Flood damage functions: a lesson from Australia

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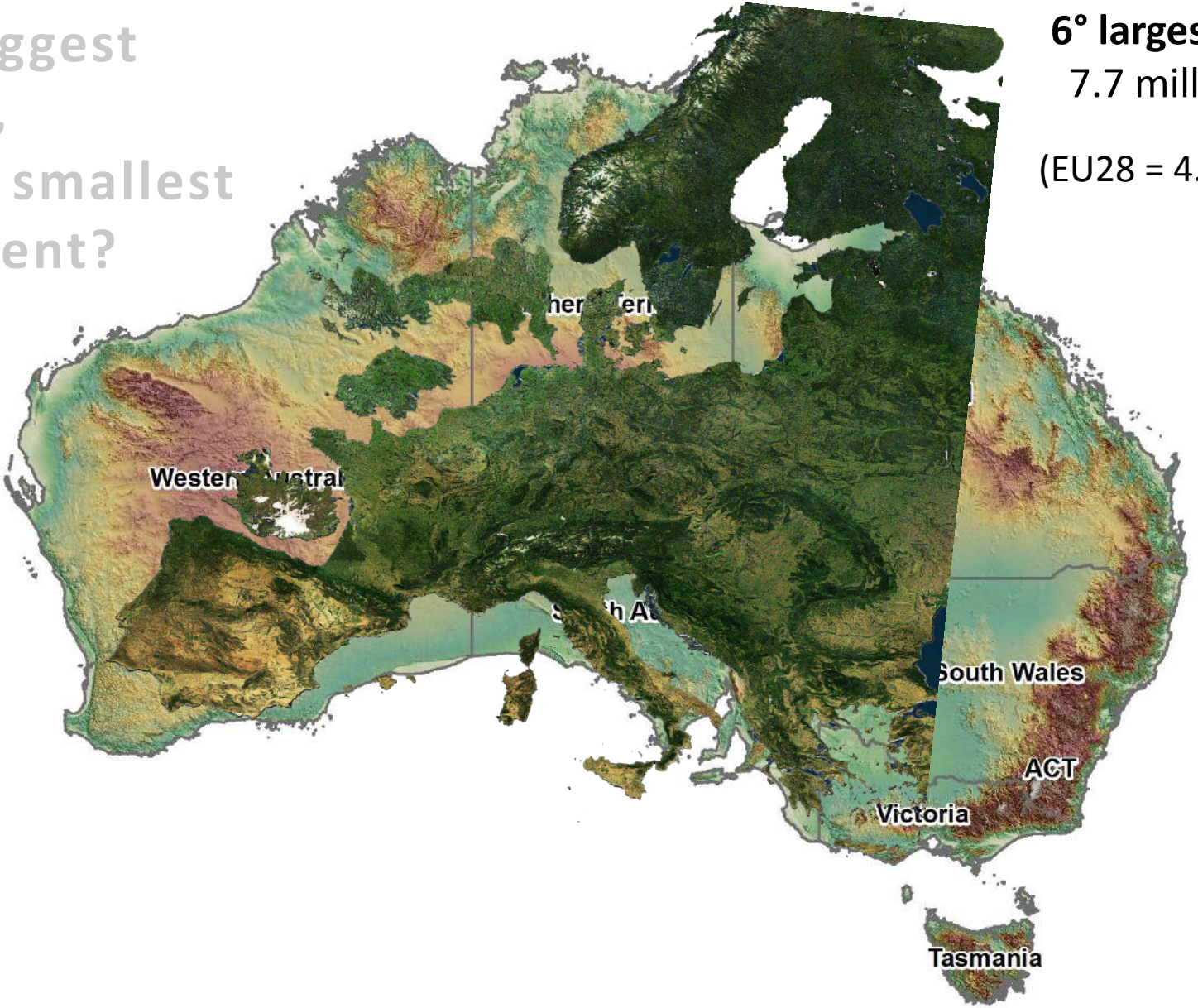
FONDAZIONE ENI ENRICO MATTEI

Science and Management of Climate Change

MARIE CURIE ACTIONS

About Australia

The biggest island, or the smallest continent?



6° largest Nation

7.7 million km^2

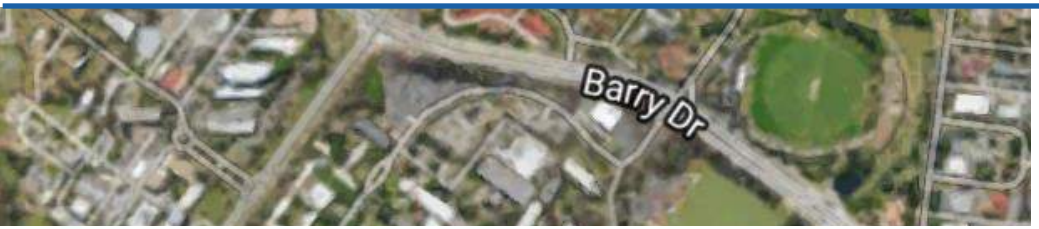
(EU28 = 4.4 mil km^2)

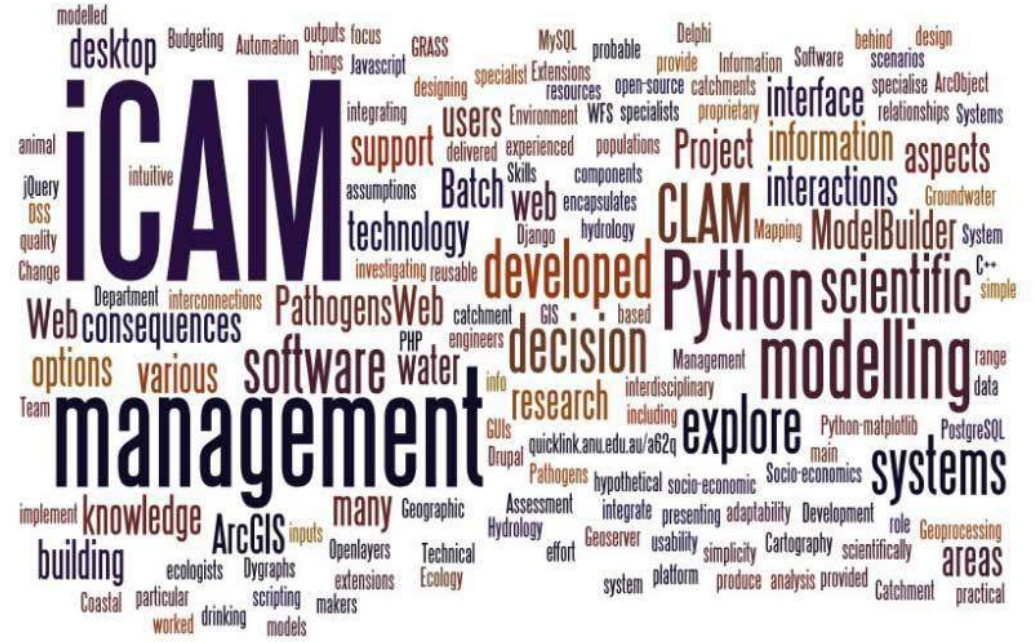
Natural hazards and Risk management

Slow, extensive

Hobart

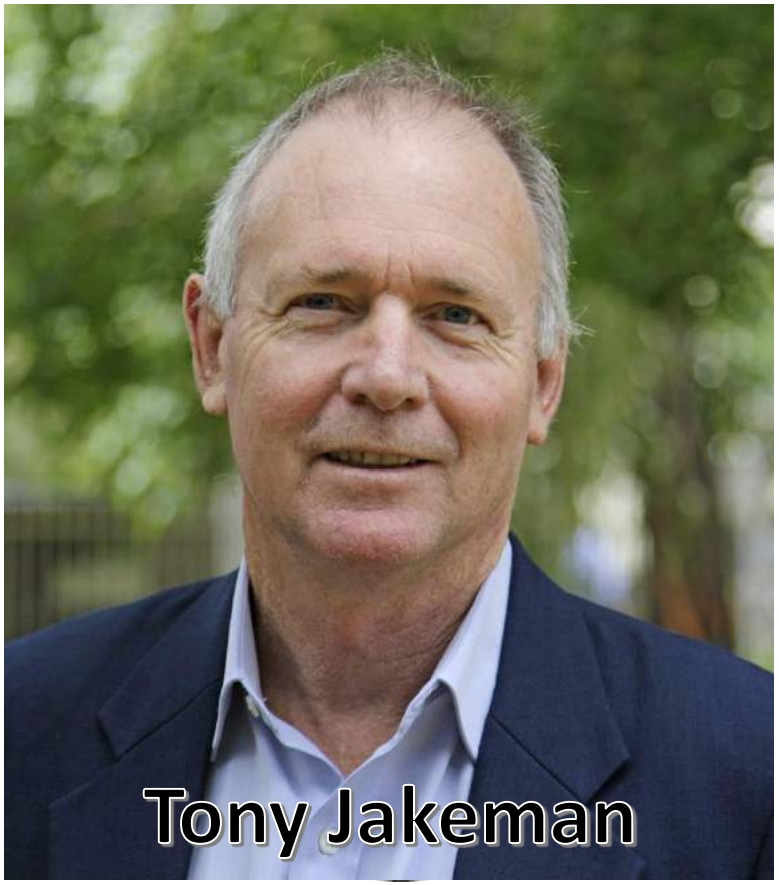
Canberra and ANU



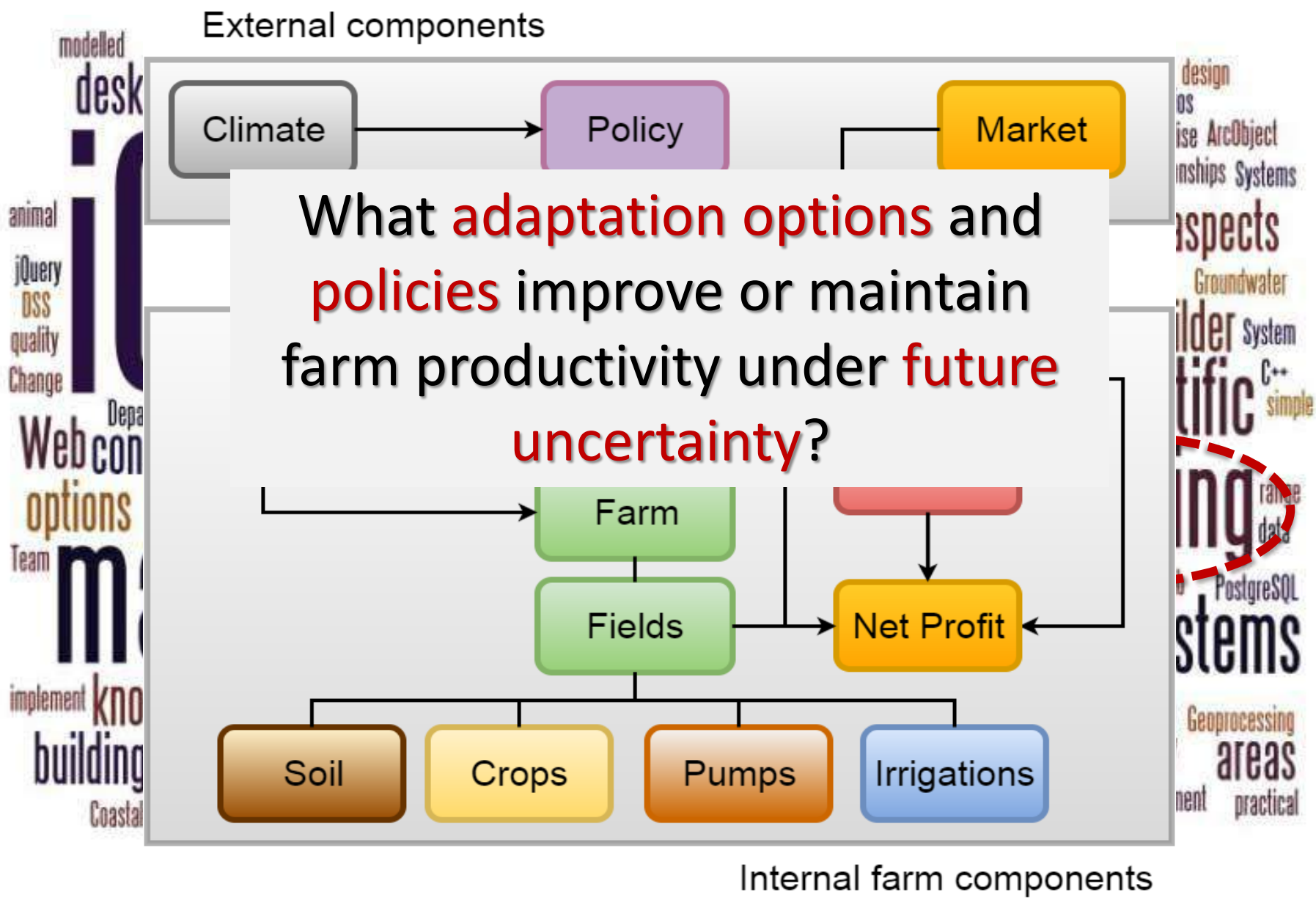


QS WORLD UNIVERSITY RANKINGS

ANU is ranked 22nd in the world and first in Australia



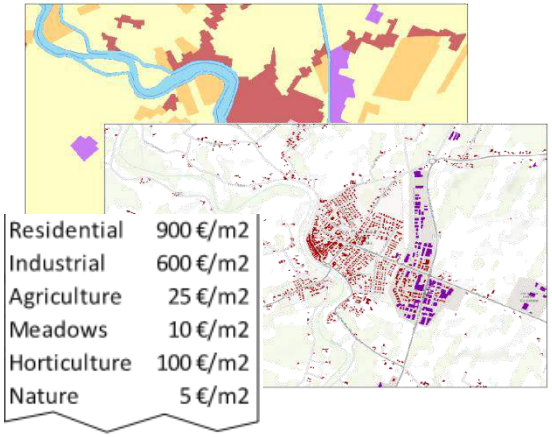
Canberra and ANU



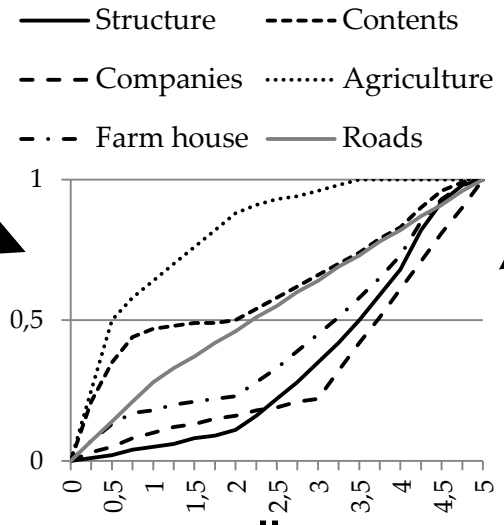
My research topic: Flood Risk Assessment

Direct, tangible impact of floods in Italy

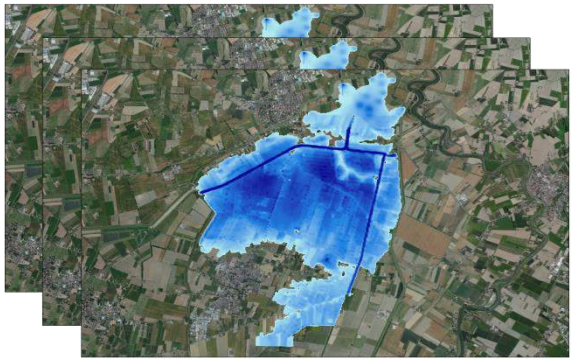
(**E**) Exposed asset



(**V**) Damage curves



(**H**) Hazard depth



APPLICATION IN ITALY

Uneven quality of spatial data across regions

Lack of a broad national study on loss functions

Damage records for model validation are poor, fragmented and inconsistent

(**R**) Flood damage

Reliable risk assessment strongly depends on the quality of basedata and on the calibration of the method

Improve Flood Damage Modelling

Expected annual losses:

500-800 million Euro

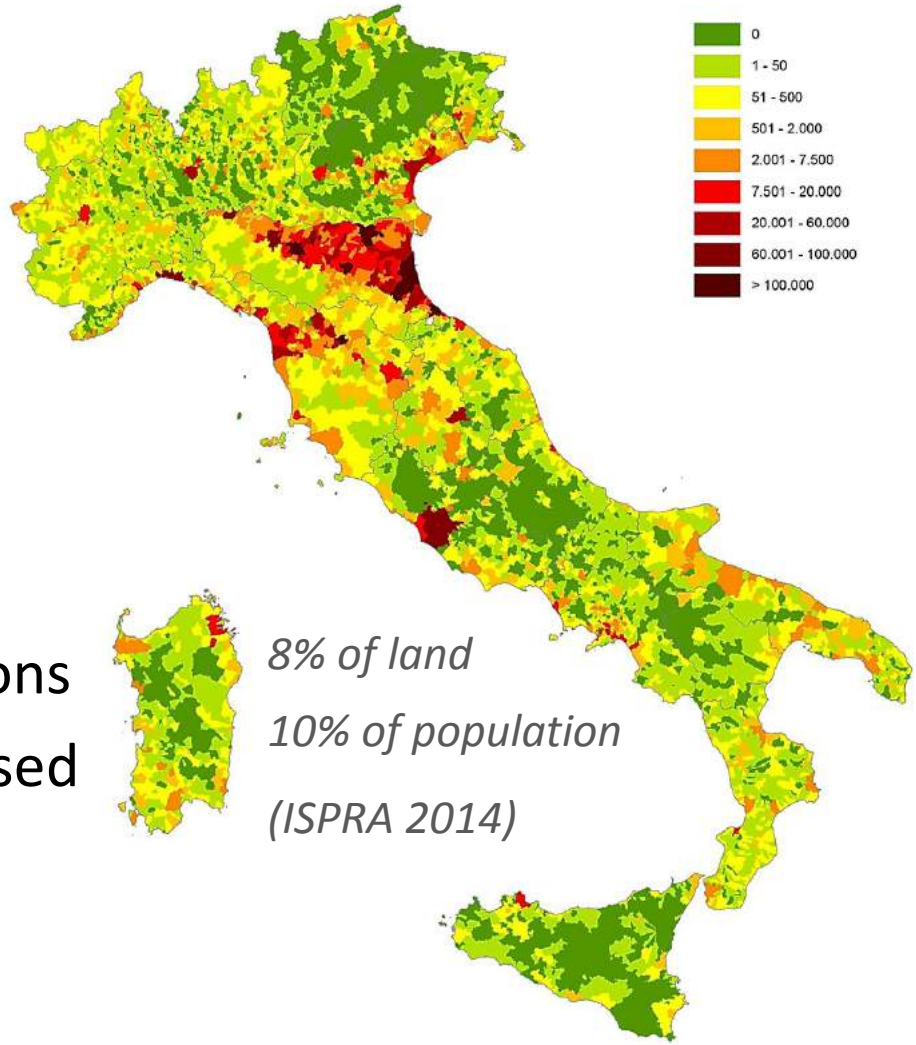
(Feyen et al., 2012)

Likely to be more than double by 2050 (Jongman et al., 2014)

Risk Management needs precise, detailed and reliable information about potential impacts in order to adopt cost-effective measures to reduce losses

- Test existing depth-damage functions
- Improve the description of exposed value
- Calibrate a new loss function

Population exposed to medium flood hazard (100-200 years RP) at municipality scale



8% of land

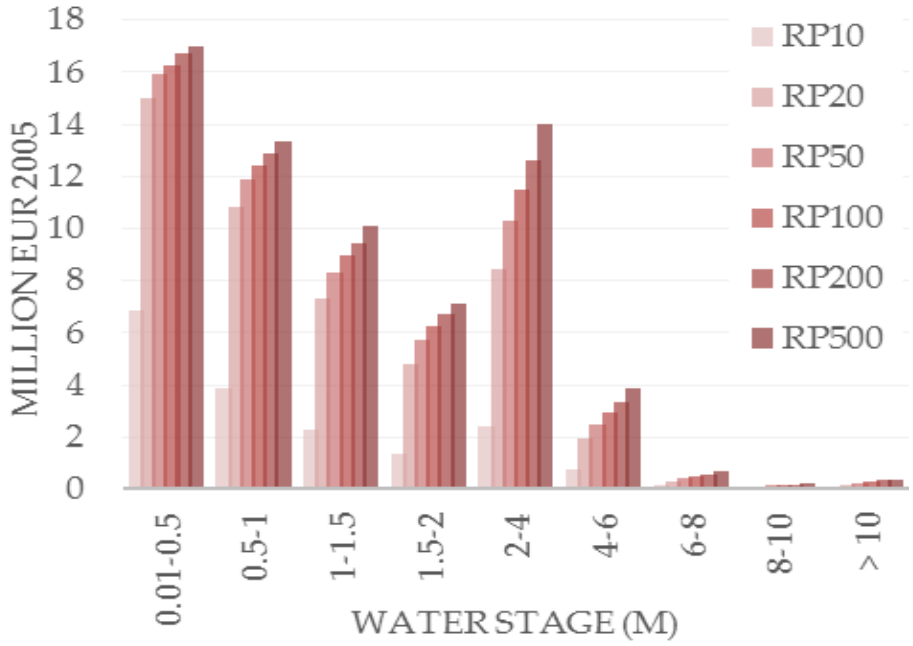
10% of population

(ISPRA 2014)

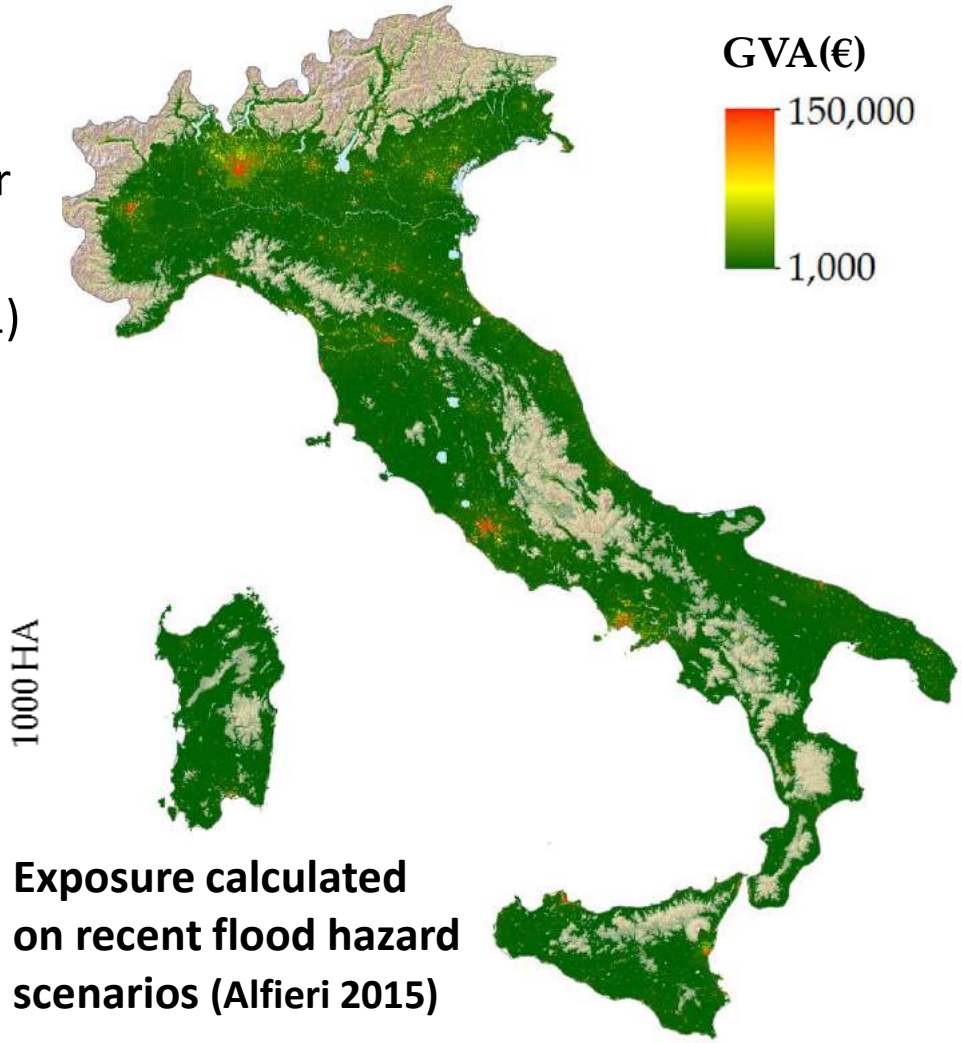
Dasymetric map of Population and GVA for Italy

Multiple ancillary data sources

- Soil sealing
- Land use
- Buildings (limited to Emilia-Romagna)
- Macrocategories of Gross Value Added for Local Market Areas
- Population tracts from ISTAT census (2011)



Dasymetric map of Italy GVA (250m) on the basis of land use and population

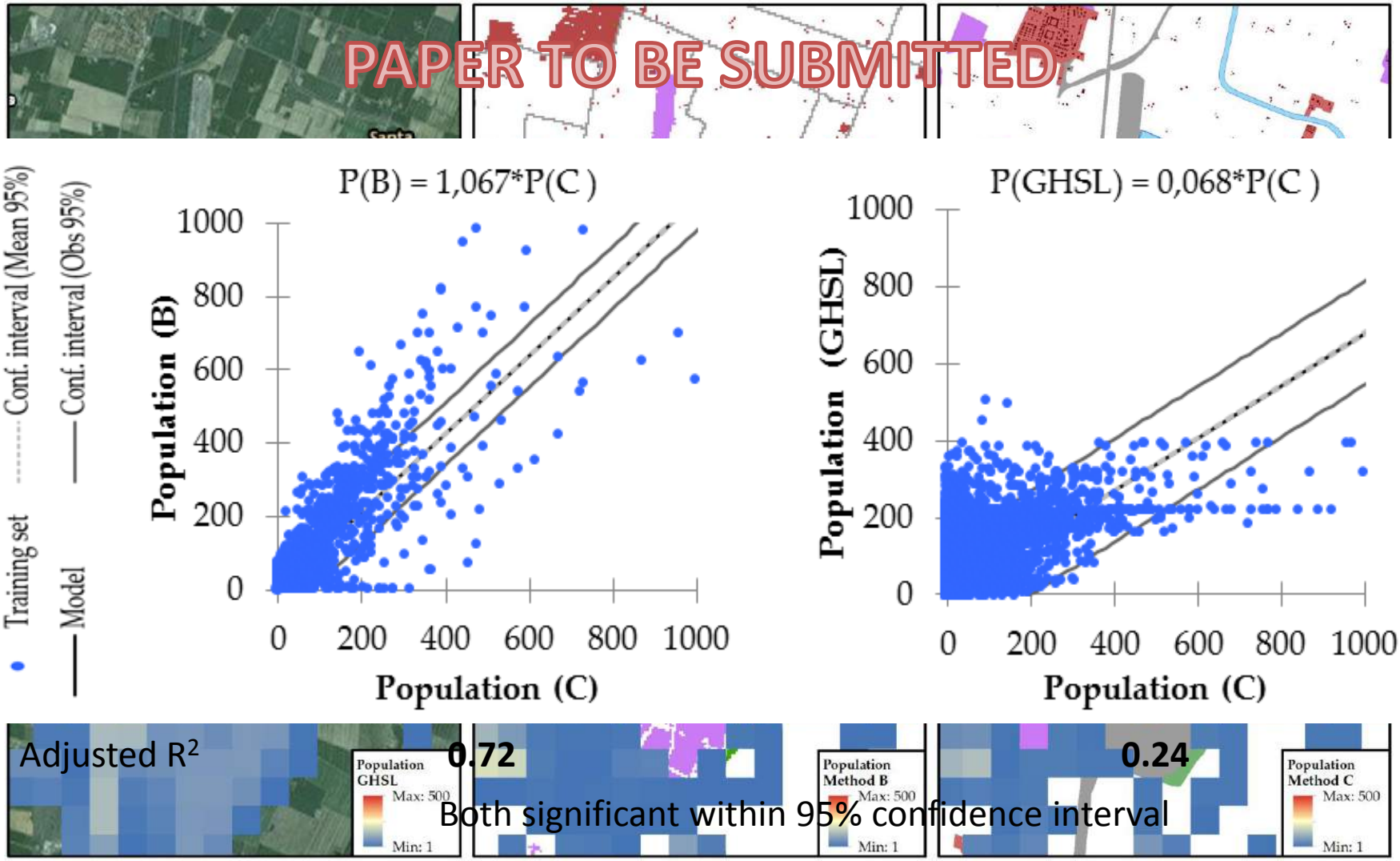


Exposure calculated on recent flood hazard scenarios (Alfieri 2015)

Dasymetric map of Population and GVA for Italy

Two dasymetric methods are compared to the GHSL population dataset

PAPER TO BE SUBMITTED

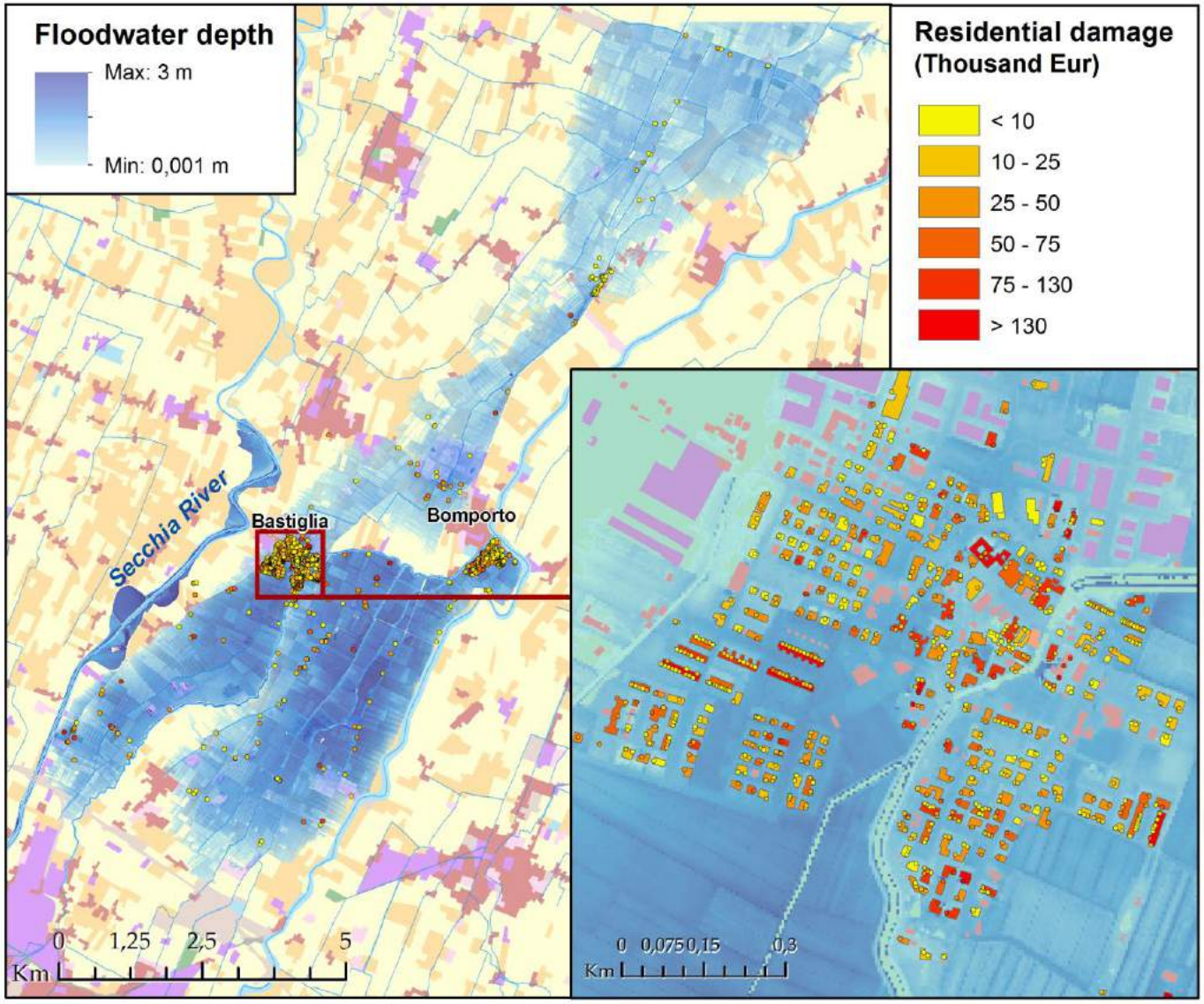


Both significant within 95% confidence interval

Better land-use description = More reliable population density projection

Flood Loss Modelling with FLF-IT

Study collaboration on Flood Loss Functions for residential structures



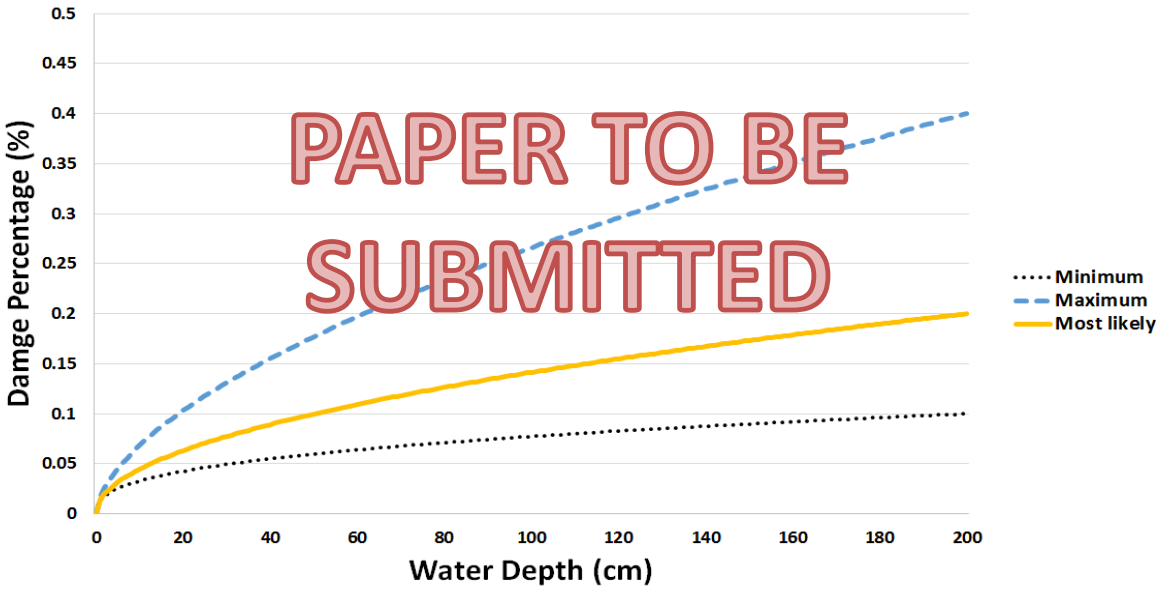
Transferability of an Australian method employed to produce a relative, synthetic loss function for residential structures based on empirical damage records (21 million EUR for structural damage alone)

Flood Loss Modelling with FLF-IT

$$d_h = \left(\frac{h}{H}\right)^{\frac{1}{r}} \times D_{max}$$

Bootstrapping approach

Damage records are resampled and the most appropriate value of the root function and maximum damage share are selected by chi-square test of goodness of fit.



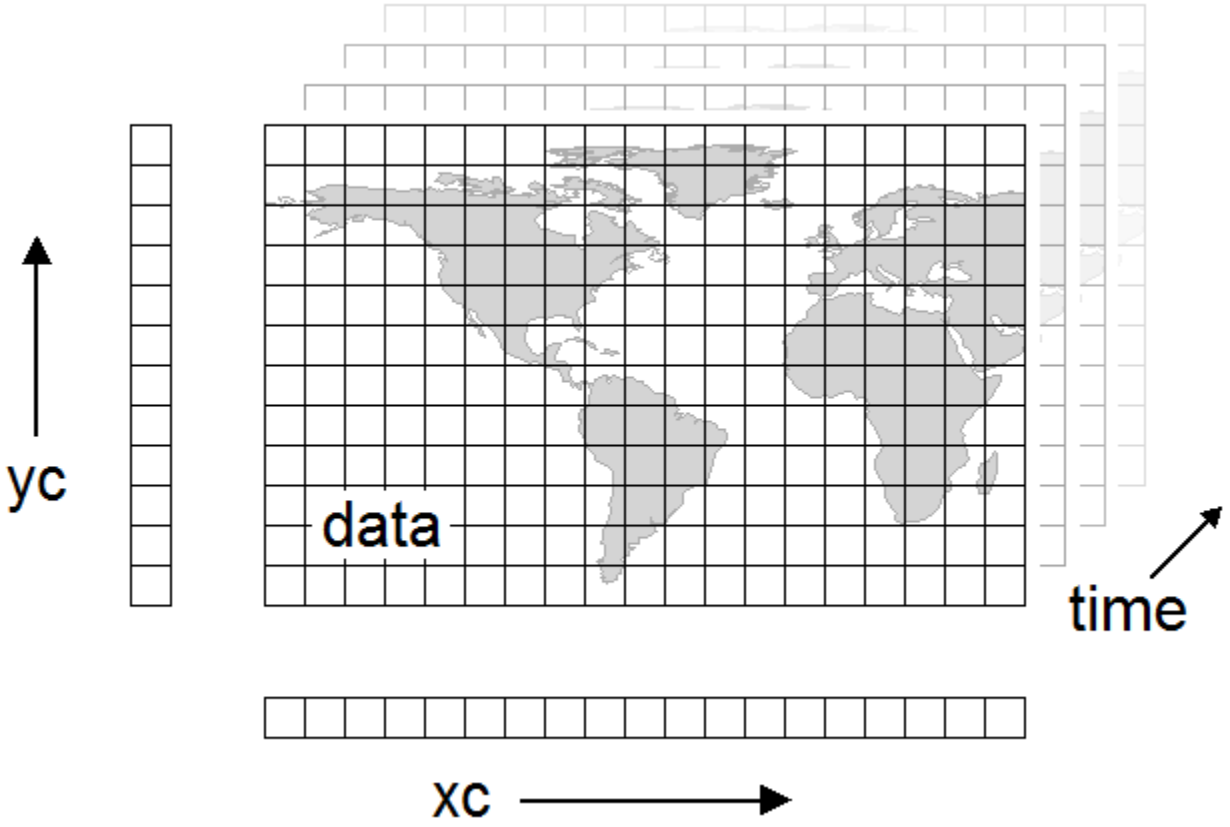
A function to describe the relationship between floodwater depth and structural damage to residential buildings.

Damage is compared to pre-event mean market value.

A three-fold cross-validation procedure has been applied on damage records in order to validate the curve.

Learning to code a .netCDF statistical tool

Development of a python tool to perform clipping and zonal statistics directly on netCDF datasets



An increasing number of datasets, especially from climatic models, are released in .cdf format which allows multiple spatial layers for different time steps.

Questions?