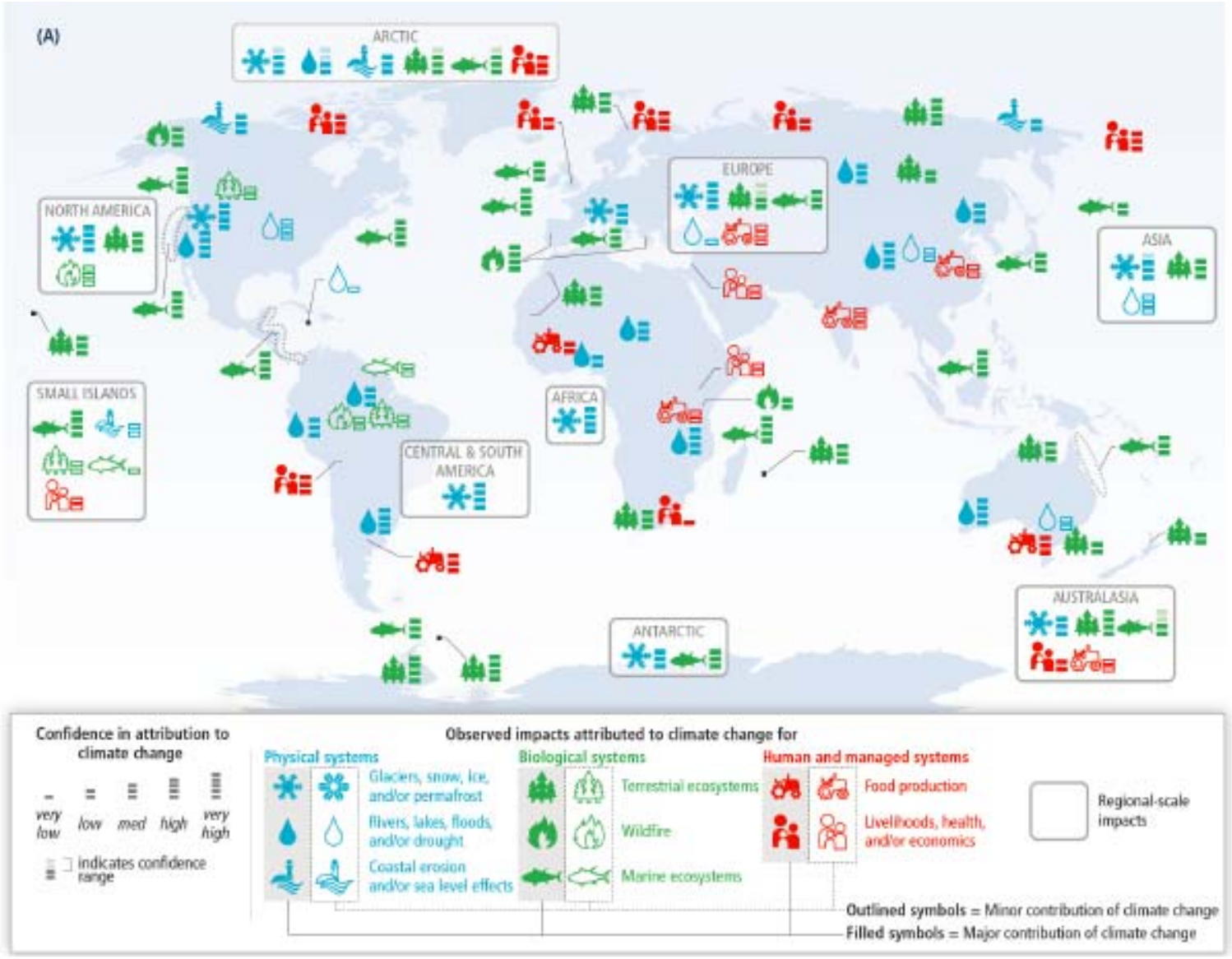
Current challenges in the impacts and adaptation to climate change:

Introduction to IPCC 5th Assessment WG2

Observed Impacts Vulnerability & Adaptation

- We are already seeing climate change and responses to it: changing precipitation affecting water resources, shifts in marine species, falls in crop yields and increases in climate related extremes.
- For countries at all levels of development the impacts are consistent with a significant lack of preparedness.

Observed Impacts of CC



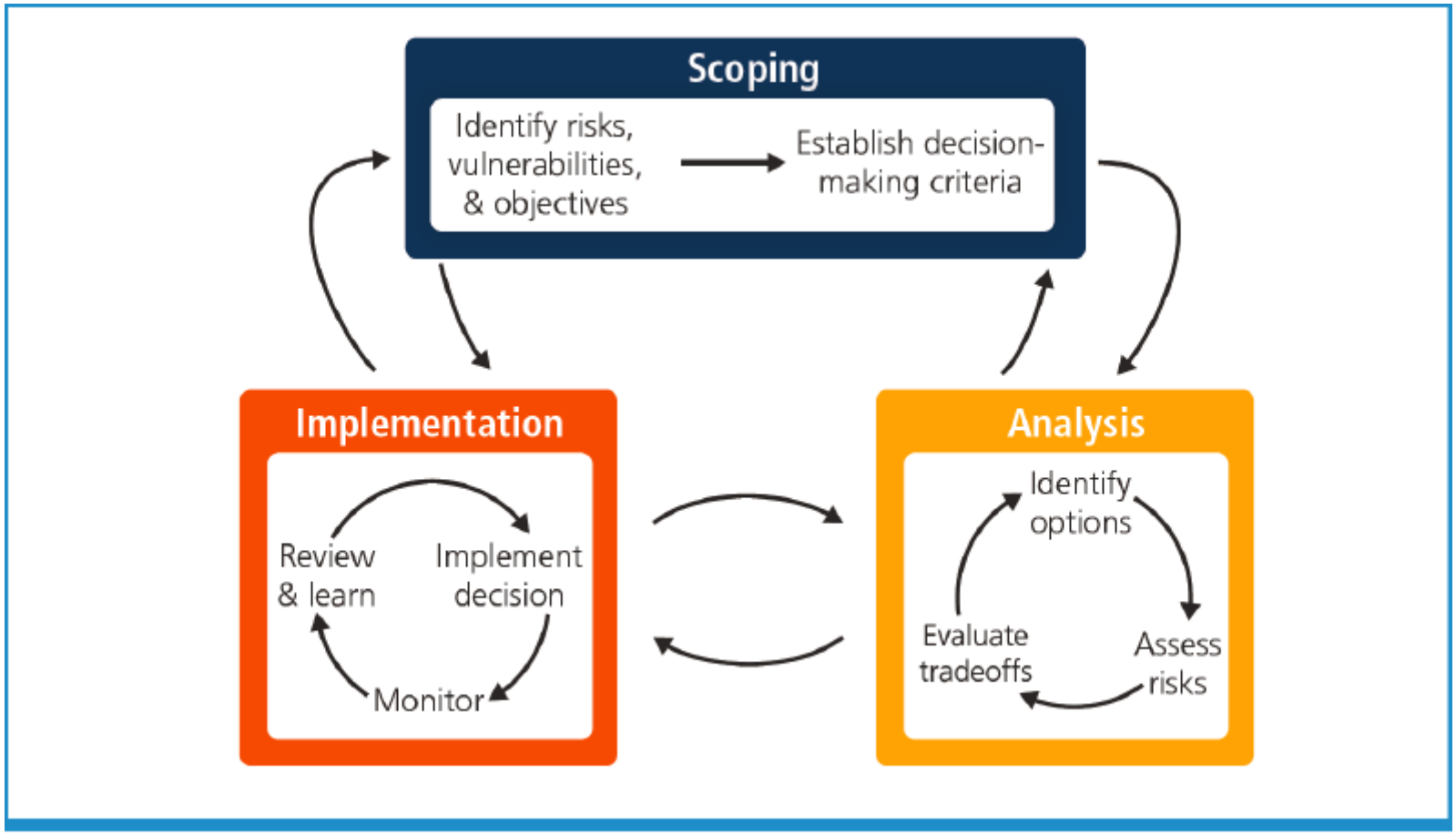
The Adaptation Experience

- Adaptation is becoming embedded in some planning processes but with limited implementation of responses.
- Focus has been on engineering and technological options with incremental actions where co-benefits are strong.
- Most adaptation activity has been restricted to impacts and adaptation planning with very little on implementation.

The Decision-Making Context

- Responding to climate-related risks involves decision-making in a context of high uncertainty about the severity and timing of impacts and of the effectiveness of actions.
- Iterative risk management methods are being developed but thy are still not at a high level of maturity.

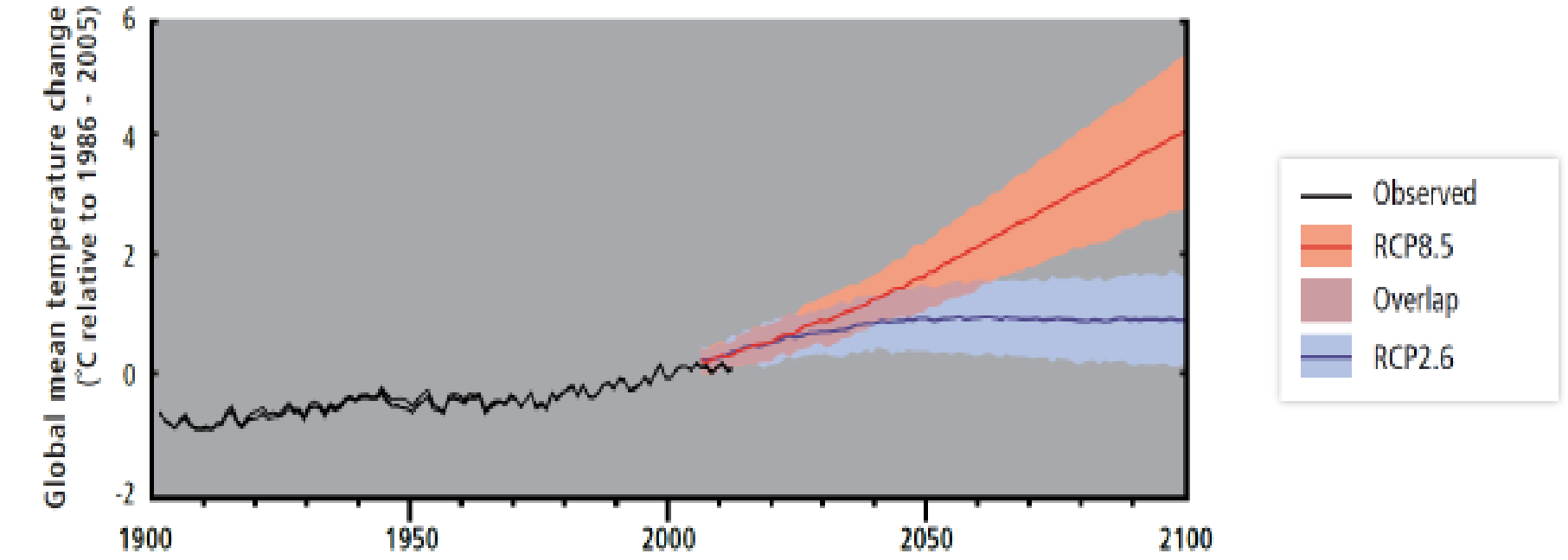
Iterative Risk Management



Adaptation Versus Mitigation

- The benefits of adaptation and mitigation occur over different but overlapping time frames.
- Projected temperature increases to 2050 are similar across different emission scenarios. During this period risks will evolve as socio-economic trends interact with a changing climate. Adaptation actions will influence outcomes.
- After 2050 temperature increases depend on emission scenarios and risks of climate change will depend on which path is followed.

Projected Climate Changes



- Observed increases from 1900 to 2005 are about 0.6ºC

Climate-resilient Pathways

- Climate resilient pathways for sustainable development are related fundamentally to what the world accomplishes with climate mitigation.
- Great rates and magnitude of climate change increases the risk of exceeding adaptation limits.
- Priorities in allocating resources between mitigation and adaptation now are, however, unclear: some models indicate priority to mitigation others to adaptation.

Future Risks

1. Risk of death, injury, ill-health and disrupted livelihoods in low-lying coastal areas and SIDS.
2. Risk of death, injury, ill-health and disrupted livelihoods for large urban populations due to inland flooding in some regions.
3. Systematic risks due to extreme weather events
4. Mortality and morbidity due to extreme heat
5. Food insecurity linked to warming, drought, floods, especially for poor populations.
6. Risks of loss of rural livelihoods due to lack of irrigation water and reduced agricultural productivity.
7. Loss of marine ecosystems, biodiversity and services they provide for coastal livelihoods.
8. Loss of terrestrial ecosystems and the services they provide for livelihoods.

Particular Reasons for Concern

- Increasing warming raises the likelihood of severe pervasive and irreversible impacts:
  - Threatened ecosystems, species extinction, food security, compromise on a wide range of human activities.
- These risks can be reduced significantly by limiting emissions of GHGs.

Sectoral Risks & Potential for Adaptation: Freshwater

- Projections are for a reduction in renewable surface and groundwater water in most sub-tropical regions.
- In contrast water resources are projected to increase in high latitudes.
- Quality of water likely to decline everywhere.
- Adaptation options: scenario planning, learning based approaches, flexible non-regret solutions can increase resilience to uncertain hydrological changes.

Sectoral Risks & Potential for Adaptation: Terrestrial Ecosystems

- A large fraction of both terrestrial and freshwater species faces increased extinction risk under projected climate change during and beyond the 21st century, as climate change interacts with other stressors, such as habitat modification, over-exploitation, pollution, and invasive species.
- Actions, such as maintenance of genetic diversity, assisted species migration and dispersal, manipulation of disturbance regimes (e.g., fires, floods), and reduction of other stressors, can reduce, but not eliminate these risks in part by helping species to adapt to the changes.

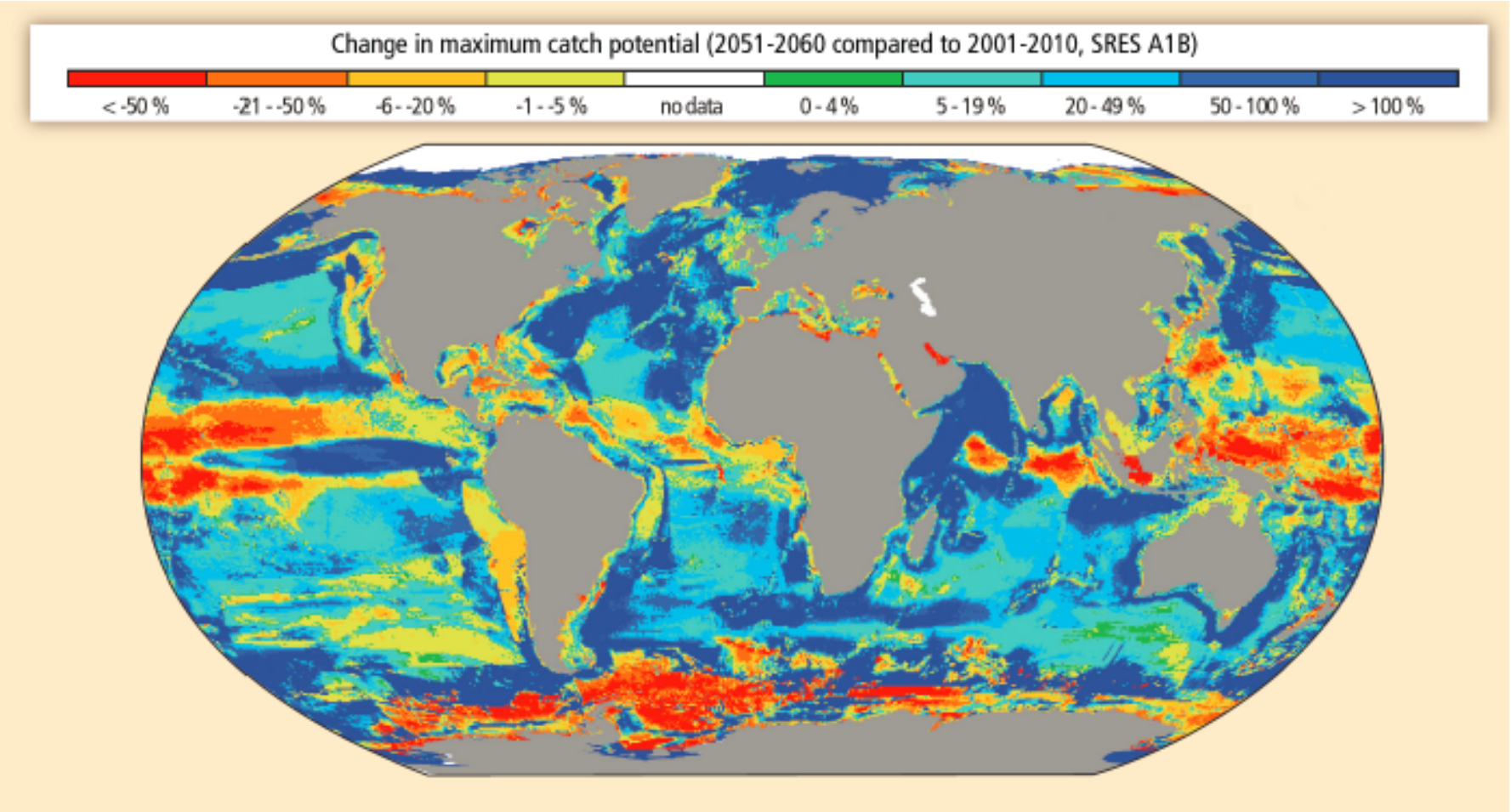
Sectoral Risks & Potential for Adaptation: Coastal & Low Lying Areas

- Sea-level rise projected throughout the 21st century and beyond, will increasingly cause adverse impacts such as submergence, coastal flooding, and coastal erosion.
- The population and assets exposed to coastal risks will increase significantly in the coming decades due to population growth, economic development, and urbanization.
- Adaptation options include protection measures as well as land use planning. Costs vary a lot by region and in some islands could be very high.

Sectoral Risks & Potential for Adaptation: Marine Ecosystems

- Spatial shifts of marine species due to projected warming will cause high-latitude invasions and high local-extinction rates in the tropics and semi-enclosed seas.
- Richness and fisheries catch potential are projected to increase, on average, at mid and high latitudes and decrease at tropical latitudes.
- For medium to high emissions scenarios ocean acidification poses substantial risks to marine ecosystems, especially polar ecosystems and coral reefs.
- Adaptation options discussed include large scale translocations of industrial fishing, flexible management, reductions of other stressors such as pollution, restoration of mangroves, coral reefs etc..

Changes in Catch Potential 2050+



Sectoral Risks & Potential for Adaptation: Food Security

- Projected changes in yields vary a lot by region and crop. Declines are larger in low latitudes and declines increase in all regions over time.
- Adaptation measures include development of more resilient varieties, shifts to crops that are less affected by climate change, changes in timing of crops and increased efficiency in the use of water.
- A part of this is autonomous but a part involves public decision-making.

Sectoral Risks & Potential for Adaptation: Urban Areas

- Heat stress, extreme precipitation, inland and coastal flooding, landslides, air pollution, drought, and water scarcity pose risks in urban areas.
- Risks are amplified for those lacking essential infrastructure and services or living in poor-quality housing and exposed areas.
- Reducing basic service deficits, improving housing, and building resilient infrastructure systems could significantly reduce vulnerability and exposure in urban areas.
- Urban adaptation benefits from effective multi-level urban risk governance, alignment of policies and incentives, strengthened local government and community adaptation capacity, synergies with the private sector, and appropriate financing and institutional development

Sectoral Risks & Potential for Adaptation: Human Health

- Until mid-century, projected climate change will impact human health mainly by exacerbating health problems that already exist . Throughout the 21st century, climate change is expected to lead to increases in ill-health in many regions and especially in developing countries with low income
- Examples include greater likelihood of injury, disease, and death due to more intense heat waves and fires; increased likelihood of under-nutrition resulting from diminished food production in poor regions; risks from lost work capacity and reduced labor productivity in vulnerable populations; and increased risks from food- and water-borne diseases and vector-borne diseases.
- The most effective adaptation measures for health in the near-term are programs that implement and improve basic public health measures such as provision of clean water and sanitation, secure essential health care including vaccination and child health services, increase capacity for disaster preparedness and response, and alleviate poverty

Sectoral Risks & Potential for Adaptation: Human Security

- Climate change over the 21st century is projected to increase displacement of people.
- Displacement risk increases when populations that lack the resources for planned migration experience higher exposure to extreme weather events, particularly in developing countries with low income.
- Expanding opportunities for mobility can reduce vulnerability for such populations.
- Climate change can indirectly increase risks of violent conflicts in the form of civil war and inter-group violence by amplifying well-documented drivers of these conflicts such as poverty and economic shocks.

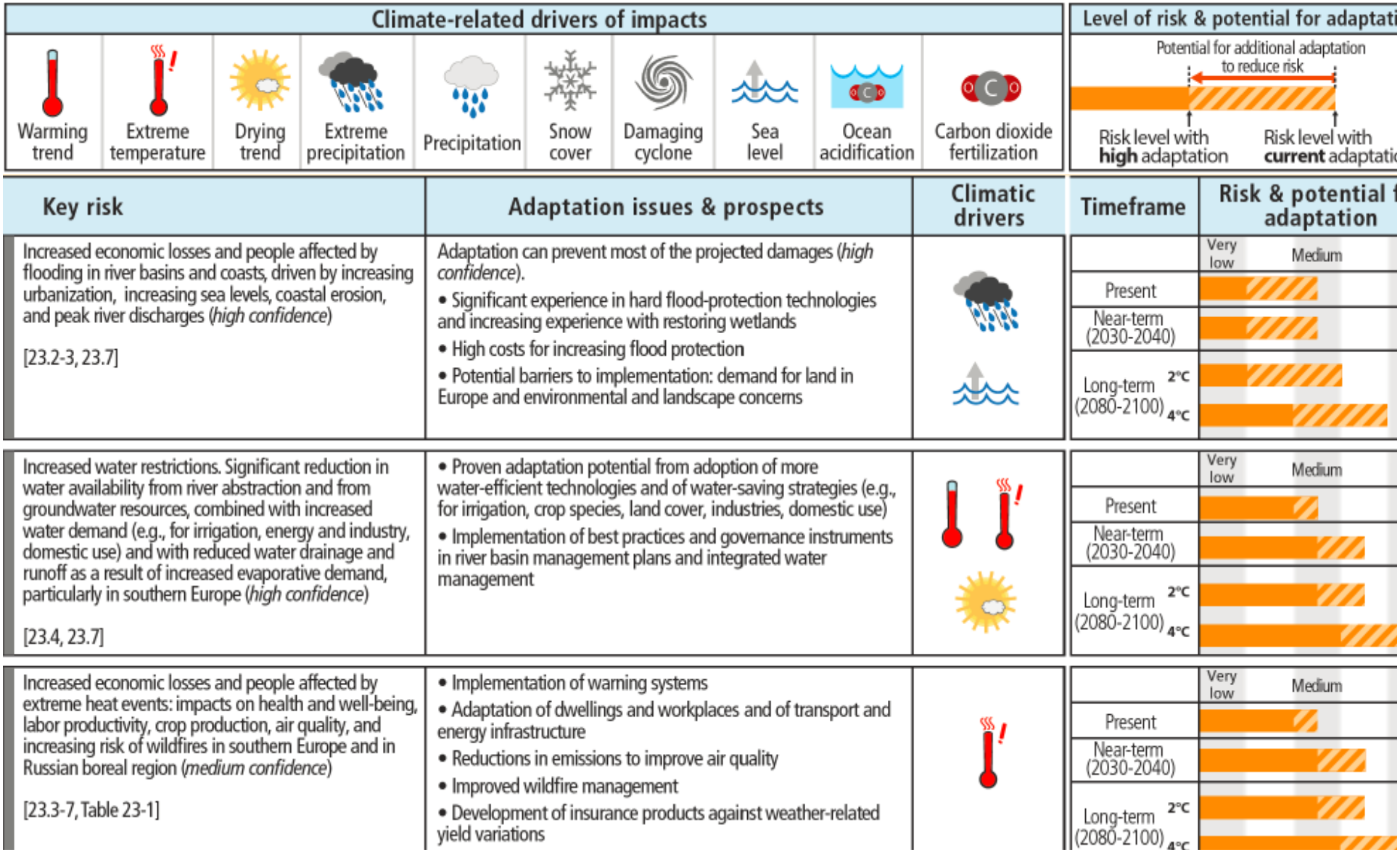
Livelihoods and Poverty

- Climate-change impacts are expected to exacerbate poverty in most developing countries and create new poverty pockets in countries with increasing inequality, in both developed and developing countries.
- Insurance programs, social protection measures, and disaster risk management may enhance long-term livelihood resilience among poor and marginalized people, if policies address poverty and multidimensional inequalities

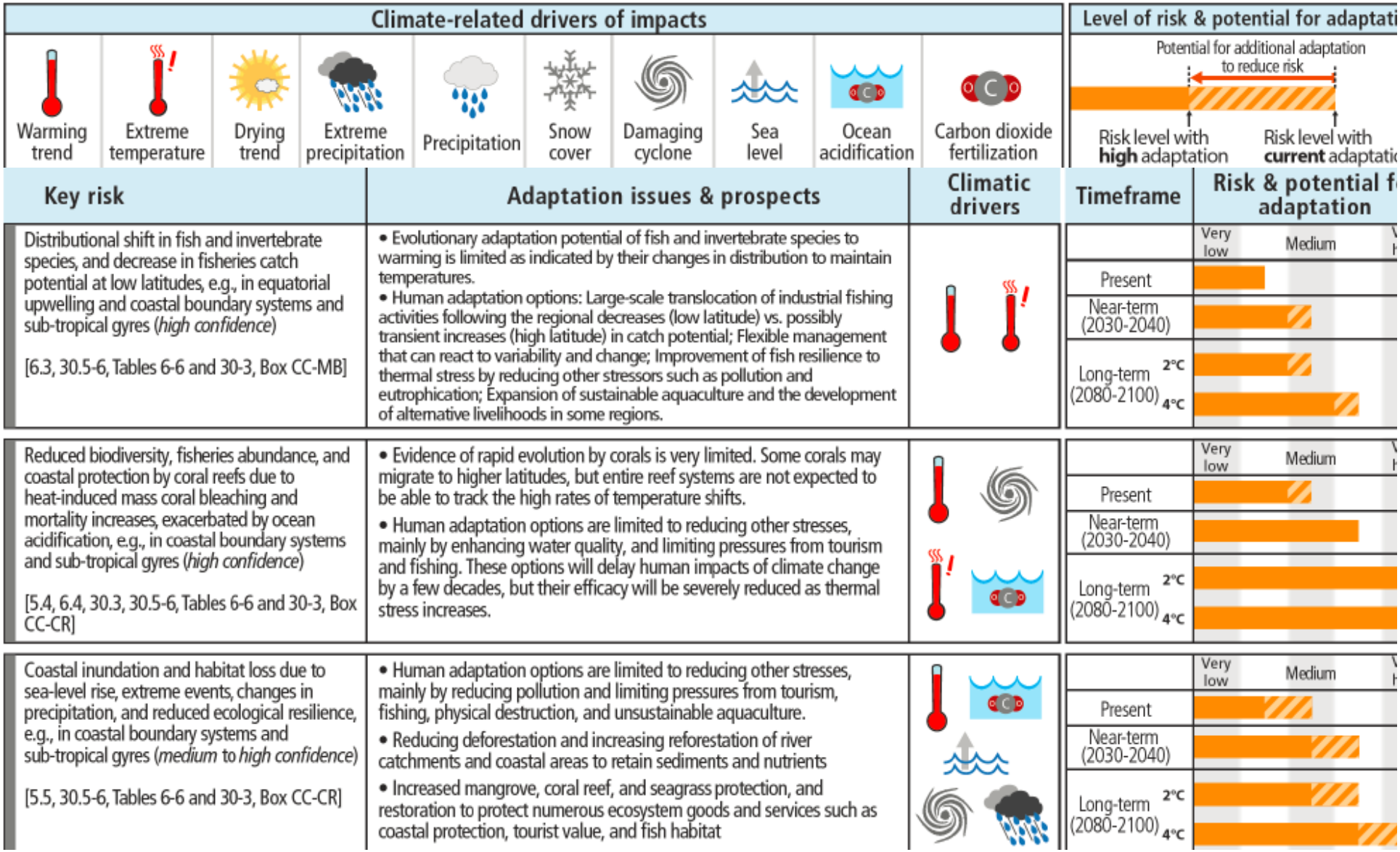
Regional Risks and Actions

- The 5th Assessment reviews the risks by region and identifies the scope for adaptation.
- The pictures show the expected reduction in risk if there is high adaptation by sector and region.
- The capacity for adaptation is evaluated for the present, the medium term and the long term.
- In some cases (e.g. Europe) the projections are relatively optimistic: adaptation can reduce the risks significantly.
- In others (e.g. Oceans, Asia) the assessment is less optimistic but still offers some hope.

Regional Risks: Europe



Regional Risks: Oceans

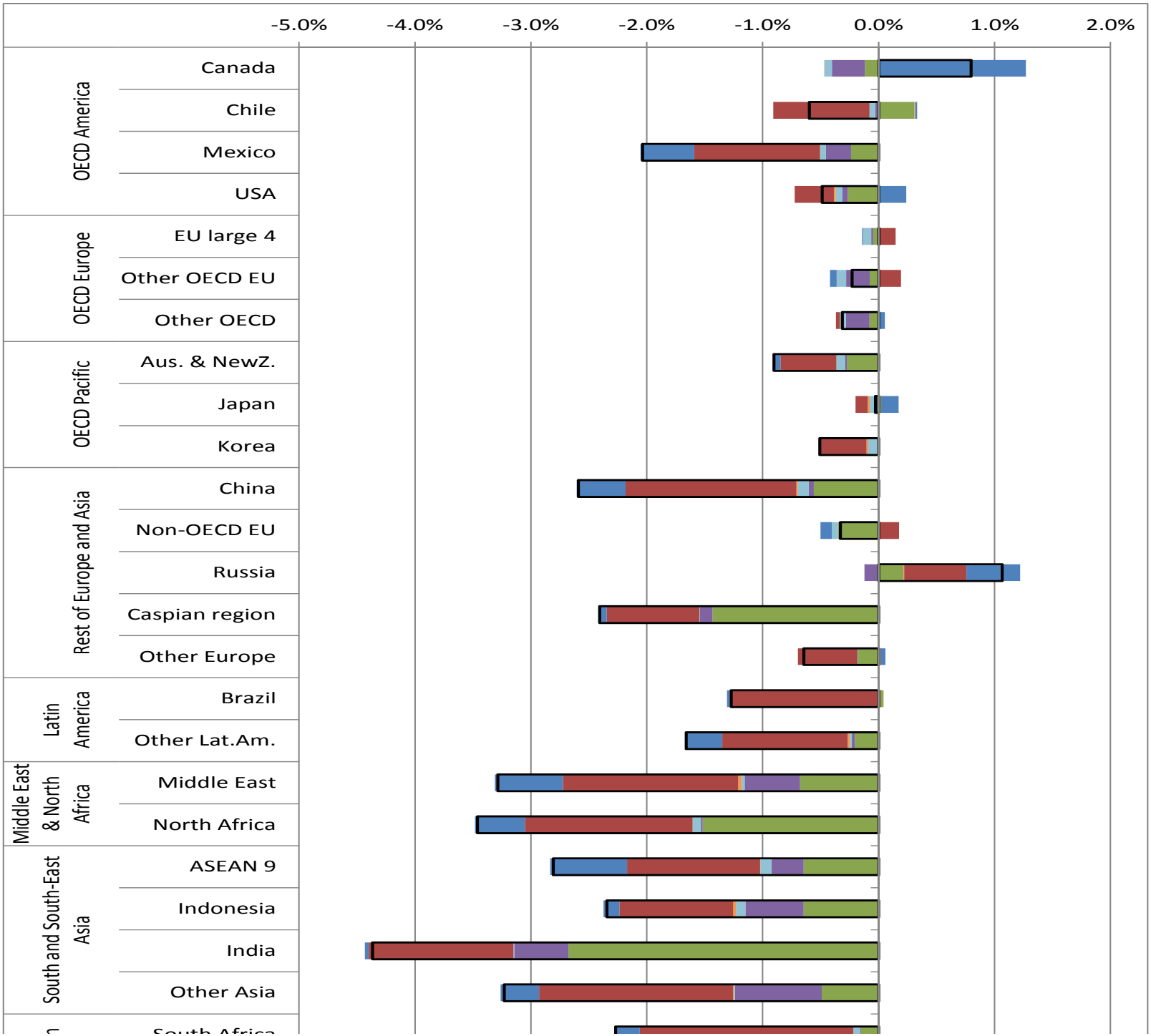


Impacts on Economic Sectors

- In most sectors other factors such as change in population, age structure, technology, relative prices and governance have bigger impacts than climate change.
- CC is expected to change energy demand between heating and cooling, location choices, demand for water. For increases in temperature of around 2ºC losses are estimated between 0.2 and 2% of income. But there are large differences between countries and losses go up with temperature.

Estimates of Economic Costs: Paradox

- The economic costs of climate change to 2060 are small. Globally they amount to about 2% of GDP, although they vary quite a lot by region, with South Asia and SS Africa having the highest losses.
- In terms of GDP per capita, these figures are even smaller given the expected growth in national income to 2060.
- The following chart shows the losses by sector and region.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OECD America
Canada
Chile
Mexico
USA
OECD Europe
EU large 4
Other OECD EU
Other OECD
OECD Pacific
Aus. & NewZ.
Japan
Korea
Rest of Europe and Asia
China
Non-OECD EU
Russia
Caspian region
Other Europe
Latin America
Brazil
Other Lat.Am.
Middle East & North Africa
Middle East
North Africa
South and South-East Asia
ASEAN 9
Indonesia
India
Other Asia

A Sceptical View of CC

SSP1	GDP PC US$PPP		
	2010	2060	
		NO CC	CC
Germany	33,138	65,539	65,015
India	2,983	33,173	31,680
Kenya	1,481	17,450	16,752

With projections like these climate change is “Much Ado About Nothing!

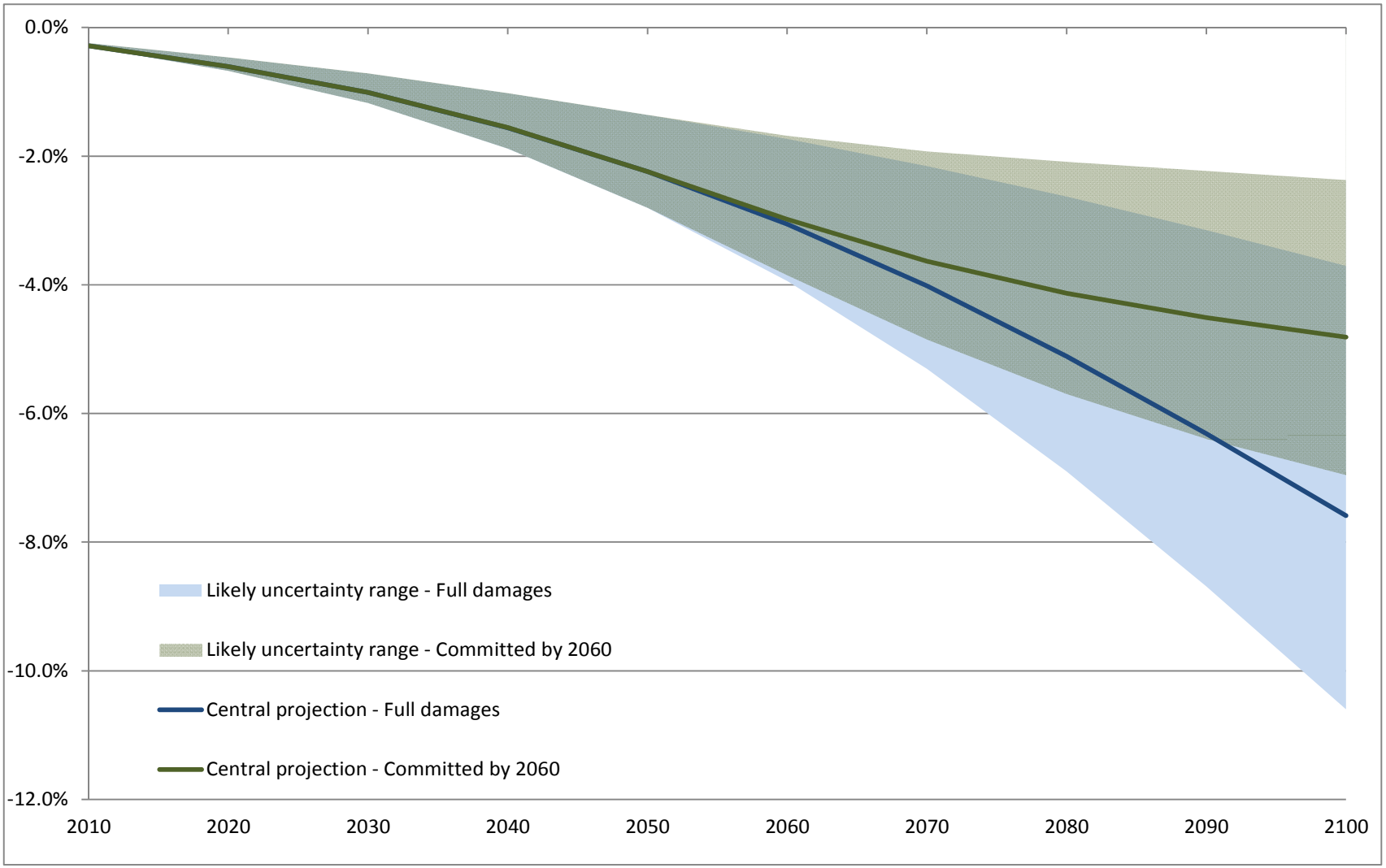
What is Wrong with Economic Estimates of CC Damages to 2060?

- Not all impacts covered in economic assessment (livestock, possible loss of life)
- Considerable uncertainty in the estimates and if the upper bound turns out to be right the figures could be 2-3 times higher. Key source of uncertainty is ECS
- The process for making the estimates is strongly driven by the underlying growth in the economy, which is assumed here to be around 2.8% per annum.
- The CGE model assumes relatively easy substitution between factors, so when there is a shock and an input such as land or water is reduced the model assumes the input can be replaced with other factors and any displaced labor can be absorbed by other sectors of the economy in a painless fashion.
- But even including all these, we don't get huge damage estimates to 2060!

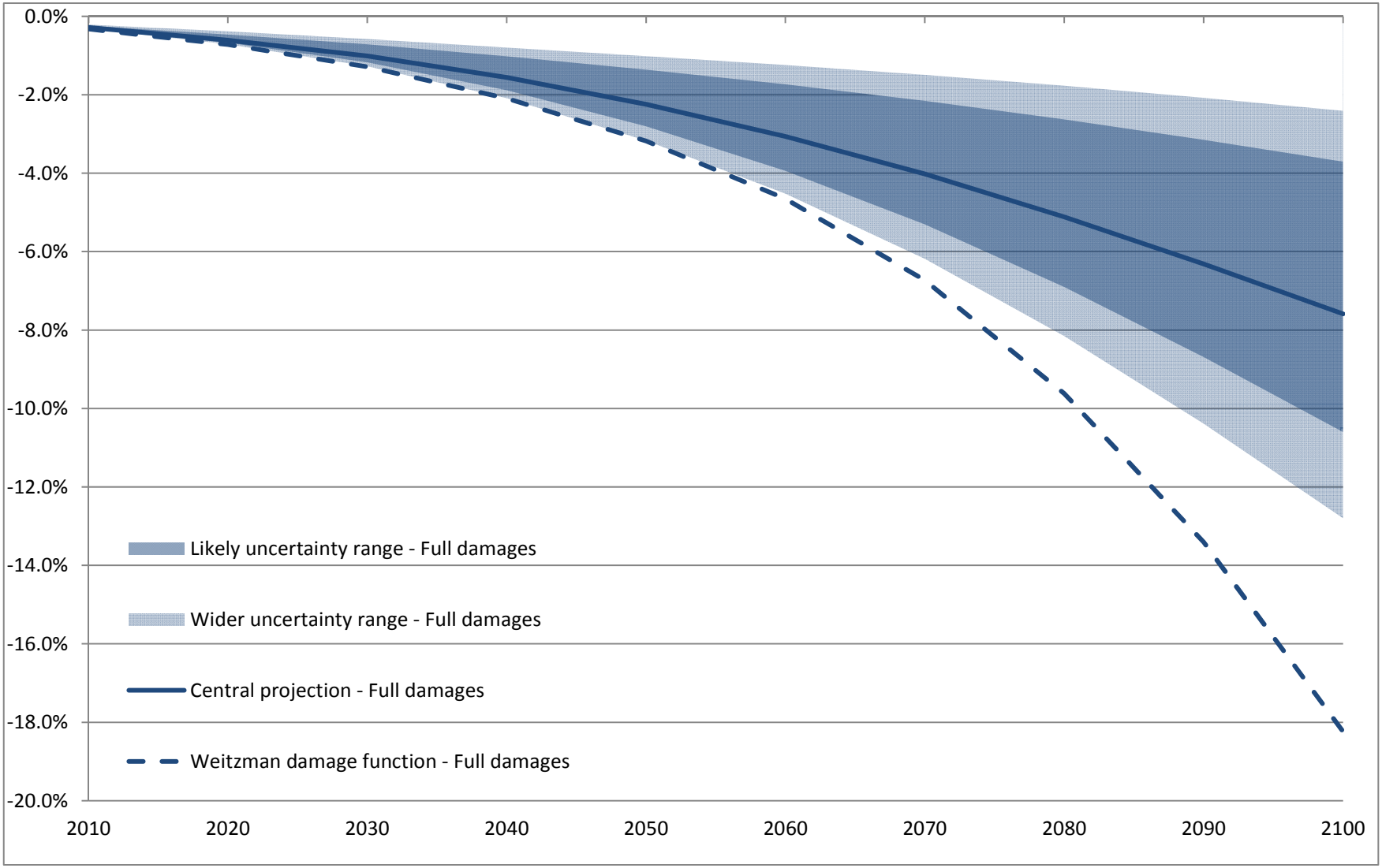
Estimates Beyond 2060

- Much more difficult to make – cannot use the detailed CGE models that link impacts of CC to individual sectors.
- Damage functions are very rough and uncertain, especially with temperature increase above $4^{o}C$.
- But with all limitations damages are much bigger from 2060 onwards.
- And uncertainty is greater
- Moreover there is a lot of inertia built in from existing emissions.

Damages to 2100: “Normal Damage Function”



Damages to 2100: “Weitzman Damage Function”



High Temperature Increases…

- Now the average annual high temperature in European cities (e.g. London) is about 17^{o}C
- With an increase of 8^{o}C it would become like Cairo, which may be manageable. But with another 8^{o}C Cairo would become like Dallol Ethiopia, which is the hottest inhabited place in the world.
- Not much is produced in Dallok Ethiopia!

Dallol Ethiopia

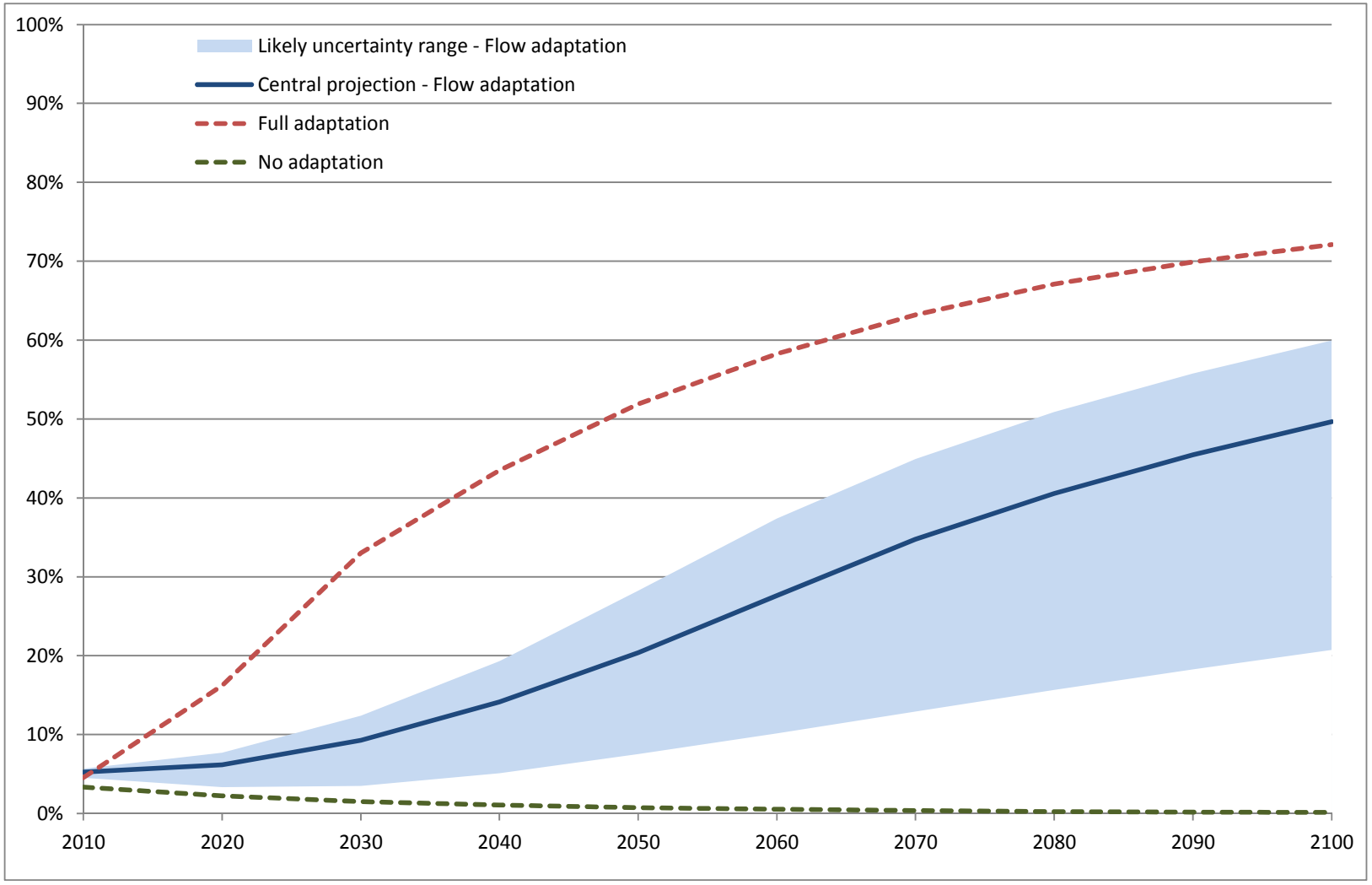
Key Messages from the Impact Analysis

- Quantified damages to 2060 are modest if the growth story is true.
- But lack of action to mitigate emissions locks in further increases in temperature beyond 2060 that are not so modest.
- And they have a large uncertainty range. At the upper end of the potential increase under BAU modern economies may not function.
- And the changes are irreversible!

Assessing Benefits of Policy Action

- Adaptation can reduce damages from CC but not get them down to zero.
- The remaining damages after adaptation are called residual damages.
- Long term models indicate adaptation can reduce damages through flow adaptation (private) and stock adaptation (public). Together if undertaken optimally they should reduce damages by up to 70% by 2100.
- How do we deal with residual damages? (loss and damage debate).

Percentage of Damages Addressed By Adaptation



Mitigation and/or Adaptation

- The optimal level of emission reductions results from equating the marginal costs of one unit of additional emission reduction with the discounted stream of additional avoided damages.
- What discount rate do we take for this? Major debate in climate economics.
- The least-cost emission pathway implies a small reduction in the absolute level of emissions until 2030 and a more rapid reduction afterwards. The lower the equilibrium climate sensitivity, the lower the benefits from emission reduction are, and hence the larger the flexibility to adjust the timing of emission reductions in the least-cost emission pathway. With high ECS the reductions have to be much greater early on (e.g. Weitzman type function).

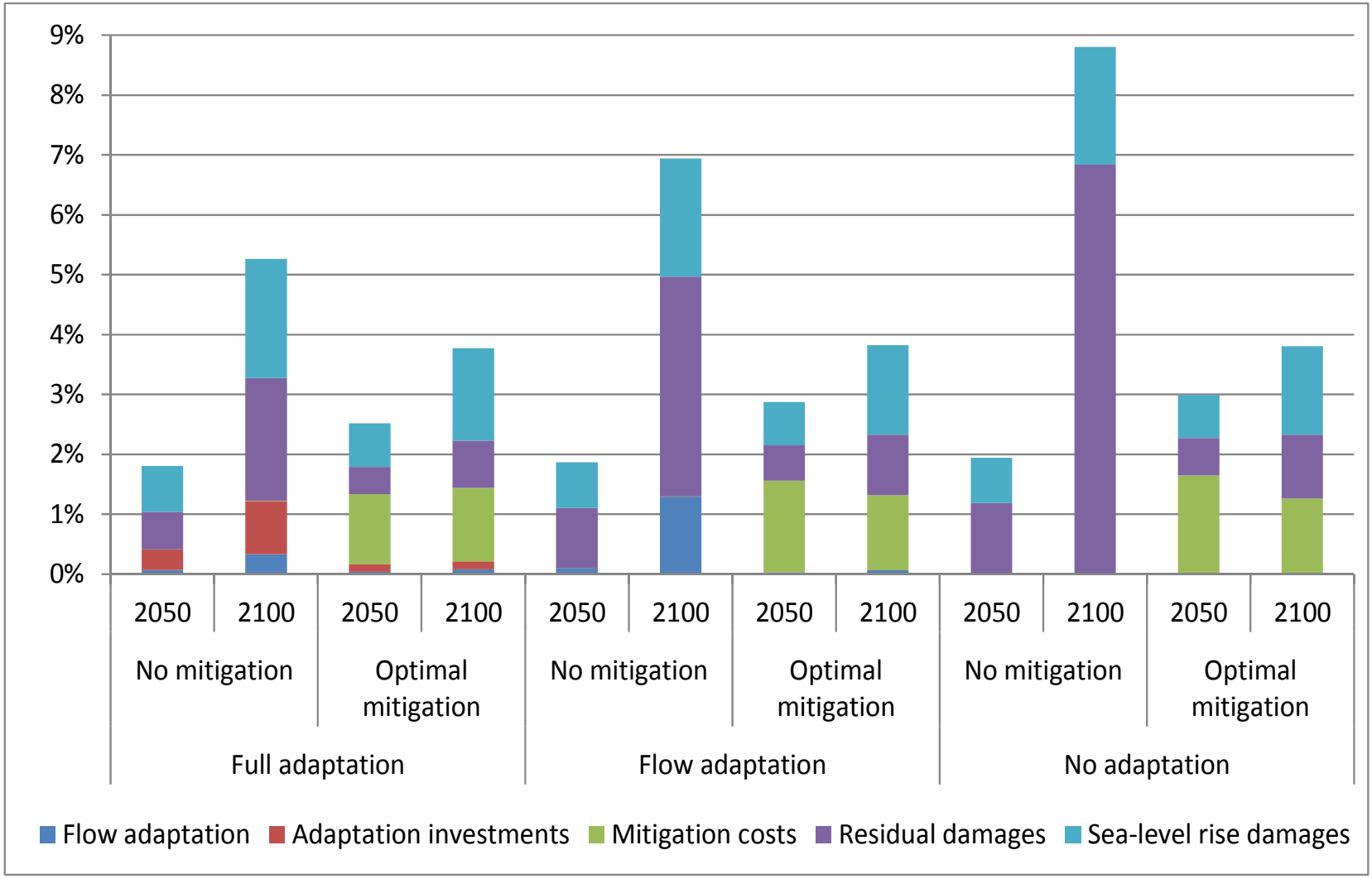
Interactions Between Mitigation and Adaptation

- The role of adaptation is much smaller when damages are limited by least-cost mitigation action.
- Adaptation and mitigation are both powerful instruments to limit climate damages.
- In terms of cost minimisation, both policies are needed.
- Next figure clearly shows that adaptation cannot be a perfect substitute for mitigation. If only adaptation policies are available damages are substantially larger than when only mitigation policies are available

Principles for Effective Adaptation

1. Adaptation is place and context specific: no single approach will work in all settings.
2. Adaptation planning can be enhanced thorough complementary actions: protecting vulnerable groups, supporting economic diversification, providing information and improving coordination across levels of government and partnerships between private and public sectors.
3. A first step in adaptation is to reduce vulnerability to current climate variability.

Total Costs With Mitigation/ Adaptation Combinations



Principles for Effective Adaptation

4. Recognition of diverse interests, circumstances and contexts can benefit decision-making.
5. The decision support is most effective when it is sensitive to context and diversity of decision types, processes and constituencies.
6. Existing and emerging economic instruments can foster adaptation by providing incentives for anticipating and reducing impacts.

Principles for Effective Adaptation

7. Common constraints that impede adaptation include limited financial and human resources, limited integration of governance, uncertainties about projected impacts etc. Underestimating the complexity of adaptation as a social process can create unrealistic expectations of outcomes.
8. Poor planning, emphasizing short term outcomes or failing to anticipate consequences can result in maladaptation.

Principles for Effective Adaptation

9. Limited evidence indicates a gap between global adaptation needs and the funds available for adaptation.
10. Significant co-benefits, synergies, and tradeoffs exist between mitigation and adaptation and among different adaptation responses; interactions occur both within and across regions. Increasing efforts to mitigate and adapt to climate change imply an increasing complexity of interactions, particularly at the intersections among water, energy, land use, and biodiversity

Conclusions

- IPCC WGII has made a sober assessment of the impacts of climate change. They are significant, vary by region and country and pose important threats to our future.
- The report concludes that while impacts in the next 30 years or so are not dependent on mitigation, after that time they depend a lot on what emissions scenario we face. Adaptation options post 2050 are much more limited with high emissions

Conclusions

- On adaptation it is more optimistic for several areas. We can adapt to a significant extent if we take the right actions.
- The key is to focus on developing adaptation strategies that are inclusive, flexible, that look at the wider picture and that are based on a realistic estimate of the benefits.
- Not all regions and not all problems can be solved in this way but many can.
- For some problems we have a more difficult agenda but even for these there is some hope.


BILLABONG
XXL
GLOBAL BIG
WAVE AWARDS
PRESENTED BY
PACIFICO
Hercules Arrives
Nazaré, Portugal
January 6, 2014
Photo by André Botelho

THANK YOU