

# Integrating top-down and bottom- up perspectives in adaptation assessment

Francesco Bosello\*, Ana Iglesias<sup>o</sup>

CMCC\*, University of Milan\*, Universidad  
Politecnica de Madrid<sup>o</sup>

## Motivation/purpose

Starting from the current methodologies/modelling approaches to climate change adaptation, identify strengths and weaknesses and propose some potential steps forward.

## Background

Adaptation is utmost important: unavoidable impacts + difficult stringent international agreement on mitigation (see Doha 2012).

Funds and mechanisms to support adaptation are being discussed (GEF funds + Adaptation Fund + “Copenhagen Accord”)

(Almost all) EU countries and the EU are endowed with an adaptation strategy.

## Background

Information on adaptation costs and effectiveness is still incomplete (EEA 2007, Agrawala and Fankhauser 2008)



Ongoing initiatives to fill the gap: FP projects like BASE, CLIMSAVE and information portals on adaptation e.g. CLIMATEADAPT

Field of increasing research

## **Question: how to spend adaptation money wisely?**

Cost and effectiveness of adaptation. Issues: sectoral vs systemic adaptation; adaptation measures, vs investment in adaptive capacity. (Fankhauser and Burton 2011)

Interaction of adaptation with other policy targets (mitigation, but also development) (Patt et al. 2010)

Role of institutional barriers and financial mechanisms in promoting adaptation. Issue: private vs public support of adaptation (Tompkins and Eakin 2011)

How to deal with uncertainty, thresholds and frictions in adjustments (Hallegatte, 2012)

## Why an answer is difficult

Adaptation can be many different things and take different forms responding to highly differentiated local circumstances; it is hardly separable from development issues. Still some coordination/planning needed at some central level.

***Integration needed across different decision and investigation scales Top-down&general/bottom-up&sectoral → true also for investigation tools. How??***

## Approaches: bottom-up vs top-down

	Top-down	Bottom-up
<b>Main variable of interest</b>	GDP, second order implications (indirect costs)	Direct costs and effectiveness of “technical “ measures
<b>Focus</b>	Strategic-economy wide	Sectoral
<b>Macro-economic context</b>	Endogenous (GE)	Exogenous (PE)
<b>Spatial Resolution</b>	“Coarse” Based upon administrative units	High, based on geo-referenced information

**Naturally, mutually supportive**



## Modelling adaptation from the top-down

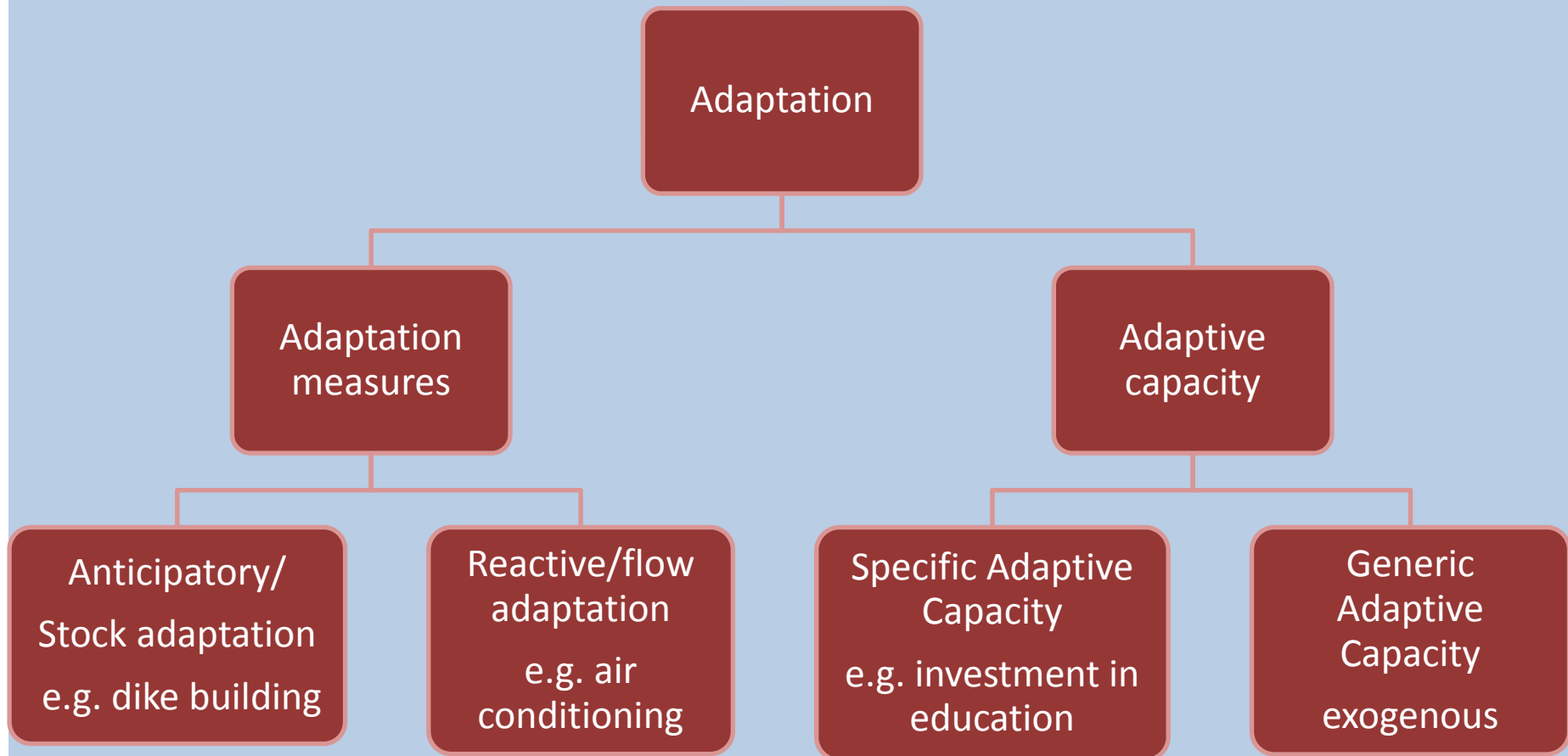
“**Adaptation is exogenous**” → “IF-THEN” analysis PAGE model (Plambeck and Hope 1997, Hope 2007...) and in CGE models (Deke et al. 2001, Darwin and Tol 2001, Bosello et al., 2007, 2012, 2013). Issue of autonomous adaptation (Ciscar et al. 2012, Aaheim et al. 2012)

**Adaptation is a “choice variable”** in hard-linked IA models.

- ✓ Adaptation as undifferentiated expenditure whether anticip. or reactive (de Bruin et al. 2009; Bosello et al 2008; Hof et al, 2009; Bahn et al. 2010)
- ✓ Adaptation differentiated by typologies in nested CES functions (Agrawala et al., 2011) Sea-level rise component in Tol (2007)



### E.g. adaptation in the AD-WITCH model

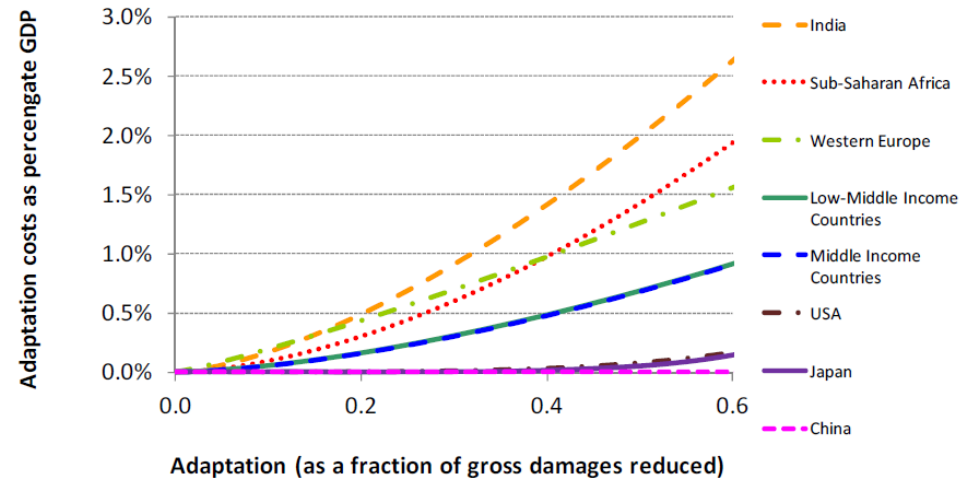


**MAdCC:** Information from the literature and experts' opinions. In the last years efforts have been made to gather systematically available knowledge on adaption cost and effectiveness per country and sectors. In particular World Bank (2010), Agrawala and Fankhauser (2008).



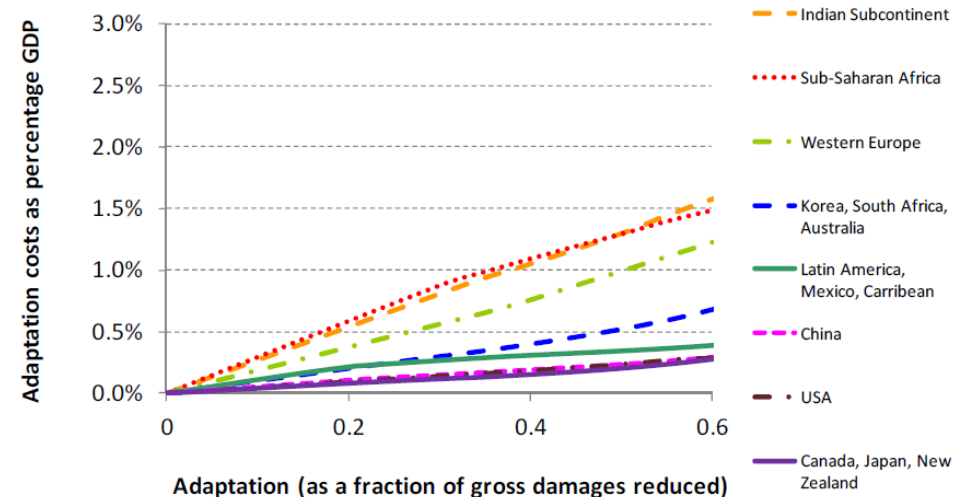
**More recently, support from Climate Adapt and other “adaptation portals”**

**AD-RICE**



**Source: Agrawala et al 2010**

**AD-WITCH**



## To do what?

Seeking for the “optimal policy portfolio” mitigation, adaptation, adaptation types → size, timing, crowding out, sensitivity to discount rates, costs, uncertainty.

Interaction react. adaptation and mitigation (de Bruin et al. 2009); antic. adaptation and mitigation (Bosello 2008), adaptation mix and mitigation (Agrawala et al 2011)

Interaction antic. adaptation and accumulation of “green and brown” capital (Bahn et al 2010)

Interaction adaptation (development aids) mitigation (Tol and Dowlatabady 2001, Tol 2007), coastal protection mitigation (Tol 2007, Anthoff and Tol 2010)

Use of revenues from carbon trading to finance adaptation (Hof et al. 2009)





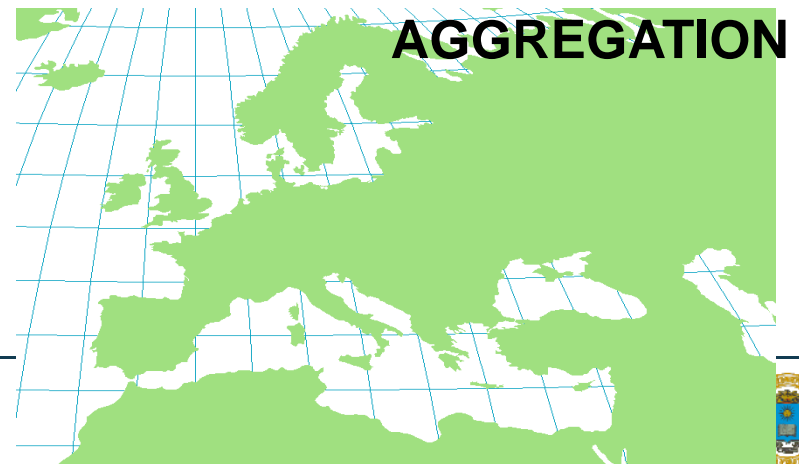
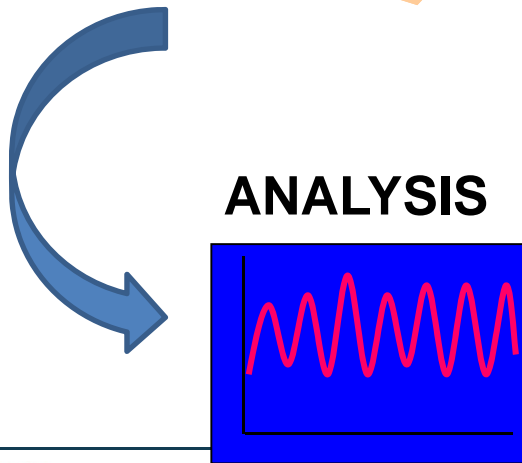
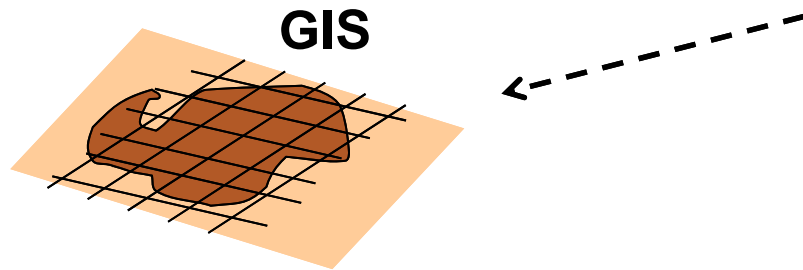
## The bottom-up

To address complexity and understand local vulnerabilities



# Modelling adaptation from the bottom-up

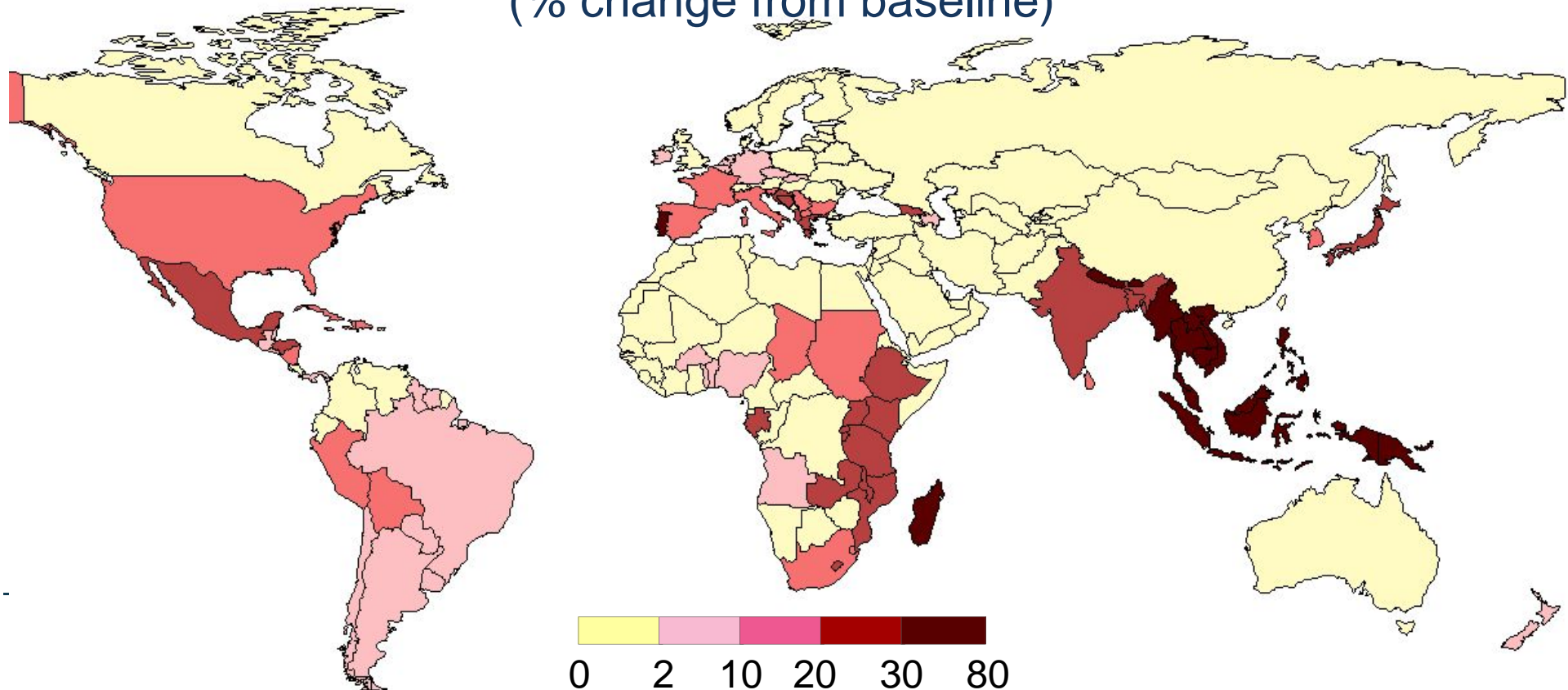
Bottom up does not mean small...





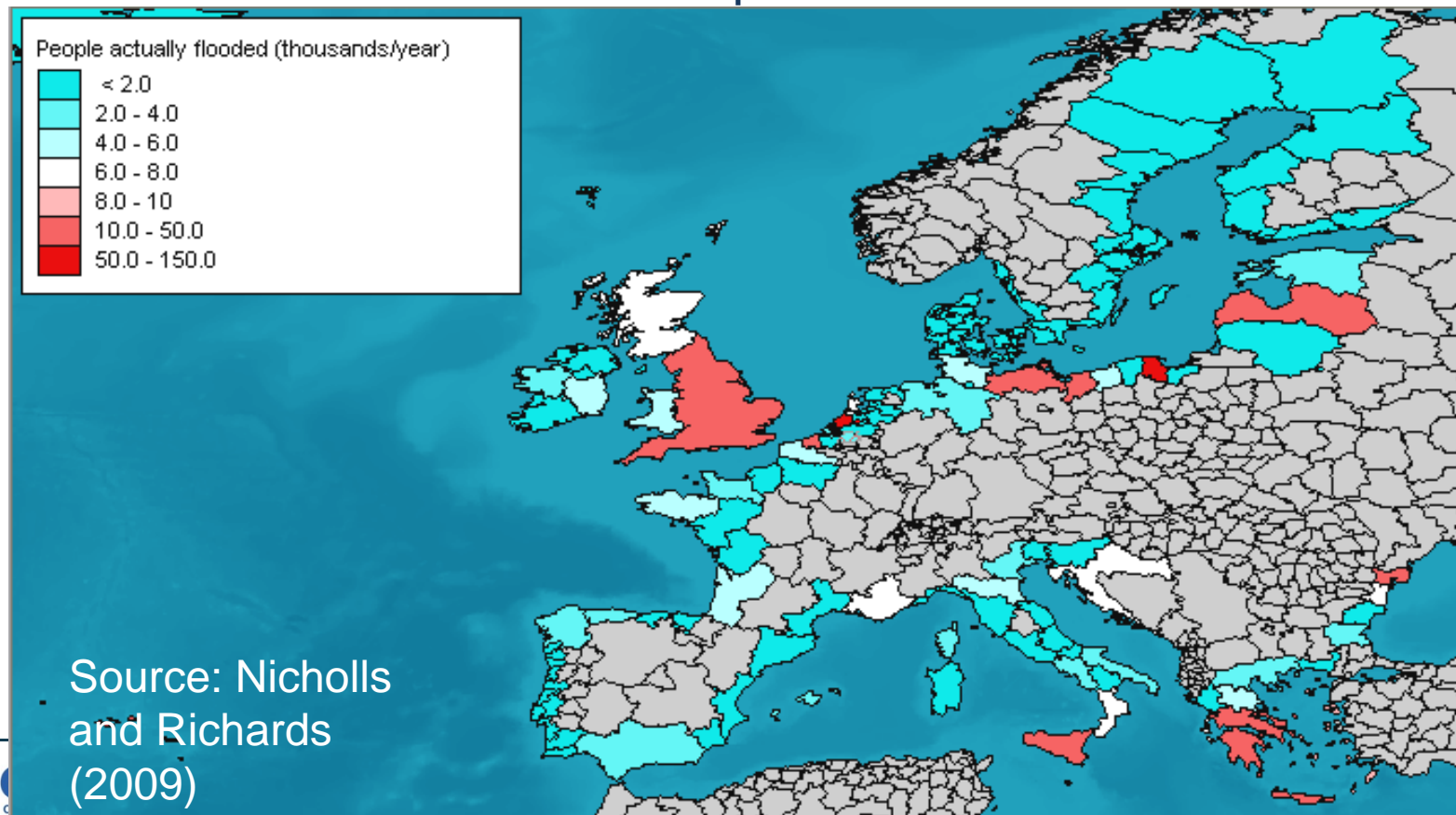
## Modelling adaptation from the bottom-up

Ex.1: Additional water for irrigation to adapt food production to the impacts of a middle emissions scenario in 2050s  
(% change from baseline)



## Modelling adaptation from the bottom-up

Ex.2: People actually flooded. A2 scenario, 2080s without adaptation





## Integration, some preliminary thoughts

The idea of “optimal adaptation” defined from a top-down perspective is misleading.

Top-down model can rather highlight:

The potential higher order consequences of given adaptation strategy

the interaction between mitigation and adaptation or other policy objectives (optimization can still play a normative qualitative role here)

departures from full rationality, the role of preferences risk, uncertainty

Indication on adaptation should be left to bottom-up approaches

## In practice:

Better grounding of TD cost benefit adaptation functions on BU information and

- higher spatial resolution in TD, but with “grain of salt”
- Use of upscaled information from BU models (rather than literature survey), to calibrate MAdCC
- Consistency in background scenario assumptions between TD and BU.

Interesting potential development: diversification in TD approaches of adaptation cost effectiveness at the sectoral level (at the moment only the FUND model does this, but on the impact side)

***Thanks!***