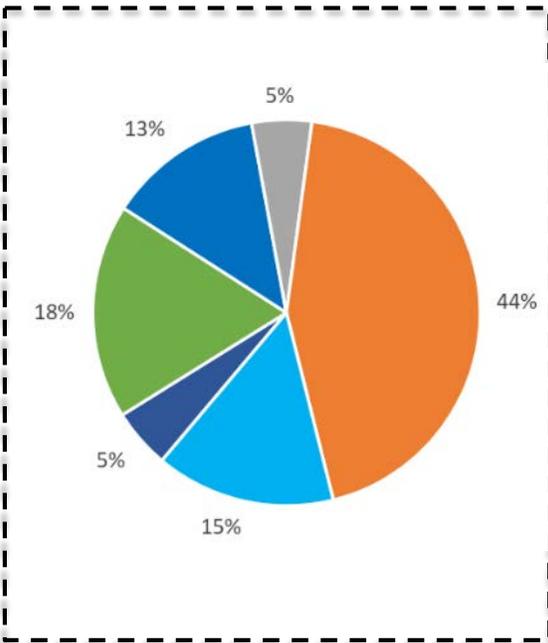
Example II: analysis of data for the reconstruction of the flood impact scenario (all public and private exposed items)



Strengths of data:

- Multi-sector perspective

The importance of a multi-sector perspective



- Public buildings
- Residential
- Extra damages to private
- Agriculture activities
- Economic activities
- Structural measures and first intervention to reduce hydrological risk
- Roads
- Lifelines (energy, water and sewage)

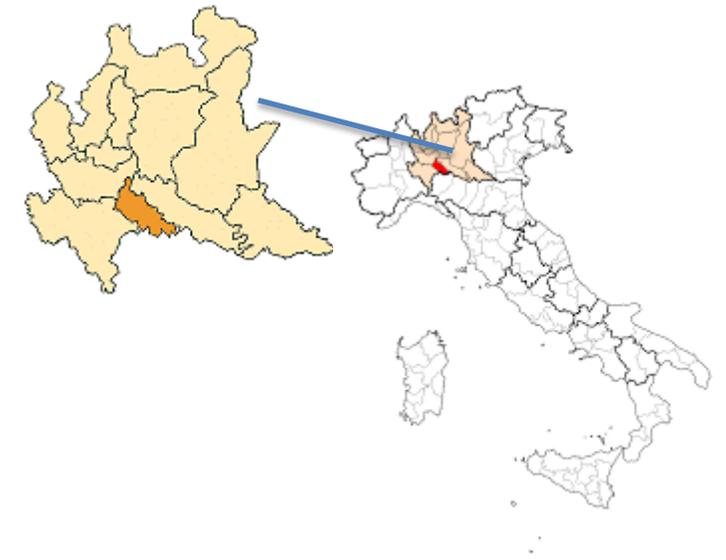
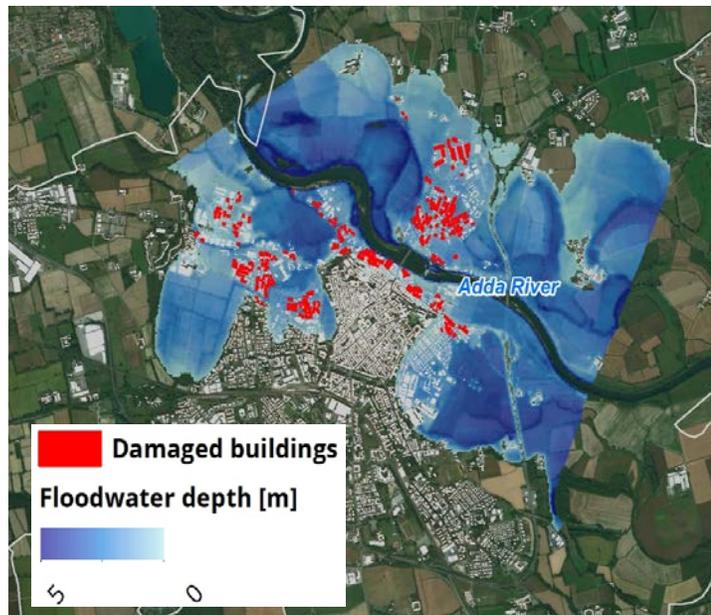
not necessarily the relative weight of sectors is the same between events in different places neither in the same place at different times

Example III: analysis of data for understanding damage mechanisms (all sectors)

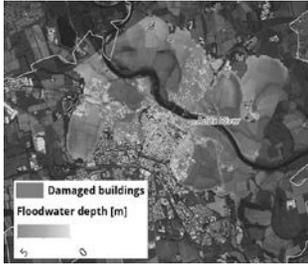
Case study: Flood in Lodi (Northern Italy) in 2002

Available data:

- Report by affected citizens (residential buildings: 329, commercial activities: 89) → papery form
- Estimates of regional technicians (farms: 14)
- Regional reporting sheets/tables for the request of national compensation (public items) → very incomplete/scattered



Example III: analysis of data understanding damage mechanisms (all sectors)

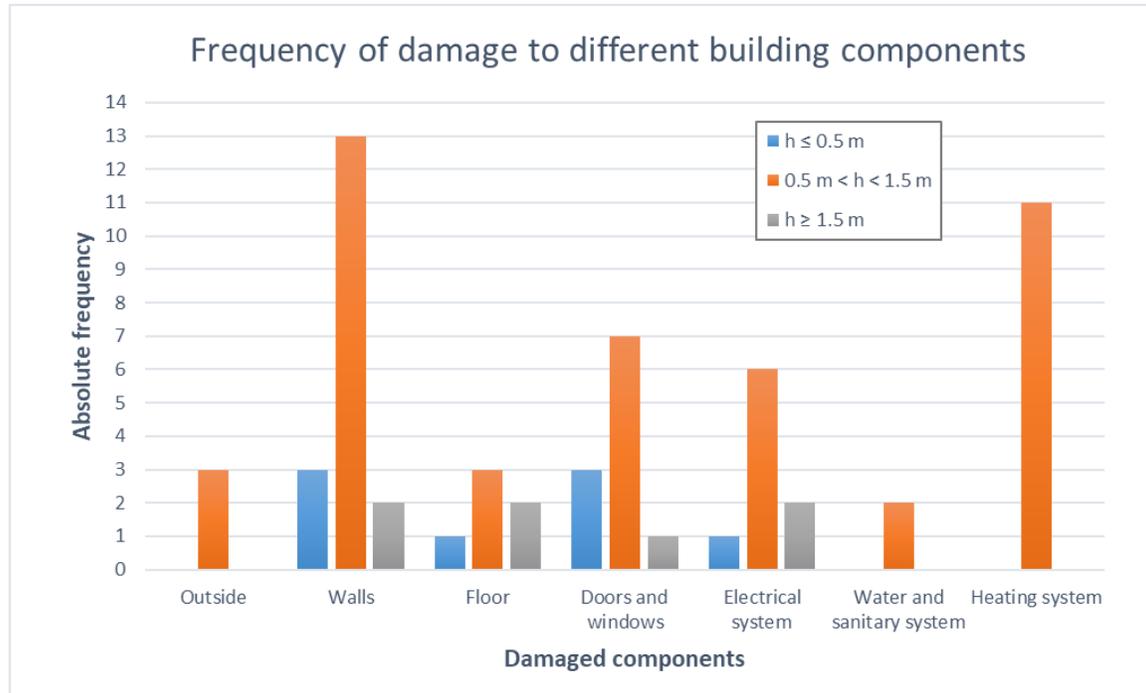


Challenges in the use of data:

- Limited information on damage explicative variables
- Estimation of hazard variables by means of hydrologic/hydraulic modelling is time consuming & not always feasible
- Estimation of exposure and vulnerability variables is hampered by the lack of updated (past) thematic data
- Original data (in papery form) are difficult to handle → summary reports
- Qualitative description of physical damage
- Information structured for compensation needs (e.g. by room not by floor, aggregated information on technological systems)
- Incoherence between expected and declared physical damage (unexpected behavior with respect to existing knowledge on damage mechanisms)

Example III: analysis of data understanding damage mechanisms (all sectors)

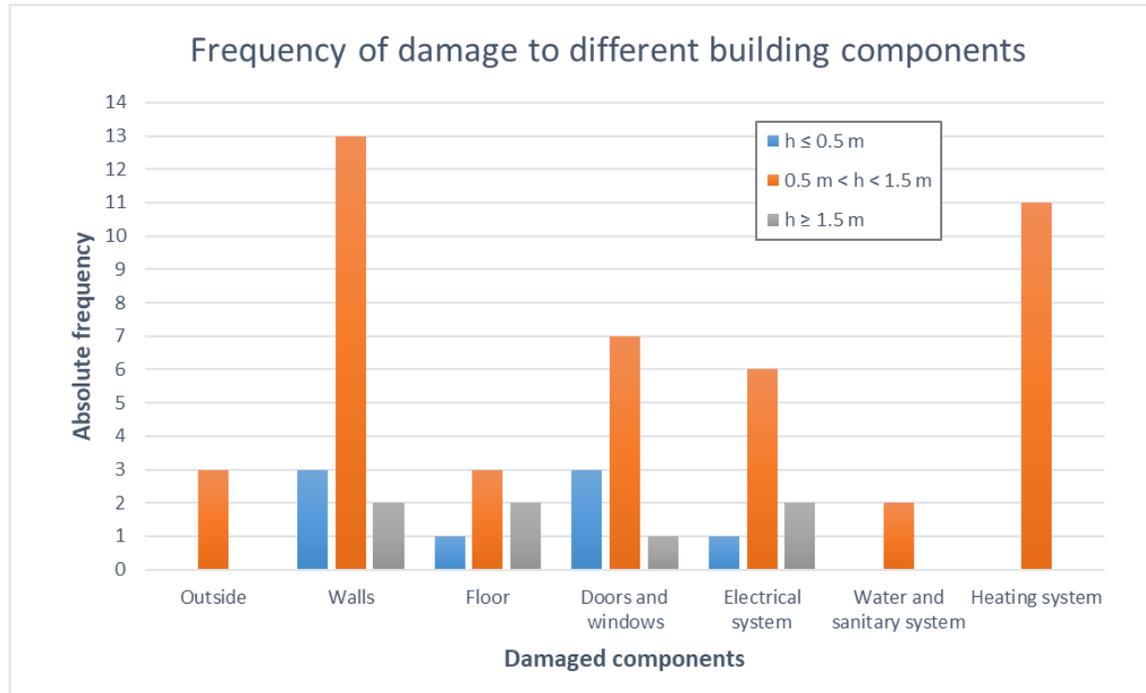
Incoherence between expected and declared physical damage



- total damage of the floor was declared only for water depths higher than 1.5 m, although in principle this damage type should be independent from water depth
- frequency of damage to doors and windows decreases moving from the middle to the highest water depth class, as opposed to expectations
- no damage to water, sanitary and heating systems was declared for water depth higher than 1.5 m, contrary to what expected by considering the typical height of the technical installations in Italian houses

Example III: analysis of data understanding damage mechanisms (all sectors)

Incoherence between expected and declared physical damage



What is damage?

- Reconstruction vs. return to functionality
- Importance of survey physical and monetary damage

The RISPOSTA (Reliable InStruments for POST event damage Assessment) procedure

Objective:

To define **information to be collected, how, when and by whom**, in order to provide consistent and reliable data to its users. The latter are identified as all the authorities/people dealing with the consequences of a flood, in the emergency and the recovery phases.

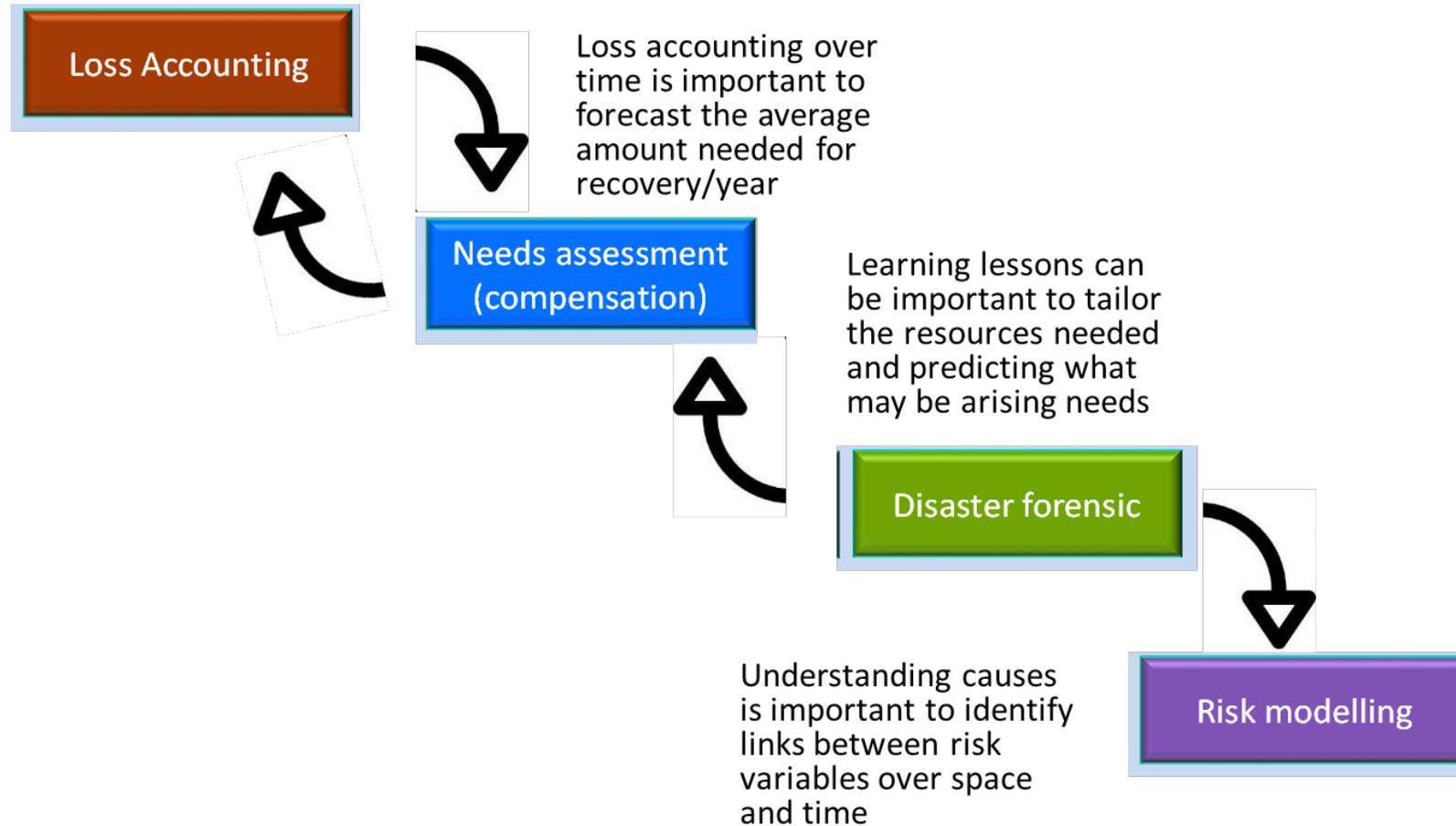
When to apply the procedure

In case of flood in the Umbria Region

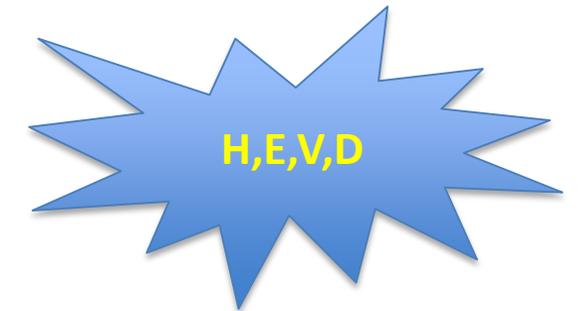
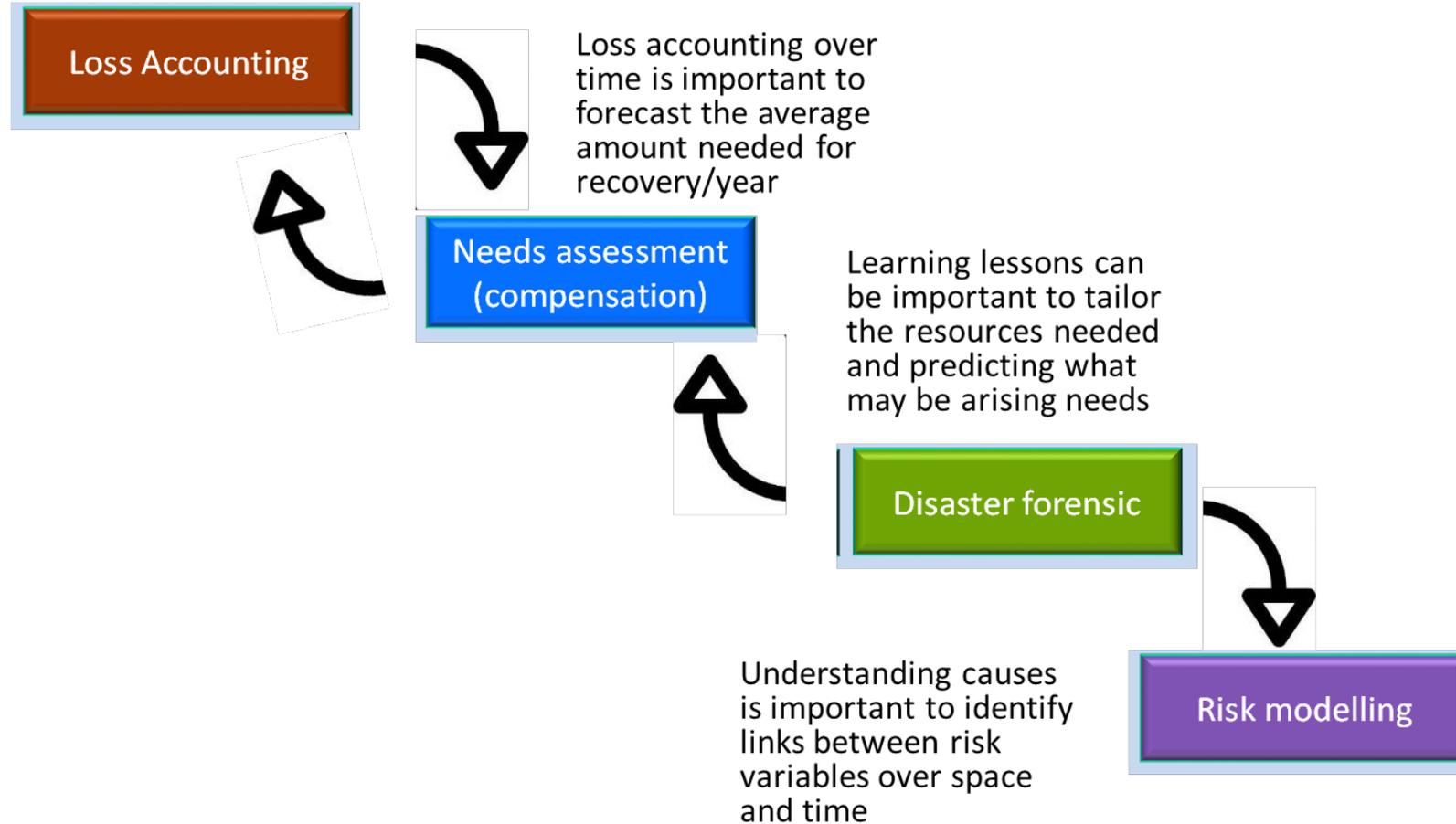
Who apply the procedure?

RISPOSTA is implemented by the Regional Civil Protection Authority (RCPA) of the Umbria Region with the support of Politecnico di Milano as an Expert Centre in flood damage.

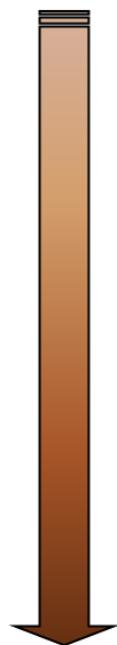
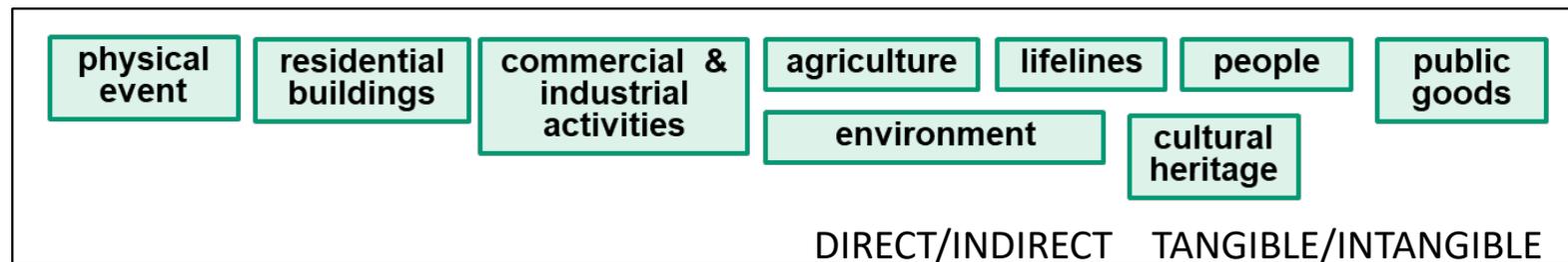
RISPOSTA: the multi-usability of collected data



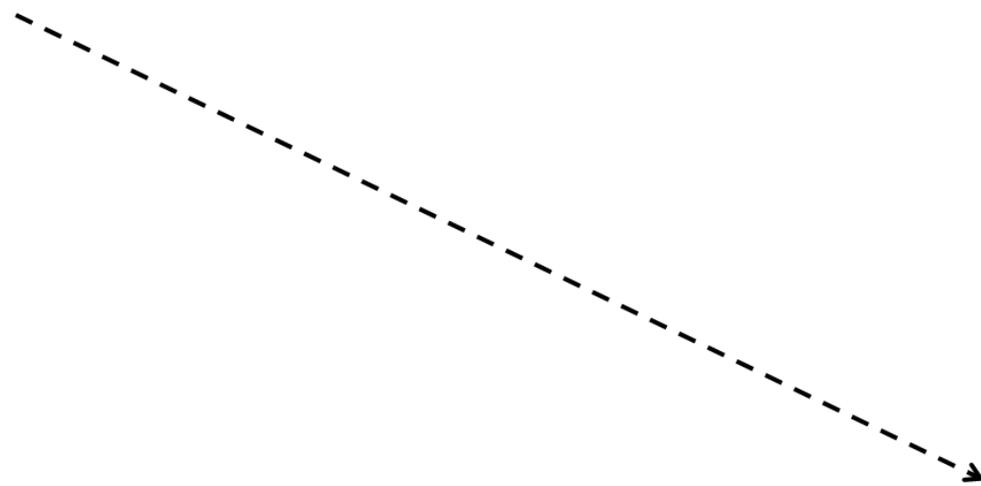
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The four logical axes of the procedure



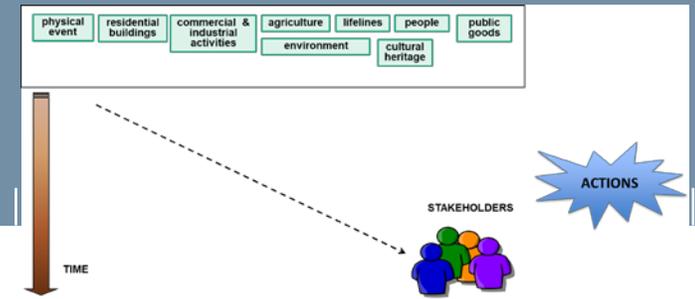
TIME



ACTORS



The time of the action



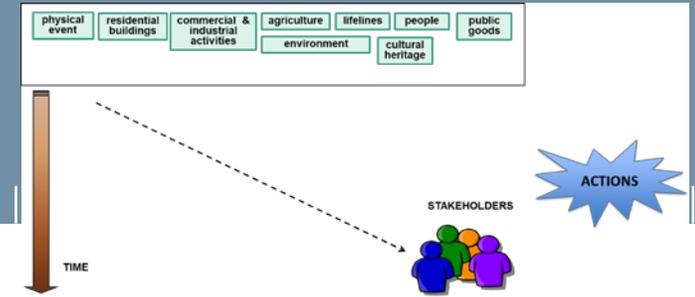
Time is the first logical axis, which **delineates when activities included in the procedure must be performed.**

Time of activities was defined by considering:

- the evolution of the flood event and of consequent damaging processes
- the need for information of different users during the emergency and the recovery phase;
- the administrative procedures for recovery management and damage compensation in effect at the national and the European level.

Actors: who does what

The second logical axis classifies activities according to actors, meaning **who collects and uses the data**.



RCPA

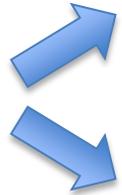
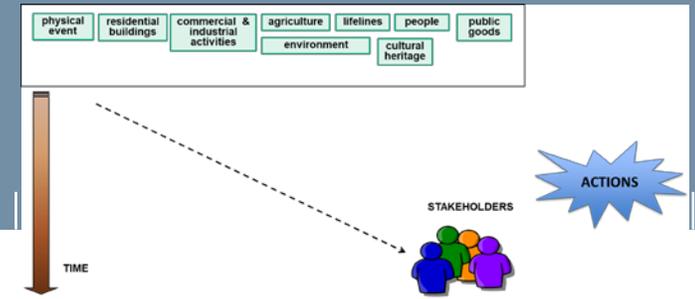
is interested in having a more comprehensive overview of flood impacts, being on the frontline of the emergency management and acting as the coordinator of data during the emergency and the recovery phase.

Others authorities, utilities companies, trade associations & citizens:

They collect and use (damage) data to deal with the emergency and recovery phases which are related only to items within their competency (e.g. provincial authorities for roads, utilities companies for essential service infrastructures, citizens for private residences/premises).

Actors: who does what

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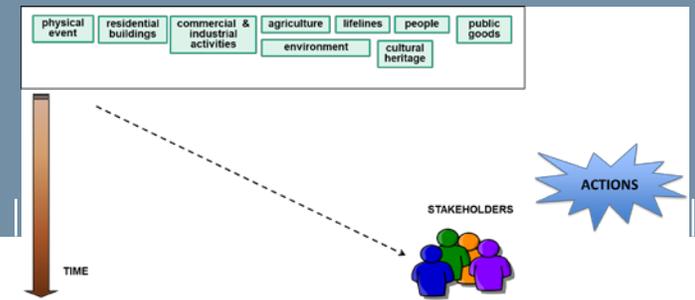
Public actors

They are legally enforced to collect and communicate their data to the RCPA, in order to ease both the emergency and the recovery phases. Accordingly, they are compulsorily involved in the procedure.

Private actors

They are neither obliged to collect data nor to communicate them to the RCPA. Their involvement in the procedure is then on a voluntary base.

Actions: activities to be performed



The third logical axis classifies **three groups of activities according to the type of actions implemented in the procedure**

Data gathering

Whenever “centralized” actors already collect damage data within their competency, protocols must be negotiated with data owners in order to acquire and organize available knowledge.

→ *The main idea at the base of data gathering is (i) to avoid data duplication, (ii) to minimize data collection efforts by integrating existing successful practices and (iii) to guarantee data sharing and integration.*

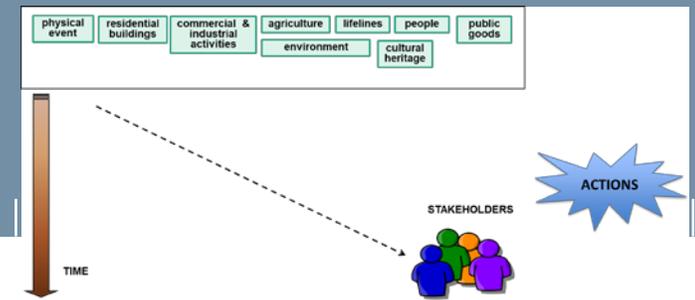
Field survey

when data collection is presently performed by “scattered” actors and/or on a voluntary base (like in the case of private citizens), a field survey is necessary to guarantee the availability and consistency of data of interest. Accordingly, specific procedures and methods were developed within RISPOSTA

Data coordination

including all elaborations required for the definition of complete event scenarios in the reporting phase

Sectors: homogeneous group of exposed items



Damage data collection (and analysis) is performed per “exposed sectors” in the procedure

Sectors were chosen by balancing reporting and collection needs.

1. Describing flood impacts per “exposed sectors” allows rationalizing the system under investigation and highlighting interconnections among its different parts
2. Sectors were identified according to the possibility of adopting homogeneous actions for data collection within each sector:
 - sectors (from d to h) → data gathering from external stakeholders;
 - sectors (a, b, c, i) → field survey of damage data

sectors considered by the procedure:

- (a) residential buildings
- (b) industrial and commercial premises (i.e. businesses)
- (c) farms
- (d) infrastructures
- (e) public items
- (f) emergency costs
- (g) people
- (h) environmental and cultural heritage
- (i) *the physical scenario.*

Main activities included in RISPOSTA, according to the logical axes of the procedure (time, actors, actions and exposed sectors)

| ACTIVITIES | ACTOR | | ACTION | | | SECTOR | | | | | | | | | |
|---|-------|----------------|--------|-----------|--------------|------------|------------|-------|-----------------|--------------|-----------|--------|-------------------|------------------|--|
| | RCPA | Expert. Centre | Survey | Gathering | Coordination | Residences | Businesses | Farms | Infrastructures | Public items | Emergency | People | Environ./cultural | Physic. scenario | |
| Acquisition of pre-existing knowledge on the hazard | X | | | X | | | | | | | | | | X | |
| Acquisition of pre-existing knowledge on exposure and vulnerability | X | | | X | | X | X | X | X | X | X | X | X | | |
| Set-up and management of the IS | | X | | | X | | | | | | | | | | |
| Data sharing | | X | | | X | | | | | | | | | | |
| Event | | | | | | | | | | | | | | | |
| Acquisition of data on the physical event | X | | | X | | | | | | | | | | X | |
| Data sharing | | X | | | X | | | | | | | | | | |
| 2-3 days | | | | | | | | | | | | | | | |
| Survey of the flooded area/water elevation | X | | X | | | | | | | | | | | X | |
| Organization and coordination of the survey (flooded areas) | | X | X | | | | | | | | | | | X | |
| Data analysis (field survey) | | X | | | X | | | | | | | | | | |
| Data validation (physical event) | | X | | | X | | | | | | | | | | |
| Inputting data (physical event) | | X | | | X | | | | | | | | | | |
| Data sharing | | X | | | X | | | | | | | | | | |
| 20 days | | | | | | | | | | | | | | | |
| Survey of damage to residences and businesses | X | | X | | | X | X | | | | | | | | |
| Organization and coordination of the survey (residences and businesses) | | X | X | | | X | X | | | | | | | | |
| Acquisition of damage data from the Regional Emergency Room (SOUR) | | X | | X | | | | X | X | X | X | X | X | | |
| Data analysis (field survey) | | X | | | X | | | | | | | | | | |
| Data validation (residences/businesses/SOUR) | | X | | | X | | | | | | | | | | |
| Inputting data (residences/businesses/SOUR) | | X | | | X | | | | | | | | | | |
| Data sharing | | X | | | X | | | | | | | | | | |
| 90 days | | | | | | | | | | | | | | | |
| Survey of damage to residences (optional) | X | | X | | | X | | | | | | | | | |
| Organization and coordination of the survey (residences) | | X | X | | | X | | | | | | | | | |
| Acquisition of damage data from the responsible stakeholders (optional) | | X | | X | | | | X | X | X | X | X | X | | |
| Acquisition of monetary damage data | | X | | X | | X | | X | X | X | X | X | X | | |
| Data validation (all sectors except businesses/monetary damage data) | | X | | | X | | | | | | | | | | |
| Inputting data (all sectors except businesses/monetary damage data) | | X | | | X | | | | | | | | | | |
| Data analysis (field survey, complete event scenario) | | X | | | X | | | | | | | | | | |
| Data sharing | | X | | | X | | | | | | | | | | |
| 6 months | | | | | | | | | | | | | | | |
| Survey of damage to businesses | X | | X | | | | X | | | | | | | | |
| Organization and coordination of the survey (businesses) | | X | X | | | | X | | | | | | | | |
| Acquisition of damage data from the responsible stakeholders | | X | | X | | | | X | X | X | X | X | X | | |
| Acquisition of monetary damage data | | X | | X | | | X | X | X | X | X | X | X | | |
| Data validation (all sectors except residences/monetary damage data) | | X | | | X | | | | | | | | | | |
| Inputting data (all sectors except residences/monetary damage data) | | X | | | X | | | | | | | | | | |
| Data analysis (field survey, complete event scenario) | | X | | | X | | | | | | | | | | |
| Data sharing | | X | | | X | | | | | | | | | | |
| 12 months | | | | | | | | | | | | | | | |

Main activities included in RISPOSTA, according to the logical axes of the procedure (time, actors, actions and exposed sectors)

some activities must be performed in peace time and mainly consist in acquiring base information for activities to be performed after the event

| ACTIVITIES | ACTOR | | | ACTION | | | SECTOR | | | | | | | | | |
|---|-------|---------------|--------|-----------|--------------|------------|------------|-------|-----------------|--------------|-----------|--------|-------------------|------------------|--|--|
| | RCPA | Expert-Centre | Survey | Gathering | Coordination | Residences | Businesses | Farms | Infrastructures | Public items | Emergency | People | Environ./cultural | Physic. scenario | | |
| Acquisition of pre-existing knowledge on the hazard | X | | | X | | | | | | | | | | X | | |
| Acquisition of pre-existing knowledge on exposure and vulnerability | X | | | X | | X | X | X | X | X | X | X | X | | | |
| Set-up and management of the IS | | X | | | X | | | | | | | | | | | |
| Data sharing | | X | | | X | | | | | | | | | | | |
| Event | | | | | | | | | | | | | | | | |
| Acquisition of data on the physical event | X | | | X | | | | | | | | | | X | | |
| Data sharing | | X | | | X | | | | | | | | | | | |
| 2-3 days | | | | | | | | | | | | | | | | |
| Survey of the flooded area/water elevation | X | | X | | | | | | | | | | | X | | |
| Organization and coordination of the survey (flooded areas) | | X | X | | | | | | | | | | | X | | |
| Data analysis (field survey) | | X | | | X | | | | | | | | | | | |
| Data validation (physical event) | | X | | | X | | | | | | | | | | | |
| Inputting data (physical event) | | X | | | X | | | | | | | | | | | |
| Data sharing | | X | | | X | | | | | | | | | | | |
| 20 days | | | | | | | | | | | | | | | | |
| Survey of damage to residences and businesses | X | | X | | | X | X | | | | | | | | | |
| Organization and coordination of the survey (residences and businesses) | | X | X | | | X | X | | | | | | | | | |
| Acquisition of damage data from the Regional Emergency Room (SOUR) | | X | | X | | | | X | X | X | X | X | X | | | |
| Data analysis (field survey) | | X | | | X | | | | | | | | | | | |
| Data validation (residences/businesses/SOUR) | | X | | | X | | | | | | | | | | | |
| Inputting data (residences/businesses/SOUR) | | X | | | X | | | | | | | | | | | |
| Data sharing | | X | | | X | | | | | | | | | | | |
| 90 days | | | | | | | | | | | | | | | | |
| Survey of damage to residences (optional) | X | | X | | | X | | | | | | | | | | |
| Organization and coordination of the survey (residences) | | X | X | | | X | | | | | | | | | | |
| Acquisition of damage data from the responsible stakeholders (optional) | | X | | X | | | | X | X | X | X | X | X | | | |
| Acquisition of monetary damage data | | X | | X | | X | | X | X | X | X | X | X | | | |
| Data validation (all sectors except residences/monetary damage data) | | X | | | X | | | | | | | | | | | |
| Inputting data (all sectors except residences/monetary damage data) | | X | | | X | | | | | | | | | | | |
| Data analysis (field survey, complete event scenario) | | X | | | X | | | | | | | | | | | |
| Data sharing | | X | | | X | | | | | | | | | | | |
| 6 months | | | | | | | | | | | | | | | | |
| Survey of damage to businesses | X | | X | | | | X | | | | | | | | | |
| Organization and coordination of the survey (businesses) | | X | X | | | | X | | | | | | | | | |
| Acquisition of damage data from the responsible stakeholders | | X | | X | | | | X | X | X | X | X | X | | | |
| Acquisition of monetary damage data | | X | | X | | | X | X | X | X | X | X | X | | | |
| Data validation (all sectors except residences/monetary damage data) | | X | | | X | | | | | | | | | | | |
| Inputting data (all sectors except residences/monetary damage data) | | X | | | X | | | | | | | | | | | |
| Data analysis (field survey, complete event scenario) | | X | | | X | | | | | | | | | | | |
| Data sharing | | X | | | X | | | | | | | | | | | |
| 12 months | | | | | | | | | | | | | | | | |

The procedure for the survey of damage to residential/industrial buildings

| ACTIVITIES | ACTOR | | ACTION | | | SECTOR | |
|---|-------|----------------|--------|-----------|--------------|------------|------------|
| | RCPA | Expert. Centre | Survey | Gathering | Coordination | Residences | Businesses |
| Acquisition of pre-existing knowledge on exposure and vulnerability | X | | | X | | X | X |
| Event | | | | | | | |
| Survey of damage | X | | X | | | X | X |
| Organization and coordination of the survey | | X | X | | | X | X |
| 90 days | | | | | | | |
| Survey of damage to residences (optional) | X | | X | | | X | |
| Organization and coordination of the survey (residences) | | X | X | | | X | |
| Acquisition of monetary damage data | | X | | X | | X | |
| 6 months | | | | | | | |
| Survey of damage to businesses | X | | X | | | | X |
| Organization and coordination of the survey (businesses) | | X | X | | | | X |
| Acquisition of monetary damage data | | X | | X | | | X |
| 12 months | | | | | | | |

- 1. acquisition of pre-existing knowledge** on the exposure and vulnerability of buildings/premises by extracting information from existing databases.
- 2. Survey of damage to buildings/premises.** The survey is performed in the field by means of ad-hoc forms few months after the event. A second survey can be carried out some months later, with the aim of collecting information on longer-term damage (typically indirect damage) not defined at the time of the first survey.
- 3. Acquisition of monetary damage data.** During the survey, damage is assessed in physical units (e.g. number of damaged doors, square meters of damaged floor). In a second step, the monetary damage value is assessed on the basis of the compensation requests submitted by owners.

The forms for the survey of damage to residential buildings

- Information typically include **hazard, exposure and vulnerability factors, direct physical damage** (like damage to doors, walls, technical equipment like the electrical and plumbing systems, furniture, etc.) and mitigation actions taken during the warning period and before the event.
- Some information on **indirect damage** is collected like the number of days spent outside the building, and the time and costs needed for clean-up
- In order to cover the largest possible number of building typologies (e.g. apartment buildings, small detached houses, semi-detached houses), **they are organized into colored sheets corresponding to the building as a whole, the common areas (entrance, stairs), and individual dwellings.** They may be completely or partly filled in, depending on the specific characteristics of the building to be surveyed



SCHEDA A: INFORMAZIONI GENERALI

SCHEDA B: DANNI ALLA UNITA' IMMOBILIARE

SCHEDA C: DANNI ALLE PARTI COMUNI

SCHEDA D: DANNI AGGIUNTI

The forms for the survey of damage to industrial/commercial buildings (...and farms)

- The forms for industrial/commercial premises were designed in order to meet information needs for all users.
- damage to the building structure and its main functional parts (as for residences) **damage to the production/commercial unit are recorded.**
- Information registered in the forms include damage to machinery and production plants, equipment, raw materials and finished products, and stock.
- Data to be collected regard also actions performed to mitigate the damage, recovery costs and indirect damage, including lost working days, lost clients, and the consequences for labor.
- **The forms are organized into colored sheets corresponding to the difference types of damage that may occur in the premise** (such us damage to building structure, damage to machinery, indirect damage, etc.). They may be completely or partly filled in, depending on the occurrence of certain types of damage



SCHEDA A: INFORMAZIONI GENERALI

Indirizzo della azienda
Sezione 1 - Informazioni Generali
Sezione 2 - Descrizione dell'evento
Sezione 3 - Distribuzione spaziale
Sezione 4 - Identificazione danni

SCHEDA B: DANNI ALLA UNITA' IMMOBILIARE

Indirizzo della azienda
Sezione 1 - Informazioni Generali
Sezione 2 - Danni alla struttura
Sezione 3 - Danni alle parti comuni
Sezione 4 - Danni alle attrezzature
Sezione 5 - Danni alle macchine
Sezione 6 - Danni alle attrezzature
Sezione 7 - Danni alle macchine

SCHEDA C: DANNI ALLE PARTI COMUNI

Indirizzo della azienda
Sezione 1 - Informazioni Generali
Sezione 2 - Danni alle parti comuni
Sezione 3 - Danni alle parti comuni
Sezione 4 - Danni alle parti comuni
Sezione 5 - Danni alle parti comuni
Sezione 6 - Danni alle parti comuni
Sezione 7 - Danni alle parti comuni

SCHEDA D: DANNI AGGI ANNESSI

Indirizzo della azienda
Sezione 1 - Informazioni Generali
Sezione 2 - Danni alle parti comuni
Sezione 3 - Danni alle parti comuni
Sezione 4 - Danni alle parti comuni
Sezione 5 - Danni alle parti comuni
Sezione 6 - Danni alle parti comuni
Sezione 7 - Danni alle parti comuni

The procedure for data gathering

- 1. acquisition of already-existing knowledge on the exposure and vulnerability** of potentially affected items by extracting information from existing databases (e.g. thematic maps) or by acquiring data directly from data owner(s).
- 2. Acquisition of damage data from the Regional Emergency Room (SOUR).** This information typically regard direct damage to infrastructures, strategic buildings and people
- 3. Acquisition of damage data from the responsible stakeholders.** Information collected during the previous step is completed (when required) with information supplied by subjects/authorities responsible for data collection.
- 4. Acquisition of monetary damage data.** Information on damage is collected primary in physical units. The monetary values of damage are acquired from the Accounting Division of the RCPA whereby the latter is in charge of acquiring all reimbursement requests.

| ACTIVITIES | ACTOR | | ACTION | | | SECTOR | | | | | |
|---|-------|----------------|--------|-----------|--------------|--------|-----------------|--------------|-----------|--------|-------------------|
| | RCPA | Expert. Centre | Survey | Gathering | Coordination | Farms | Infrastructures | Public items | Emergency | People | Environ./cultural |
| Acquisition of pre-existing knowledge on exposure and vulnerability | X | | | X | | X | X | X | X | X | X |
| Event | | | | | | | | | | | |
| Acquisition of damage data from the Regional Emergency Room (SOUR) | | X | | X | | X | X | X | X | X | X |
| 90 days | | | | | | | | | | | |
| Acquisition of damage data from the responsible stakeholders (optional) | | X | | X | | X | X | X | X | X | X |
| Acquisition of monetary damage data | | X | | X | | X | X | X | X | X | X |
| 6 months | | | | | | | | | | | |
| Acquisition of damage data from the responsible stakeholders | | X | | X | | X | X | X | X | X | X |
| Acquisition of monetary damage data | | X | | X | | X | X | X | X | X | X |
| 12 months | | | | | | | | | | | |

Advantages in the use of the procedure: Standardised outcomes in the form of complete event scenarios

| Exposed sector | Type of damage | SPATIAL SCALES OF ANALYSIS | | |
|--|---|----------------------------|--------------|-----------------------------|
| | | Individual item | Municipality | (Province, Region, Country) |
| Population | physical damage | | X | |
| | affected population | | X | |
| | intangible damage | | X | |
| | changes in social status (unemployment, loss in salary, etc). | | | X |
| | social discomfort | | X | X |
| Civil Protection | costs of emergency services | | X | X |
| Infrastructures (installations and lines) | physical damage | X | | |
| | functional disruption | | X | X |
| | physical damage and functional disruption due to damages to other interconnected system | | X | X |
| public services | physical damage | X | | |
| | functional disruption | X | X | X |
| | physical damage and functional disruption due to damages to other interconnected system | | X | X |
| Economic activities | physical damage | X | | |
| | functional disruption | X | | |
| | physical damage and functional disruption due to damages to other interconnected system | X | | |
| Residences | physical damage | X | | |
| | functional disruption | X | | |
| | physical damage and functional disruption due to damages to other interconnected system | X | | |
| | loss of value | | X | |
| Environmental and cultural heritage | physical damage | X | X | X |
| | functional disruption | X | X | X |
| | physical damage and functional disruption due to damages to other interconnected system | | X | X |

The damage scenario model

Advantages in the use of the procedure: Standardised outcomes in the form of complete event scenarios

| Exposed sector | Type of damage | SPATIAL SCALES OF ANALYSIS | | |
|---|---|----------------------------|--------------|-----------------------------|
| | | Individual item | Municipality | (Province, Region, Country) |
| Population | physical damage | | X | |
| | affected population | | X | |
| | intangible damage | | X | |
| | changes in social status (unemployment, loss in salary, etc). | | | X |
| | social discomfort | | X | X |
| Civil Protection | costs of emergency services | | X | X |
| Infrastructures (installations and lines) | physical damage | X | | |
| | functional disruption | | X | X |
| | physical damage and functional disruption due to damages to other interconnected system | | X | X |
| public services | physical damage | X | | |
| | functional disruption | X | X | X |
| Economic activities | physical damages | | | |
| | functional disruption | | | |
| Residences | physical damages | | | |
| | functional disruption | | | |
| | loss of value | | | |
| Environmental and cultural heritage | physical damages | | | |
| | functional disruption | | | |

The damage scenario model

KEY PRINCIPLES:

- Observed damages must be reported for all affected sectors
- Reported information must regard not only the damage itself but also its explicative variables
- Not only physical damages, but also functions disruption and “systemic” damages
- In the case of population, besides physical damage, “catch” impacts on the affected communities
- When possible, damages must be described in terms of both physical units and monetary values.
- Spatial scale: damages manifest at different scales; the reporting scale depends on the objective of the report.
- Temporal scale: the damage scenario is a dynamic process: appearance of damage, availability of data, reporting needs

Advantages in the use of the procedure: Standardised outcomes in the form of complete event scenarios

“Real life test”: The Umbria/Central Italy floods in November 2012

River basin: Tiber and tributaries

$T(p) = 100\text{-}200\text{ y}$

$T(Q) = 100\text{ y}$

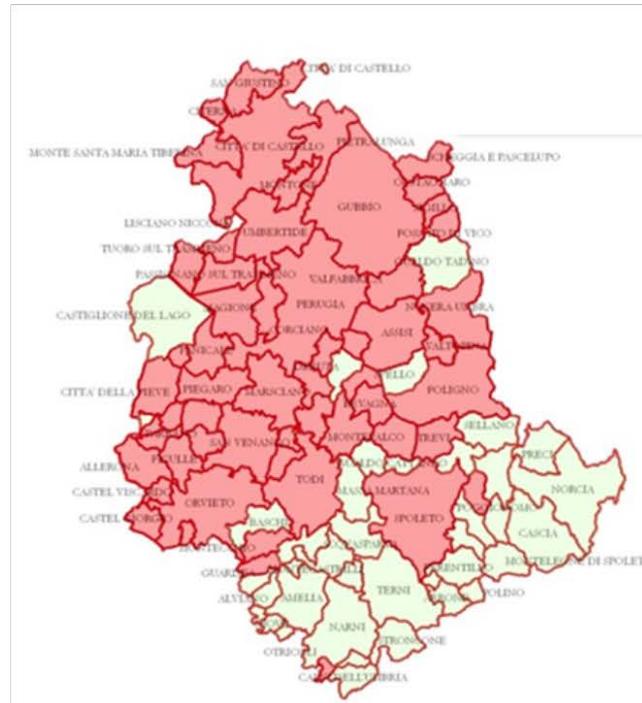
Total damages: 115 M€
0.55% of the GDP

Notice: Elbe Flood 2002
Damages: 15 000 M€
0.72% of the GDP of Germany

Umbria

Total population: 900 000

Affected municipalities: 58 / 92



POLITECNICO DI MILANO



Lo scenario di danno in seguito all'alluvione di Novembre 2012 nella Regione Umbria:

I risultati dell'attività di rilievo e analisi dei danni



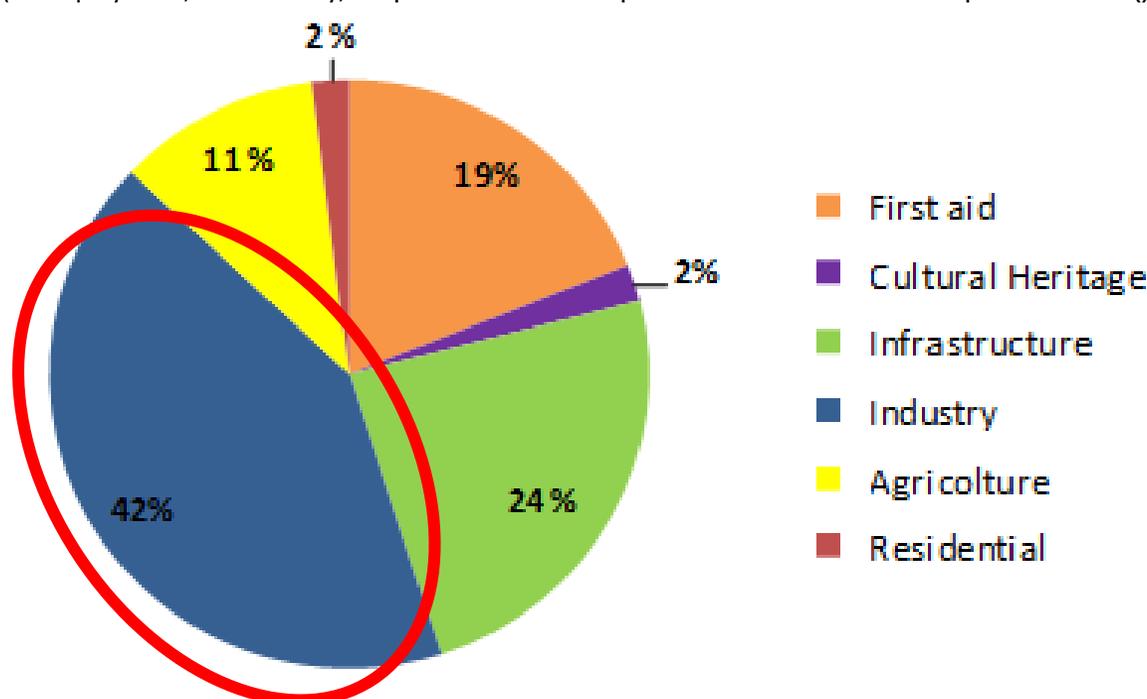
Attività condotta nell'ambito di:

Convenzione tra Politecnico di Milano e Regione Umbria inerente "lo svolgimento di studi e ricerche, formazione reciproca e sperimentazione di tecnologie innovative nel settore previsione e prevenzione rischi idrogeologici ed idraulici e in ambito multirischio" - Ottobre 2011 - Ottobre 2013

Convenzione tra Politecnico di Milano e Regione Umbria negli ambiti della "previsione, prevenzione e gestione dei rischi idrogeologici" - In corso

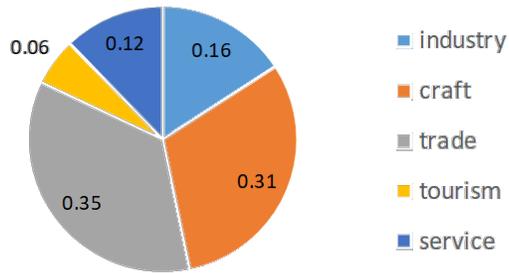
Results: multi-sectoral analysis

| Exposed sector | Type of damage | SPATIAL SCALES OF ANALYSIS | | |
|---|---|----------------------------|--------------|-----------------------------|
| | | Individual item | Municipality | (Province, Region, Country) |
| Population | physical damage | | X | |
| | affected population | | X | |
| | intangible damage | | X | |
| | change in social status (unemployment, loss in salary, etc) | | | ✓ |
| Civil Protection | social comfort | | | |
| | costs emergency | | | |
| Infrastructures (installations and lines) | physical damage | | | |
| | functional disruption | | | |
| public services | physical damage and damage to other | | | |
| | functional disruption | | | |
| Economic activities | physical damage and damage to other | | | |
| | functional disruption | | | |
| Residences | physical damage and damage to other interconnected system | | | |
| | loss of value | | X | |
| | physical damage | X | X | X |
| Environmental and cultural heritage | functional disruption | X | X | X |
| | physical damage and functional disruption due to damages to other interconnected system | | X | X |



Results: disaster forensic

Sectors of affected businesses



Investigated
businesses: 143

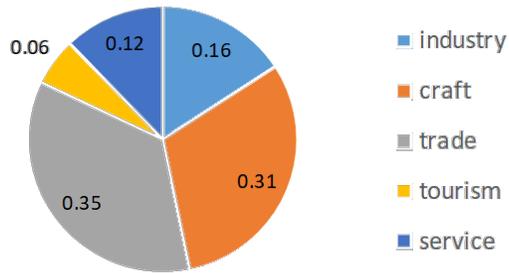
On-site survey: 11



- most of damage is due to the **CONTACT OF WATER WITH ELECTRICAL EQUIPMENT**, machinery that is usually managed electronically, and **STOCKS**;
- **building structure** plays a minor role
- damage depends on the type of “**contents**”, their age, the possibility of moving them to upper floors/heights
- **TOXIC WASTE** disposal represented a relevant cost
- The **INDIRECT DAMAGE** to businesses proved to be high in the case of the November 2012 flood; businesses owners reported that they were not able to re-start full activity before the end of February-beginning of March 2013.

Results: disaster forensic

Sectors of affected businesses



Investigated
businesses: 143

On-site survey: 11



- most of damage is due to the **CONTACT OF WATER WITH ELECTRICAL EQUIPMENT**, machinery that is usually managed electronically, and **STOCKS**;
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Calibration of flood damage models

Results: multi-scale analysis

| Exposed sector | Type of damage | SPATIAL SCALES OF ANALYSIS | | |
|---|---|----------------------------|--------------|-----------------------------|
| | | Individual item | Municipality | (Province, Region, Country) |
| Population | physical damage | | X | |
| | affected population | | X | |
| | intangible damage | | X | |
| | changes in social status (unemployment, loss in salary, etc). | | | X |
| | social discomfort | | X | X |
| Civil Protection | costs of emergency services | | X | X |
| Infrastructures (installations and lines) | physical damage | X | | |
| | functional disruption | | X | X |
| | physical damage and functional disruption due to damages to other interconnected system | | X | X |
| public services | physical damage | X | | |
| | functional disruption | X | X | X |
| | physical damage and functional disruption due to damages to other interconnected system | | X | X |
| Economic activities | physical damage | X | | |
| | functional disruption | X | | |
| | physical damage and functional disruption due to damages to other interconnected system | X | | |
| Residences | physical damage | X | | |
| | functional disruption | X | | |
| | physical damage and functional disruption due to damages to other interconnected system | X | | |
| | loss of value | | X | |
| Environmental and cultural heritage | physical damage | X | X | X |
| | functional disruption | X | X | X |
| | physical damage and functional disruption due to damages to other interconnected system | | X | X |

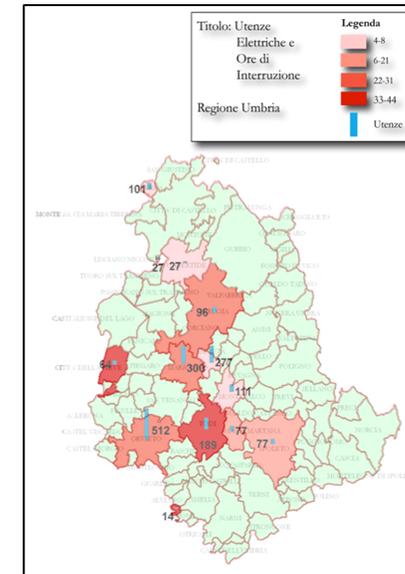
Results: structure of information (electric lines)

| Exposed sector | Type of damage | SPATIAL SCALES OF ANALYSIS | | |
|---|---|----------------------------|--------------|-----------------------------|
| | | Individual item | Municipality | (Province, Region, Country) |
| Infrastructures (installations and lines) | physical damage | X | | |
| | functional disruption | | X | X |
| | physical damage and functional disruption due to damages to other interconnected system | | X | X |

✓ Observed damages:
 ✓ fell down trellis, removed cables along riversides, damaged electrical cabins
 ✓ (0.5 M€)

| Momento della giornata | 12 Nov ore 14.00 | 12 Nov ore 18.00 | 12 Nov ore 20.00 | 12 Nov ore 22.00 | 13 Nov ore 7.30 | 13 Nov ore 11.30 | 13 Nov ore 16.00 | 13 Nov ore 19.00 | 13 Nov ore 21.00 | 14 Nov ore 10.00 |
|------------------------|------------------|------------------|------------------|------------------|-----------------|------------------|------------------|------------------|------------------|------------------|
| Comuni | | | | | | | | | | |
| Attigliano | 14 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Orvieto | 512 | 425 | 188 | 188 | 131 | 131 | 131 | - | - | - |
| Deruta | 277 | 2 | 113 | - | - | - | - | - | - | - |
| Umbertide | 27 | 27 | - | - | - | - | - | - | - | - |
| S. Venanzo | 93 | - | - | - | - | - | - | - | - | - |
| Città della Pieve | 64 | - | - | 64 | 64 | 64 | 64 | 64 | 40 | 20 |
| Ponte S. Giovanni | 15 | - | - | - | - | - | - | - | - | - |
| Marsciano | - | 300 | - | 172 | 16 | 16 | 16 | - | - | - |
| Gualdo cattaneo | - | 111 | 111 | - | - | - | - | - | - | - |
| Perugia | - | 96 | - | - | 79 | 79 | 79 | - | - | - |
| Todi | - | - | - | 44 | 189 | 189 | 189 | 189 | 189 | 189 |
| Citerna | - | - | - | 101 | - | - | - | - | - | - |
| Perugia | - | - | - | - | 79 | - | - | 11 | 6 | - |
| Spoletto | - | - | - | - | 77 | 77 | - | - | - | - |
| Massa Martana | - | - | - | - | 77 | - | - | - | - | - |

✓ Number of users without electricity per municipality at different times after the flood



✓ Number of users without electricity

✓ and maximum duration

Challenges in implementing the procedure: required efforts

Personnel

RISPOSTA is implemented with the support of Politecnico di Milano as an Expert Centre in flood damage, for all the activities that can be performed remotely, thus **reducing efforts required by the authority to perform the procedure.**

For the field survey the RCPA can ask the support of

- Regional personnel in charge of other activities;
- Trained volunteers (students, technicians);
- Local civil protection authorities (i.e. municipality level)



Challenges in implementing the procedure: required efforts

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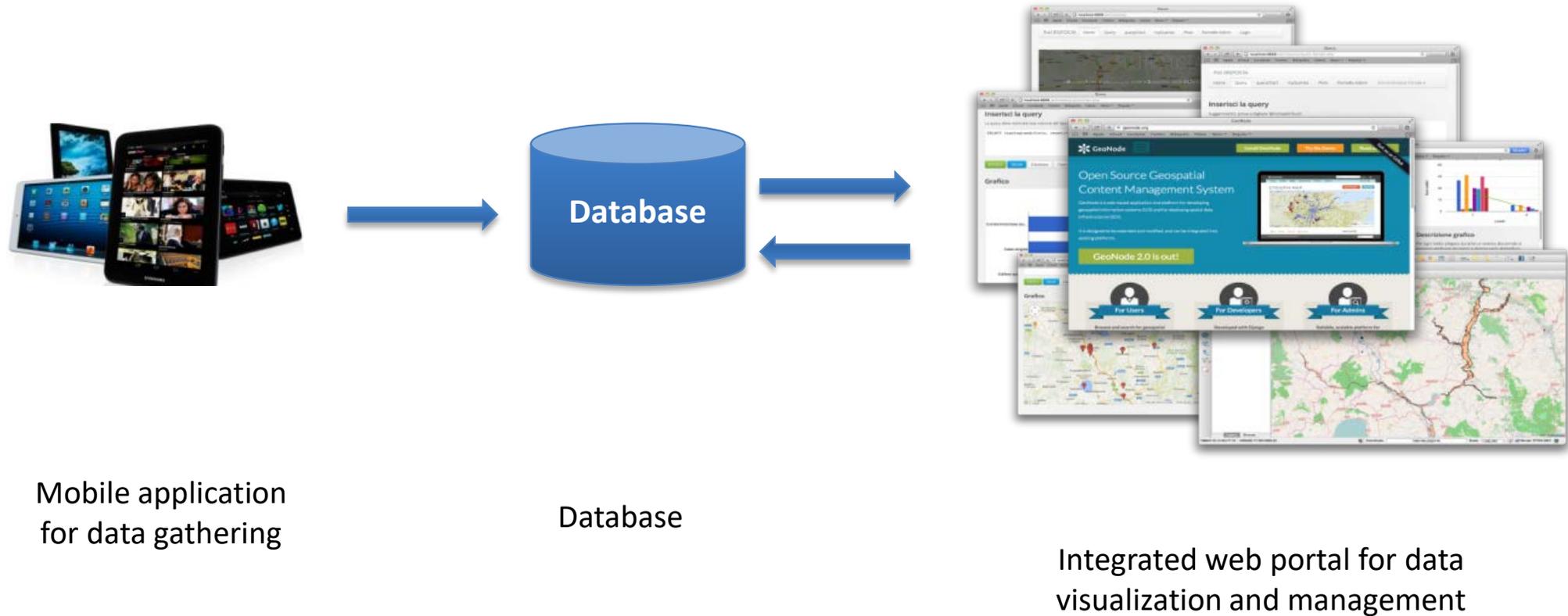
For the field survey the RCPA can ask the support of

- Regional personnel in charge of other activities;
- Trained volunteers (students, technicians);
- Local civil protection authorities (i.e. municipality level)

Time/resources

- the procedure includes as much as possible practices and procedures already in place in Italy for the management of the emergency phase and loss recording (also deriving from other hazards)
- The procedure was developed and tested with users/stakeholders

Challenges in implementing the procedure: required efforts ICT tools in support of RISPOSTA



RISPOSTA as a best practice to be widespread at EU level



www.ideaproject.polimi.it



www.lodeproject.polimi.it

Objective:

Developing an **information system** enabling:

- enhanced collection of post disaster damage data
- use of such data for compensation, needs prioritization, learning from disasters (Forin) and for improving the understanding of real events and fine tune accordingly risk forecast models

Focus:

- All hazards
- All sectors
- All EU countries

Why RISPOSTA is still not “officially” in place?

(our) possible reasons:

- Earthquake in central Italy in 2016 → focus of national and regional policies on recovery
- Political instability → need to restart the negotiation process every time there is a change in the leadership
- Political reasons → the procedure implies the adoption of an “official” and standardised estimation of damage monetary value (welcome by insurers, critical for public administrator)

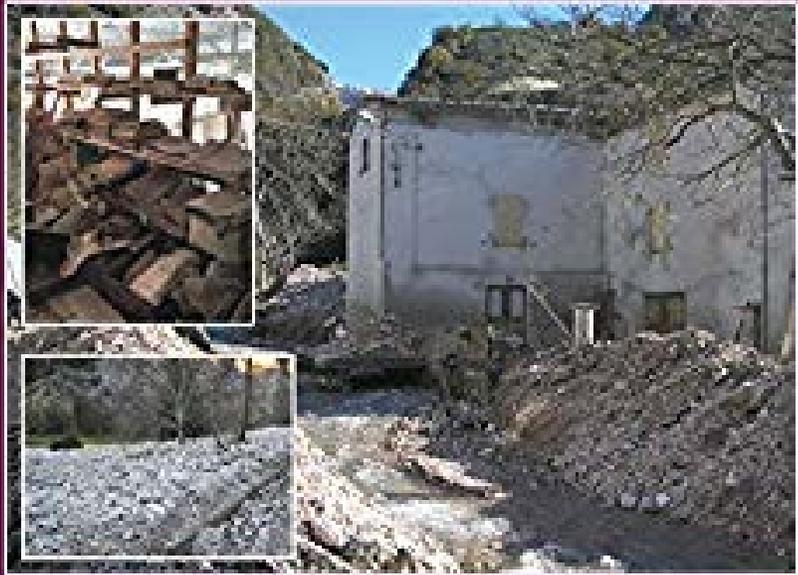
Positive aspects:

- The need of standardised procedures for ex-post data collection and analysis is still strongly required by risk managers
 - attempt to extend the procedure in the Trentino Alto Adige region



Flood Damage Survey and Assessment

New Insights from Research and Practice



Daniela Molinari, Scira Menoni, and Francesco Ballio
Editors

AGU

WILEY

Thanks for your attention!
(daniela.molinari@polimi.it)