# Future flood hazard and regional climate modeling
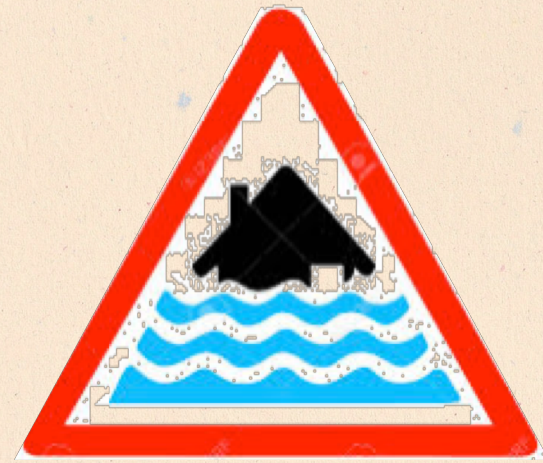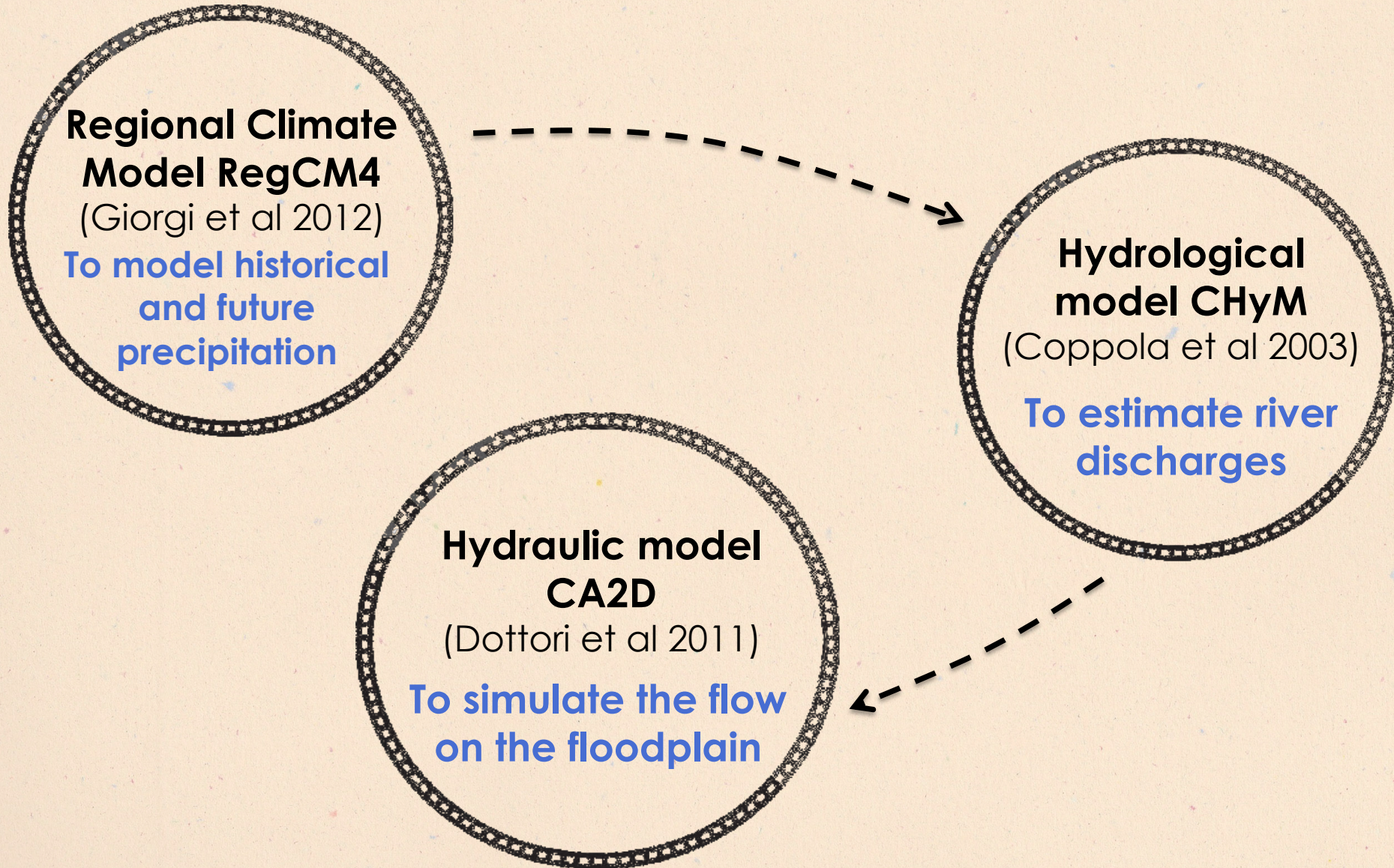
R. Nogherotto, A. Fantini, F. Raffaele, F. Di Sante, E. Coppola, F. Giorgi

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✱ Example of concrete **application** to show how climate model results can be used by **stakeholders**;

✱ An **integrated hydrological** (CHyM) and **hydraulic** (CA2D-par) approach over the Po river basin (Italy);

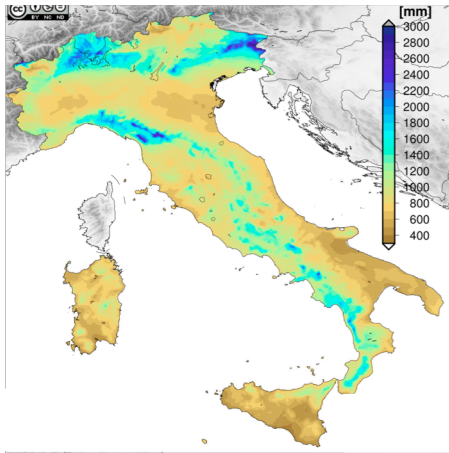✱ **Production of flood hazard maps** using observational and modeled data.

# The method:

**Regional Climate Model RegCM4** (Giorgi et al 2012) **To model historical and future precipitation**

**Hydrological model CHyM** (Coppola et al 2003) **To estimate river discharges**

**Hydraulic model CA2D** (Dottori et al 2011) **To simulate the flow on the floodplain**

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# The method:



**RegCM regional climate**

**CHyM hydrological model**
**(Coppola et al., 2003)**

**N-year discharge climatology**

1976    1977    1978    1999 ...    2099
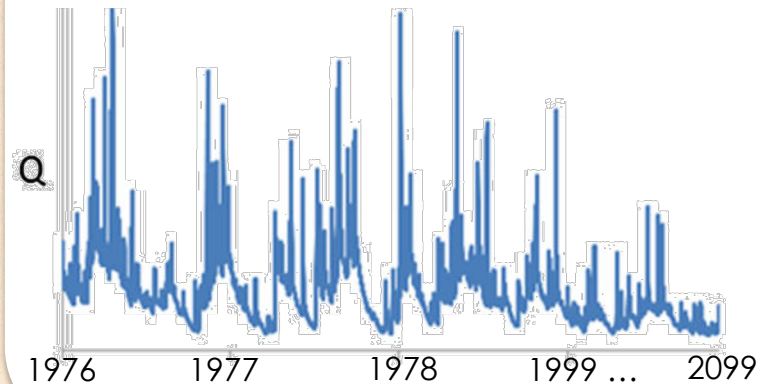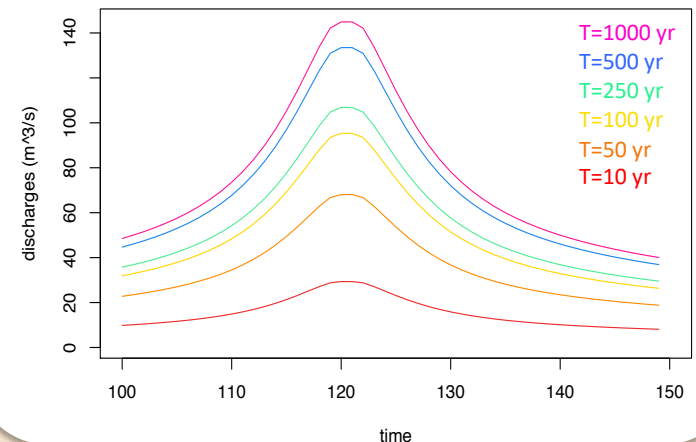
**Statistical Flood Frequency analysis**
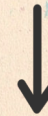
**Flood hazard maps**
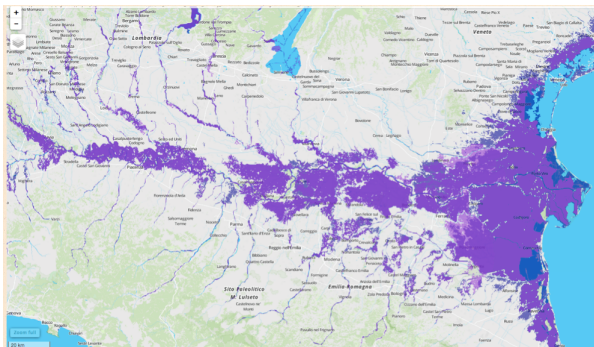
**Historical**
**Scenario RCP8.5**

**CA2D hydraulic model (Dottori et al., 2011)**

T=1000 yr
T=500 yr
T=250 yr
T=100 yr
T=50 yr
T=10 yr

discharges (m^3/s)

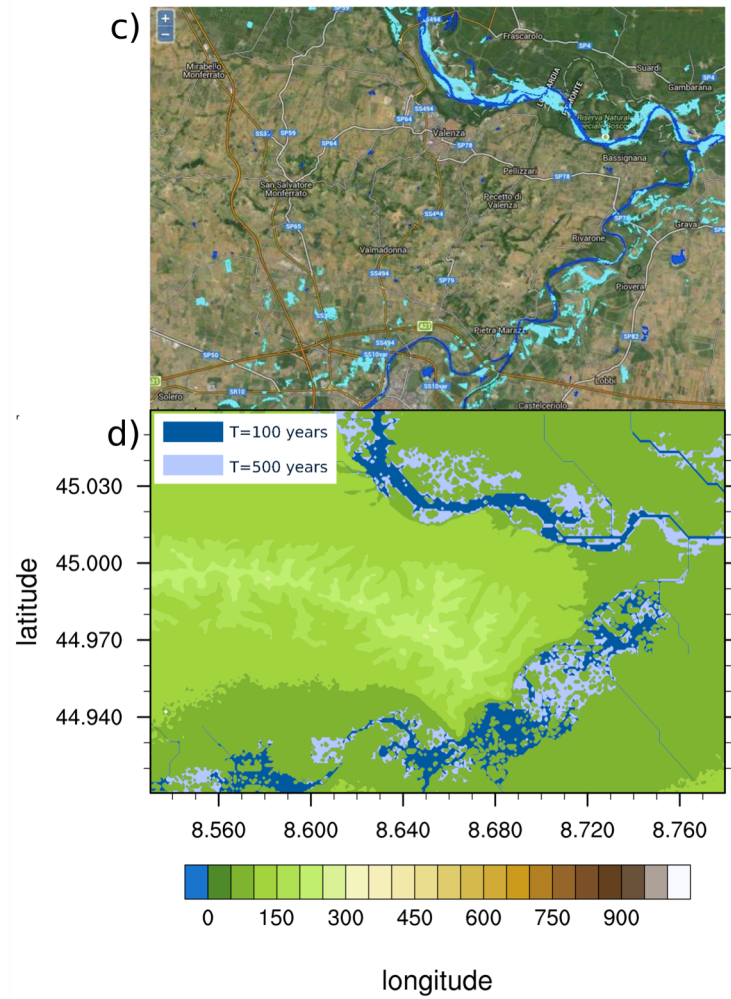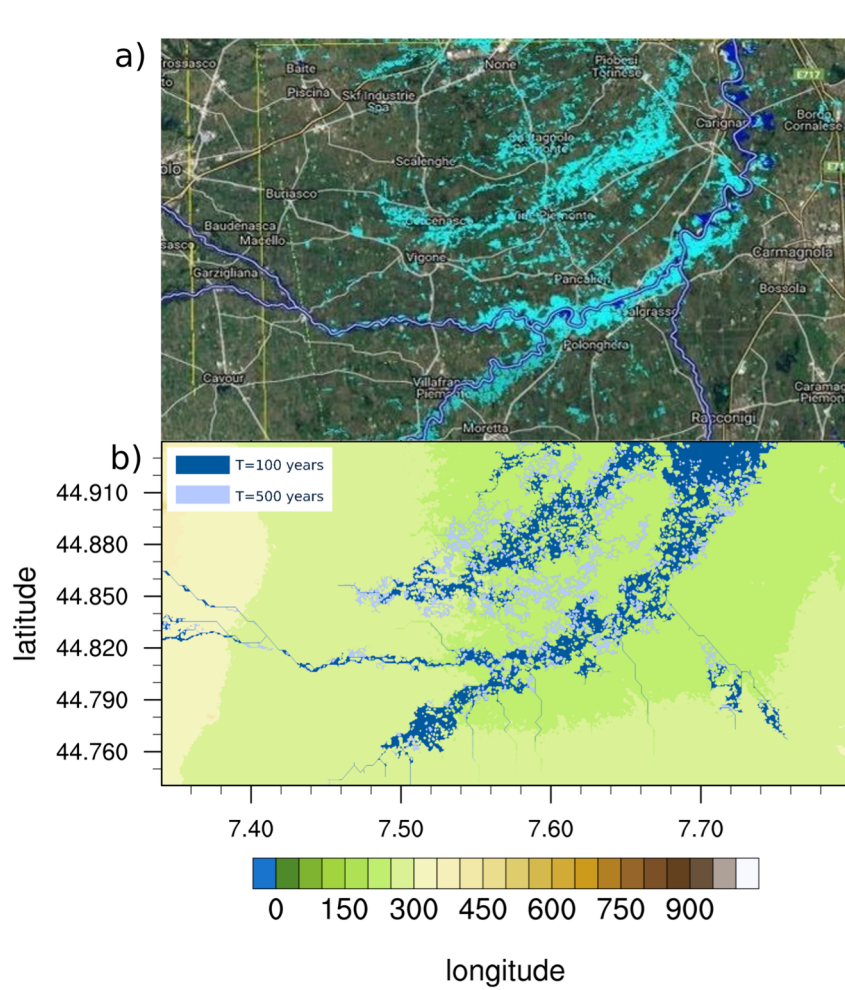time

**Synthetic Design Hydrograph (SDH)**
**(Maione et al., 2003; Beirlant et al. 2004; Alfieri et al. 2015; ...)**
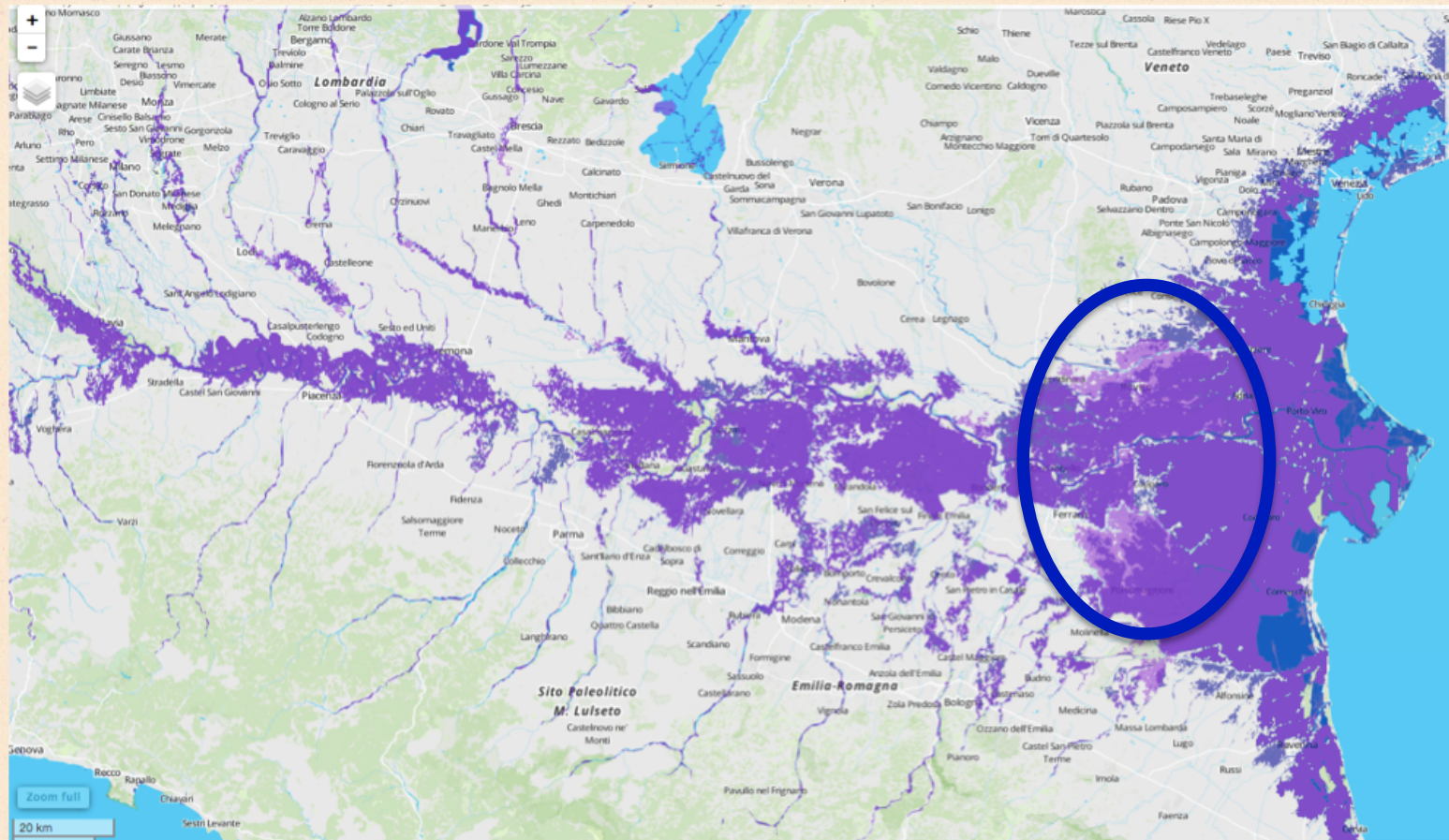
R. Nogherotto et al 2019

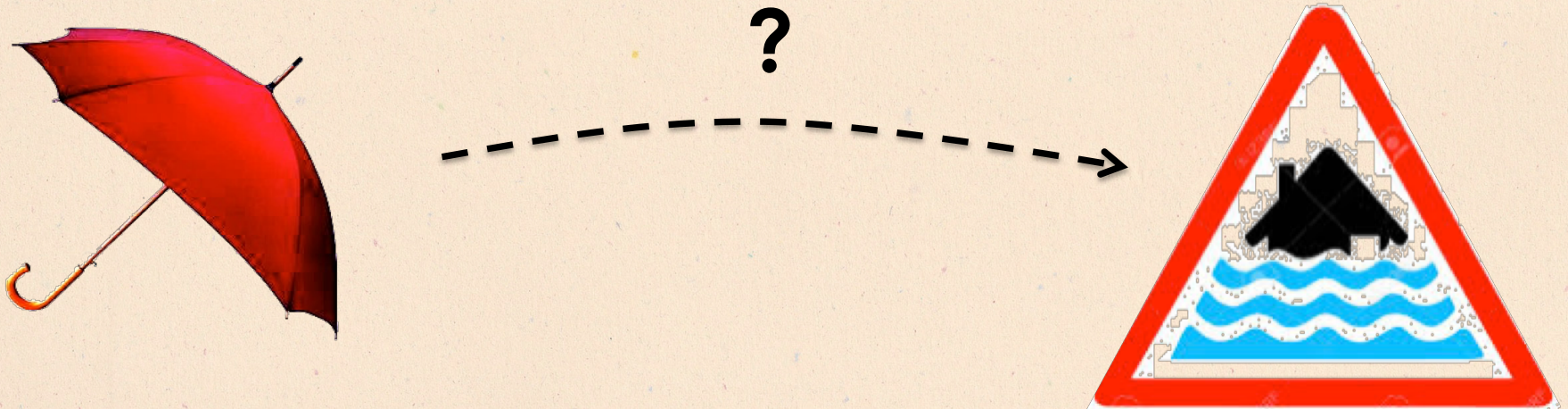T=100 yr, RegCM
T=100 yr, Obs

a)

b)

c)

d)

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# Our question:

How do the projected changes in precipitation and river discharges affect the distribution of floods?

# Use of RegCM4 regional climate model data

* **CHyM increases spatial coverage** and allows the use of observational data of precipitation;

* The use of a **regional climate model** guarantees a complete spatial and an extended **temporal coverage**;

* Validation station by station is complicated, model's error is more uniform and easier to correct.

**Two RegCM 4.6.1 12km EURO-CORDEX simulations run** (A. Fantini 2019)**:**

HadGEM  driven **1979-2016**    **historical simulation**

HadGEM  driven **1971-2099**    **scenario simulation** (RCP8.5)

**Two RegCM 4.6.1 12km EURO-CORDEX simulations run** (A. Fantini 2019)**:**

HadGEM driven **1979-2016** historical simulation

HadGEM driven **1971-2099** scenario simulation (RCP8.5)

**Precipitation change**

CHyM

**Discharges change**

**R95$_{ptot}$ change**
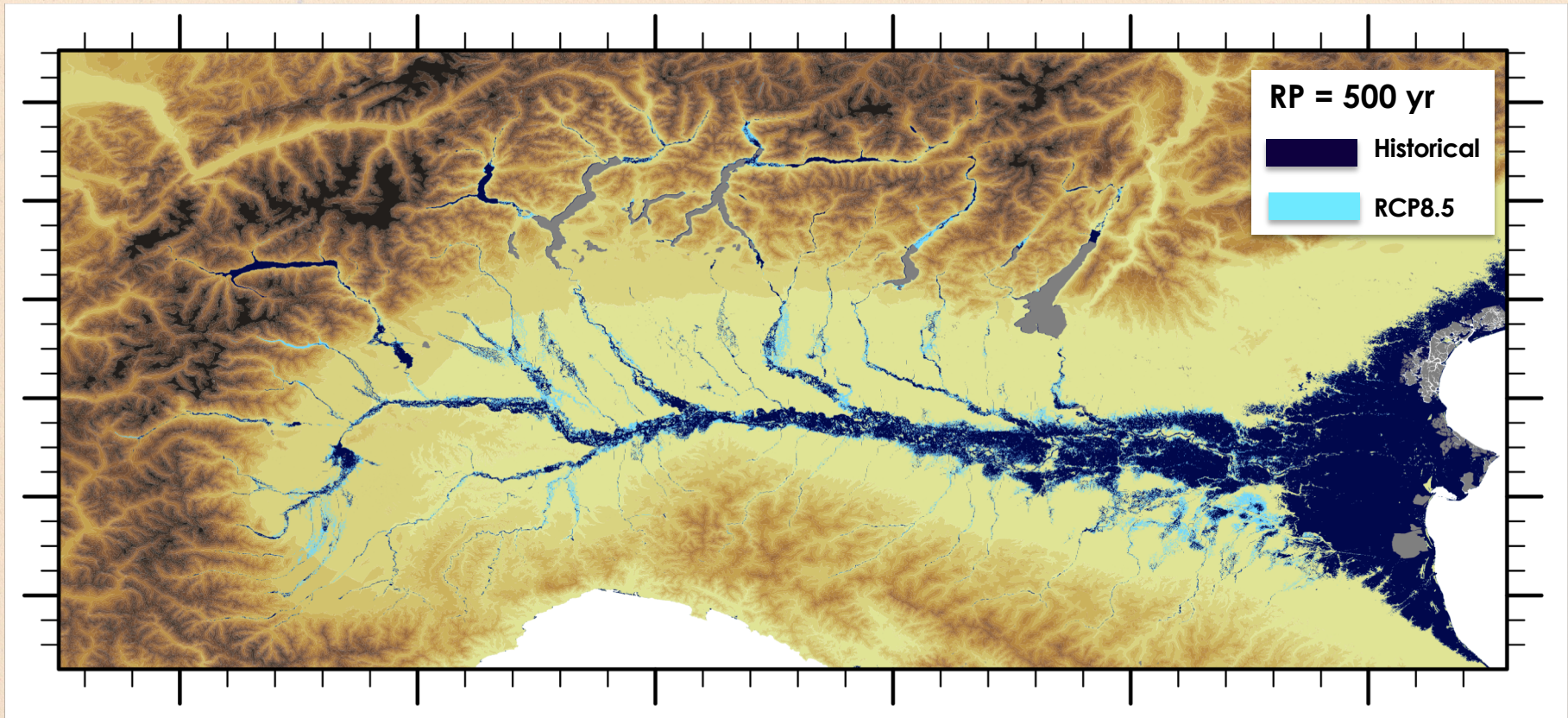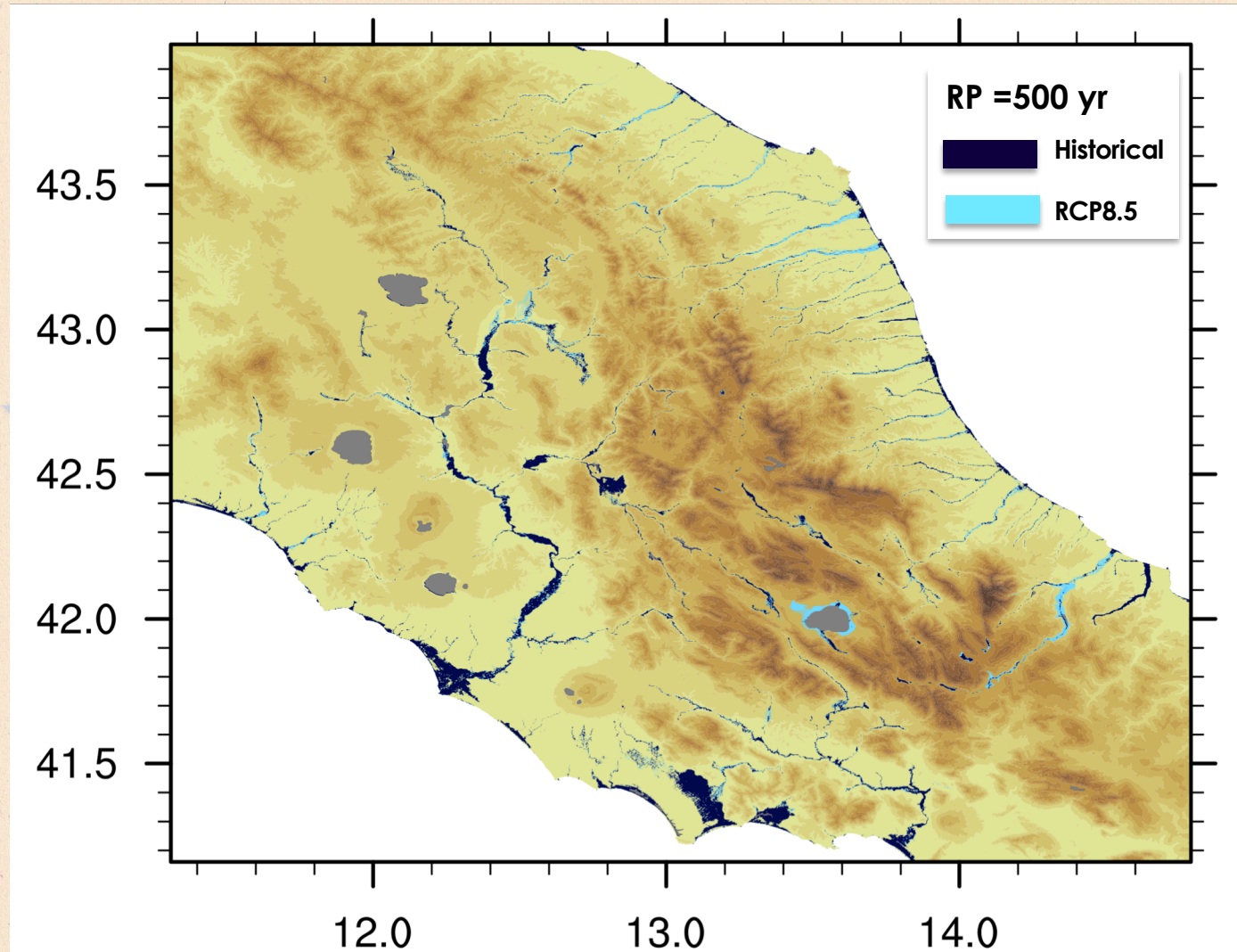
**Mean annual maximum discharge change**

We performed the flood extent simulation for a range of return periods using both **historical** and **RCP8.5** data to estimate **the flood change**.

For **T=500 yr, flooded area increases by 18%** in the North of Italy.

Central Italian **flood extent will increase in the eastern coast**, in line with the increase of maximum discharges.

# Therefore:

RegCM4 data can be used to to reproduce flood extents comparable to those obtained using observational data;

We can use the regional climate model with climate scenarios data to project flood patterns in the future and evaluate the impact of climate change on river flood hazard

# THANK YOU

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