

Multi-year Expert Meeting
on Transport, Trade Logistics and
Trade Facilitation
8th Session

**Climate Change Adaptation for Seaports
in Support of the 2030 Agenda
for Sustainable Development**

27–28 October 2020

**Coastal Flooding Risk and Adaptation in
View of Climate Change**

Presentation by

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The European Commission's science and knowledge service

Joint Research Centre

Coastal flooding risk and adaptation in view of climate change

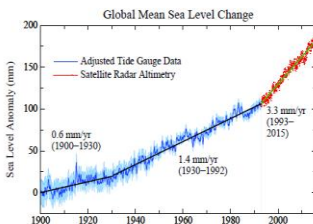
LISCoAST - Large scale Integrated Sea-level and Coastal Assessment Tool

Michalis Vousdoukas, Lorenzo Mentaschi, Luc Feyen

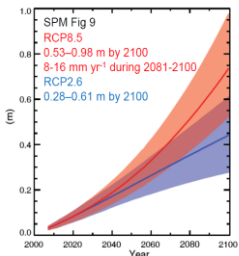
E.1 Disaster Risk Management Unit

1

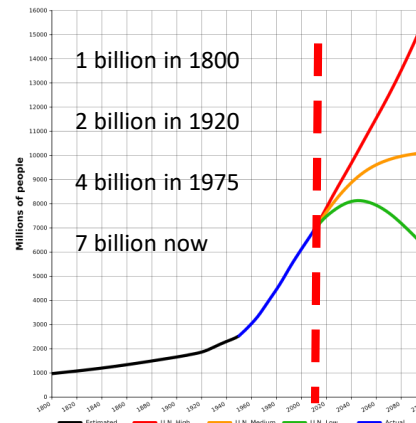
Coastal risks and challenges



Hansen ACPD, 2015



IPCC 2013



UN 2010

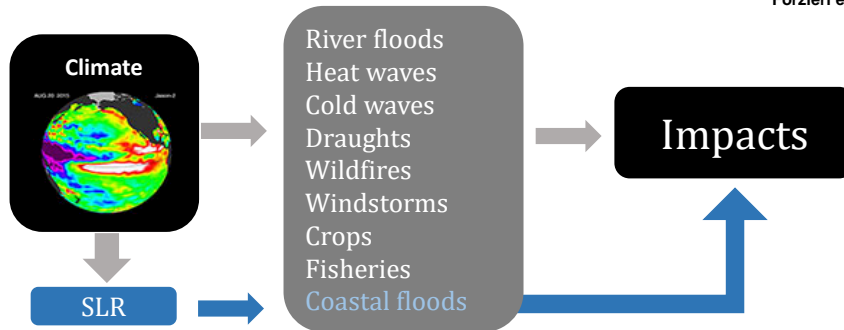
- The ocean absorbs >90% of the increase in energy
- Expansion of sea water accelerates with rising temperature
- >50% of EU population lives within 50 km of the coast
- 44% of global population lives within 100 km of the coast (UN Atlas 2010)
- A great proportion below 10 m elevation



2

What is really at stake?

Vousdoukas et al. 2020 Nature Climate Change
Alfieri et al. 2018, Climate
Forzieri et al., 2016, Climatic Change



Coastal risk becoming one of the most threatening natural hazard

River floods: 0.04% Europe's GDP (present) \Rightarrow 0.1% GDP (future)

Coastal floods: 0.01% GDP \Rightarrow 0.29-0.86% GDP



3

Policy instruments

[EU Strategy on Adaptation to Climate Change](#)

EC recommendations for [Integrated Coastal Management](#)

The [EC Floods Directive](#) requires Member States to assess if all water courses and coast lines are at risk from flooding, to map the flood extent and assets and humans at risk in these areas and to take adequate and coordinated measures to reduce this flood risk.

[EC Habitats Directive](#)

[Sendai Framework for Disaster Risk Reduction 2015-2030](#)

Paris Agreement on Climate Change and the [Sustainable Development Goals](#)

SDG11 – Sustainable cities and communities

SDG13 - Climate Action

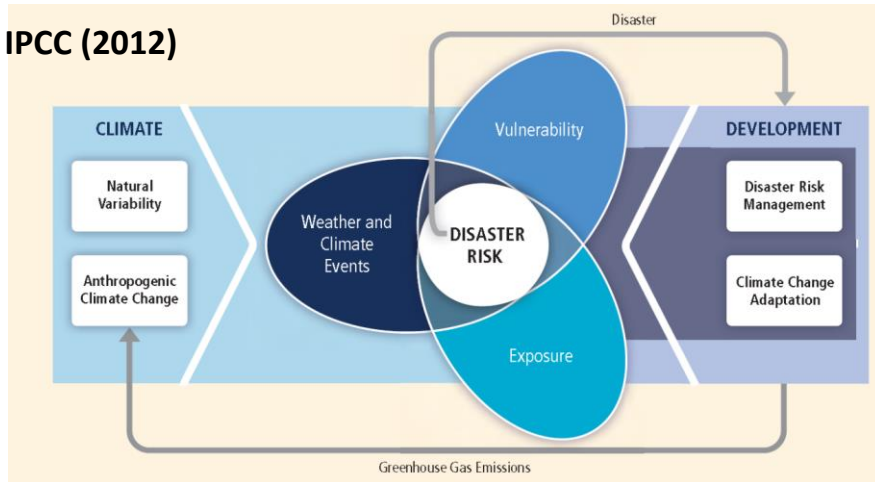
SDG15 – Life on Land



4

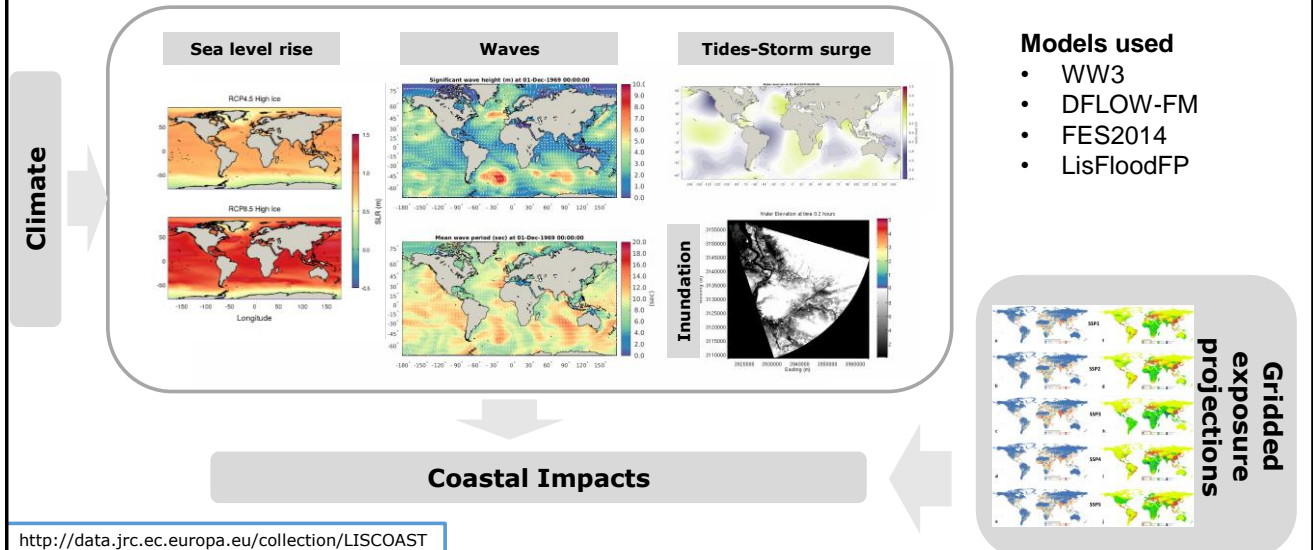
Climate risk - framework

SREX, IPCC (2012)



5

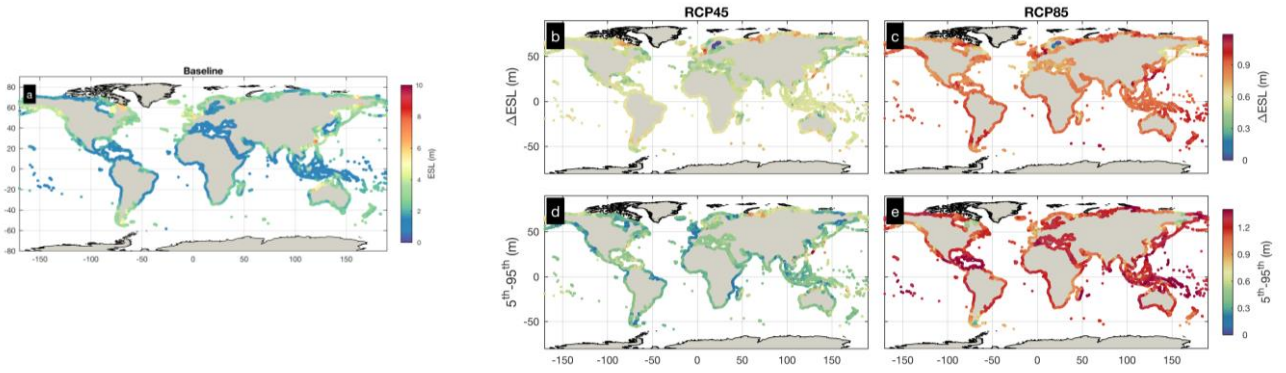
LISCoAsT – Large-scale Coastal Assessment Tool



6

ESL projections: All components

Driven by SLR, changes in tides, waves, and storm surges



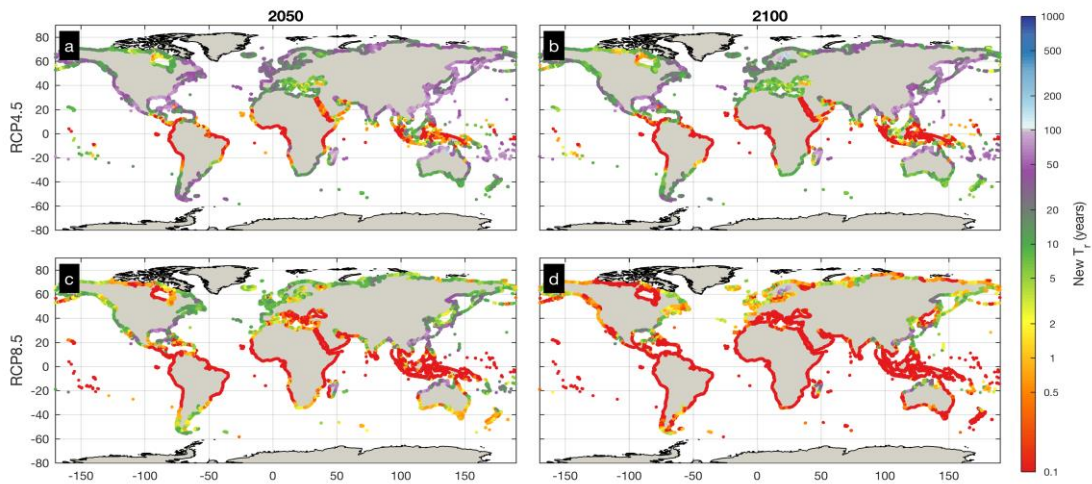
Vousdoukas et al. 2018 Nature Communications

Median rise within 20-30 cm by 2050, 51-86 cm by the end of the century



7

Intensification of ESLs



Vousdoukas et al. 2018 Nature Communications

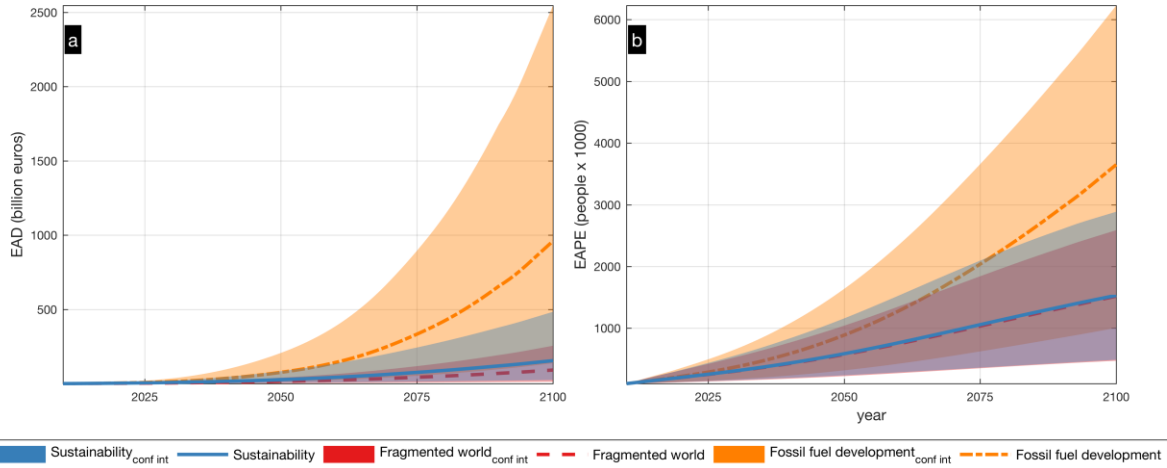
Storm of the century occurs every year by 2050 along most of the tropics

By the end of the century along most of the global coastline



8

Projections of EAD for RCP4.5 and 8.5

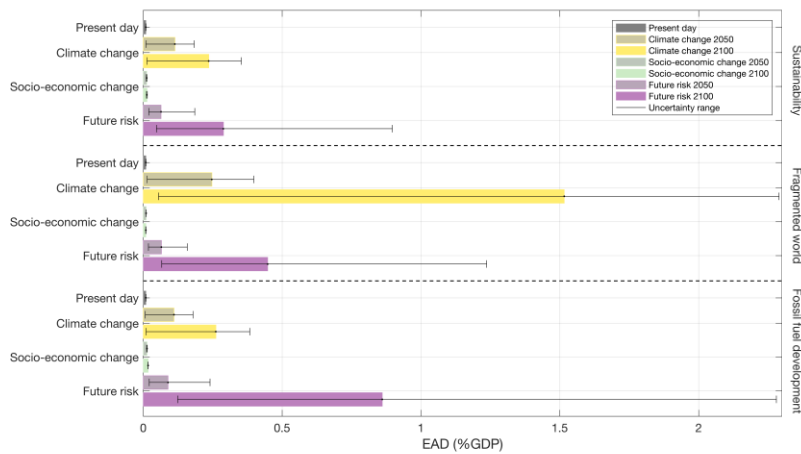


Vousdoukas et al. 2018 Nature Climate Change

Present EAD of €1.25 billion is projected to increase by 2-3 orders of magnitude by the end of the century, ranging between 93 and €961 billion.



Coastal impacts- Socio-economic vs Physical



Vousdoukas et al. 2018 Nature Climate Change

Climate becomes the main driver of rising losses in contrast to historical trends which were dominated by socioeconomic development



The challenges of coastal adaptation



Photos by www.wikipedia.org

Protect (Hard protection, beach nourishment, hybrid)

Accommodate (Reduce vulnerability) High population density → limited space to accommodate

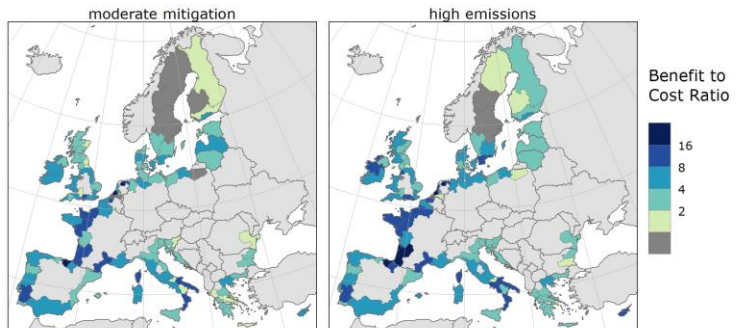
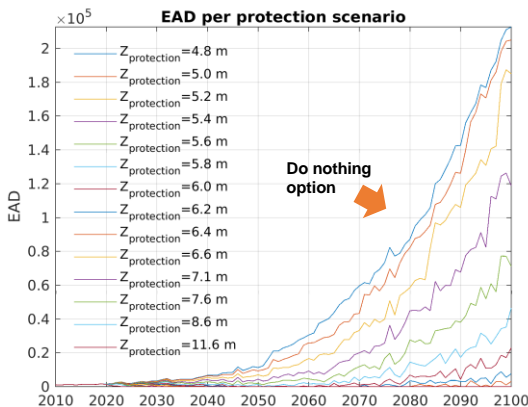
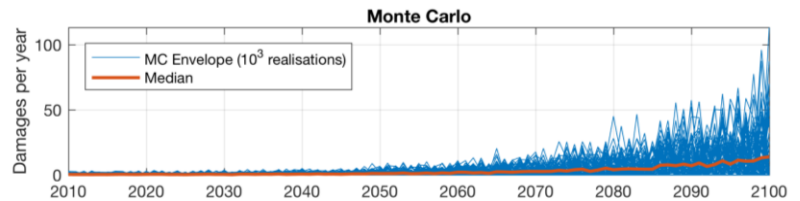
Retreat (Reduce exposure) Critical infrastructure → retreat costly and technically difficult

Do nothing Not an option with high population density and presence of critical assets



Discovering possible futures

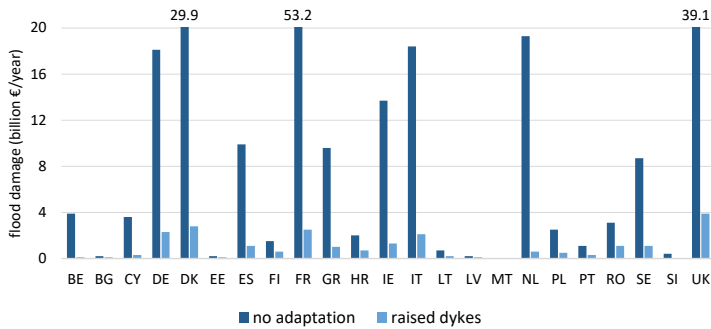
Thousands of simulations which cover the range of the combinations of GHG emissions, climate change, socioeconomic development and adaptive action



Vousdoukas et al. 2020 Nature Communications



Costs and benefits of Adaptation



Vousdoukas et al. 2020 Nature Communications

Damages (€ billion/year)

People exposed (million/year)

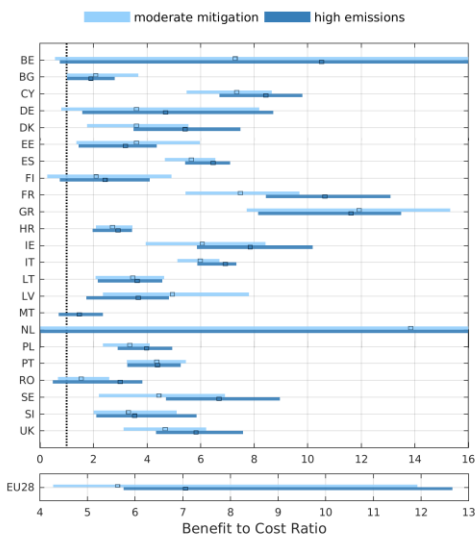
Today	High emissions		Moderate mitigation	
	No adapt	Adapt	No adapt	Adapt
1.4	239	23	111	12
0.1	2.2	0.8	1.4	0.6

Mitigation reduces 40% of the losses

Adaptation could prevent 95% of these impacts



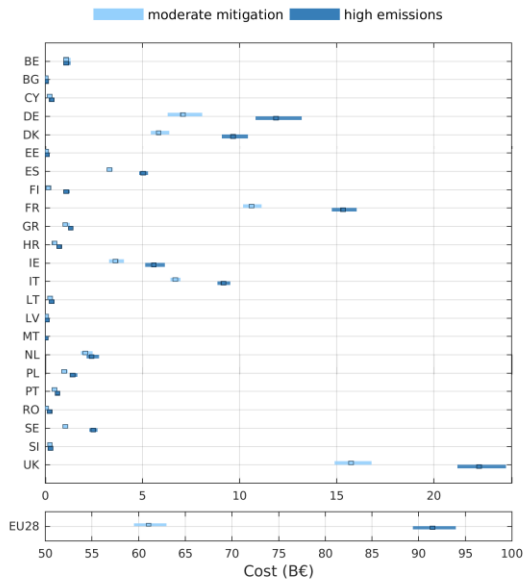
Benefit to cost ratios



- Present protection is economically optimal for 81% and 77% of the European coastline, under moderate mitigation and high emissions, respectively
- Adaptation is highly beneficial for areas with urbanization
- Higher uncertainty for NL and BE



Cost of Adaptation (discounted)

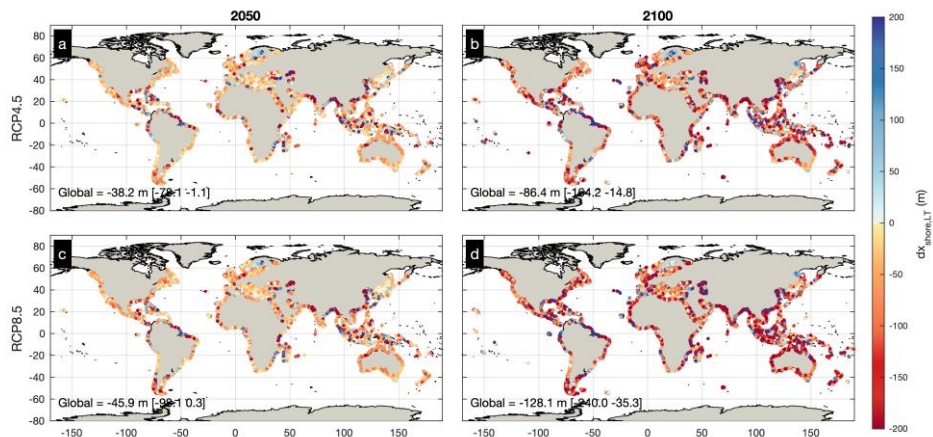


- The European average additional coastal defence height required is 84 and 100 cm under moderate mitigation and high emissions, respectively
- Costs relate a lot to coastline length and extent of coastal urbanization
- No discounting results in 3 x costs
- Allows more protection, reducing losses by >98%
- Benefit to cost ratios double



15

Global sandy beach change



Vousdoukas et al. Nature Climate Change 2020

37.2%-50.9% (99,996-135,279 km) of the world's sandy beaches could face severe erosion by the end of the century.

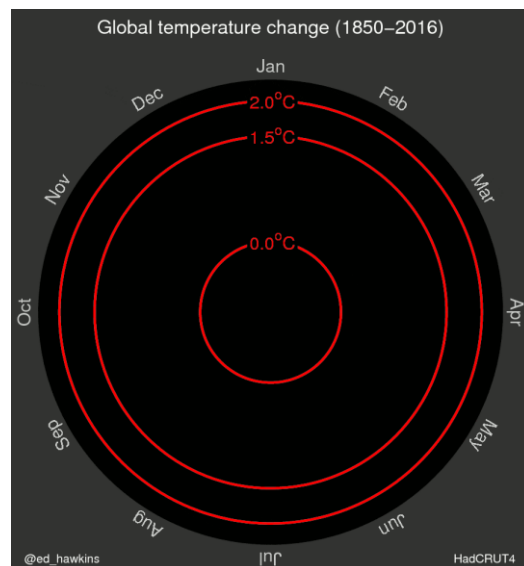
Moderate GHG emission mitigation could prevent 40% of the projected shoreline retreat (corresponding to a global average of around 42 m of preserved sandy beach width).



16

Summary-key points

- SLR and increasing population near the coast will result in higher risk
- EC-JRC has developed LISCOAST, a framework to assess future losses from coastal flooding/erosion as well as adaptive measures
- The once in a century sea level will probably rise within 20-30 cm by 2050, 51-86 cm by the end of the century; higher end scenarios reach 2 m
- Consequently catastrophic events will be more frequent: the storm of the century will occur every year by 2050 along most of the tropics, and almost worldwide by the end of the century
- In Europe, present EAD of €1.25 billion is projected to increase by 100 to 1000 times by the end of the century.
- Most of the increase is driven by climate change, in contrast to historical trends which were dominated by socioeconomic development.
- GHG emissions mitigation can reduce 40% of the above losses, while adaptation could prevent 95% of them
- Adaptation is highly beneficial for areas with urbanization and action may be needed at only 19-23% of the European coastline, depending on the GHG emissions scenario



17



Thank you very much...

<http://data.jrc.ec.europa.eu/collection/LISCOAST>

www.vousdoukas.com



18