

*Workshop “Science–policy interactions in national adaptation policy”, September 14 – 15, Utrecht*

# Climate change indicators

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# The EEA mission

*The European Environment Agency is the EU body dedicated to providing sound, independent information on the environment*

*We are a main information source for those involved in developing, adopting, implementing and evaluating environmental policy, and also the general public*



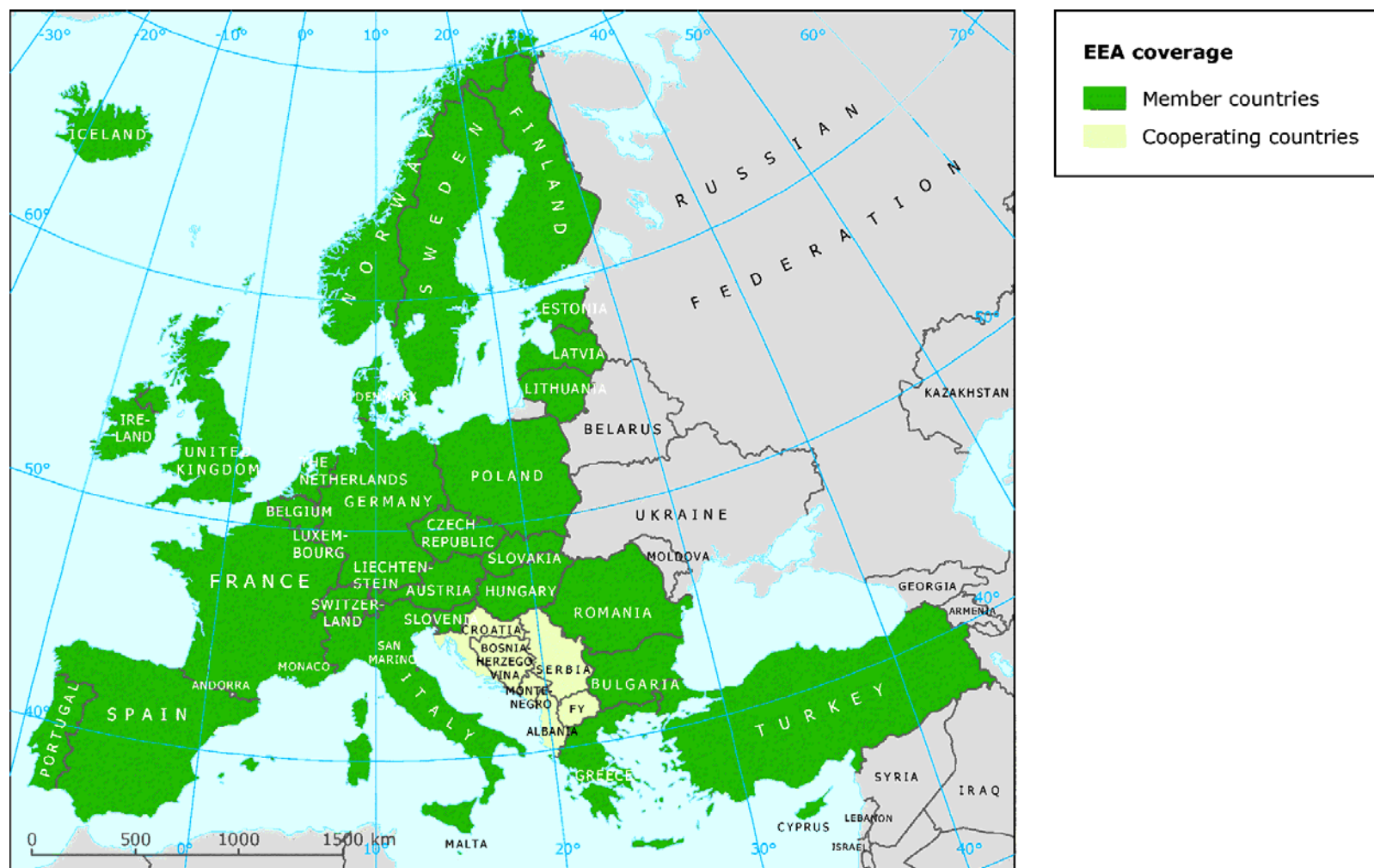
# The EEA is...

- An independent information provider
  - An analyst and assessor
  - Building bridges between science and policy
  - Dependent upon strong networks to carry out its work
- ...to support policy processes and inform the public

## EEA clients

- Institutions and governments: European Commission, Parliament, Council, EEA member countries
- Policy influencers: NGOs, business, media, advisory groups, scientists, debaters
- General public

# EEA and member/collaborating countries



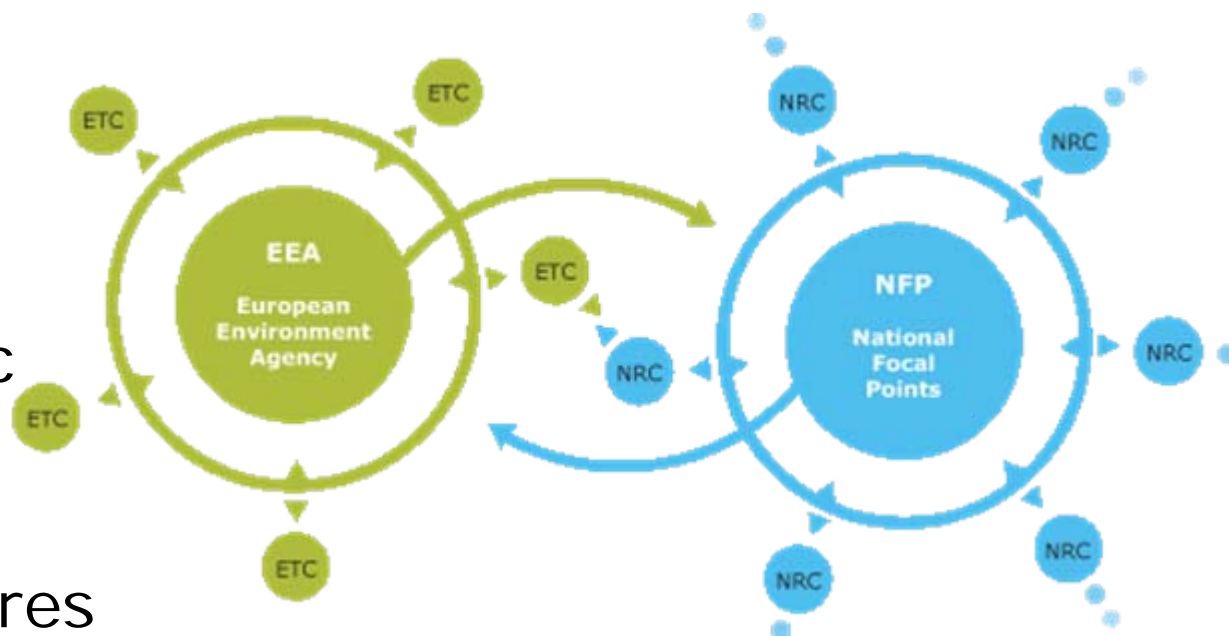
# The Shared Environmental Information System - SEIS

- SEIS aims to improve, modernise and streamline environmental information
- It is to be
  - A distributed, integrated, web-enabled system
  - A network where public providers share data and information
  - Based on existing e-infrastructure, systems and services at national and EU level
  - Completed by 2013

# European environment information and observation network (Eionet)

## About 300 national institutions

- National focal points
- European topic centres
- National reference centres
- Other institutions



# Key EU environmental policy processes with (climate change) information needs

- ***Mitigation of climate change***
- Commission White Paper '***Adapting to climate change*** : Towards a European Framework for action'
- ***Water*** Framework Directive (River basin management plans needed by 2009 and 2015) (draft guidance for MS) and Water Scarcity and Droughts strategy, assessment by 2012
- ***Nature protection*** directives (e.g. Habitat directive) and implementation of the Natura2000 network; policies to ***halt biodiversity loss*** (2010 target), 2010 assessment report; Draft Strategy on Biodiversity, ecosystems goods and service and climate change (2009)
- ***Marine Strategy*** Framework Directive (achievement of good environmental status of the EU's marine waters by 2020), initial assessment by 2012

# Development of CC IVA in EEA reports

- Natural disasters (2004)
- Overview on vulnerability and adaptation in member countries (2005)
- Climate change and water (2007)
- Costs of inaction to climate change (2007)
- Impacts of climate change (2004, update 2008)
- Water scarcity and droughts (2009)
- CC and water resources in the Alps, case studies (2009)
- Guidance on integrating CC in Water FWD river basin management plans (2009)

*Increasingly moving from impacts to vulnerability and adaptation*





# Impacts of Europe's changing climate (2008)

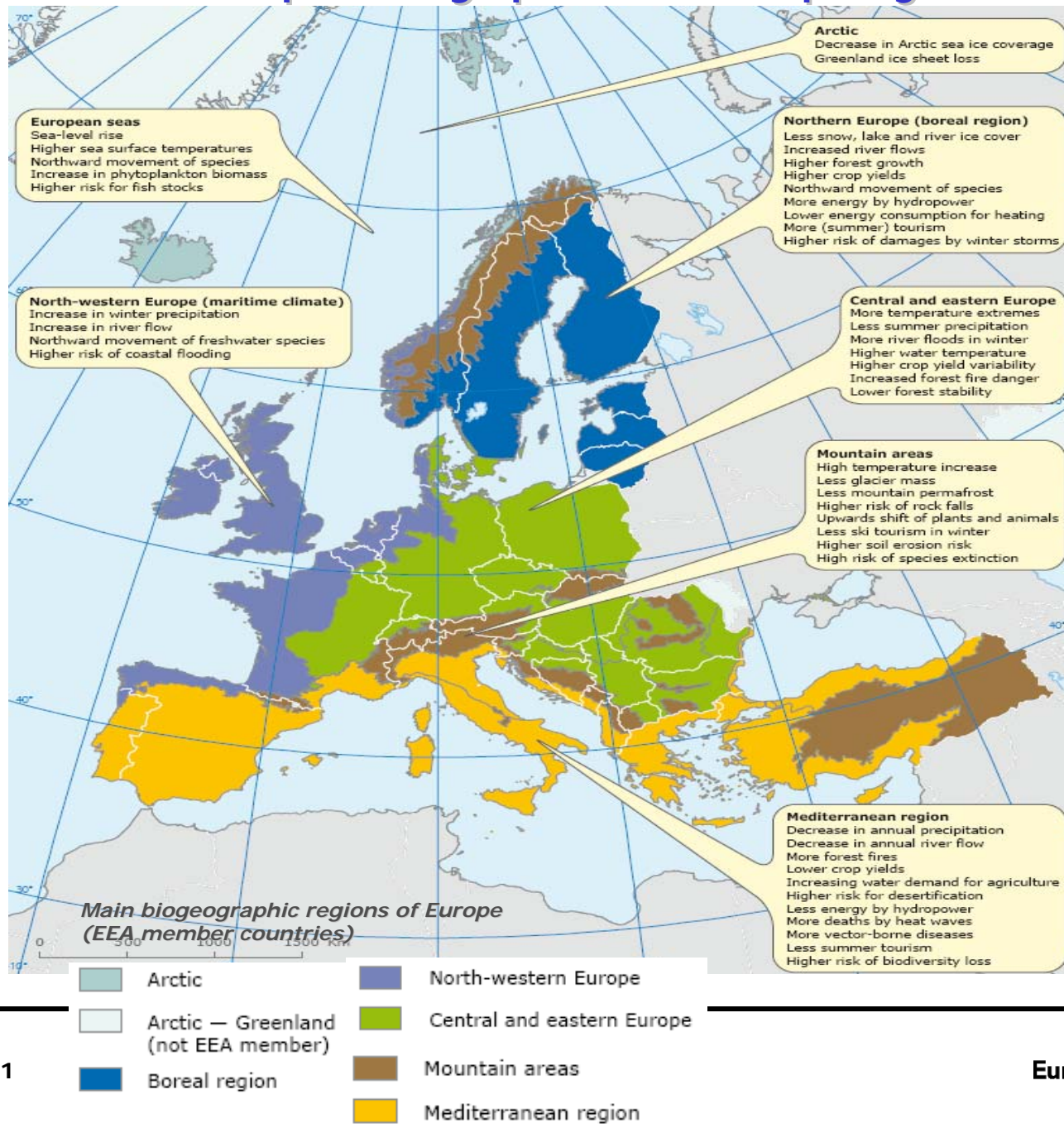
- Jointly by EEA, JRC and WHO Europe
  - Observed and projected trends by 40 indicators
  - Vulnerable regions and sectors
  - Summary of national adaptation plans
  - Overview of main data gaps
- Based on existing EU and national research (different scenarios)
- Scientific advisory group
- Regular updates foreseen (web publication)



# Coverage

- Atmosphere and climate
- Cryosphere (glaciers, snow and ice)
- Marine biodiversity and ecosystems
- Water quantity
- Freshwater quality and biodiversity
- Terrestrial ecosystems and biodiversity
- Soil
- Agriculture and forestry
- Human health
- Vulnerability and economic aspects (sectors)

# Europe key past and projected impacts



Most vulnerable areas

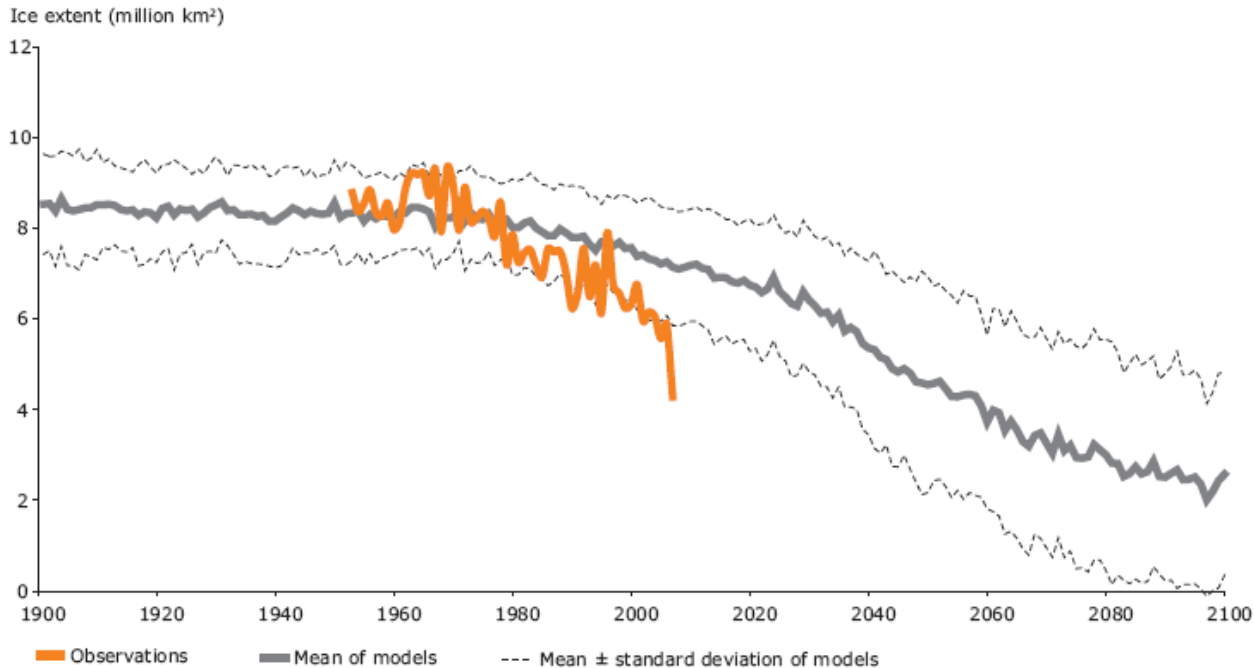
- Southern Europe
- Mountain areas (Alps, etc)
- Coastal zones
- River floodplains
- Arctic region



# Arctic sea ice

- Arctic sea ice extent has declined at an accelerating rate, especially in summer
- The record low ice cover in September 2007 was half of the size of a normal minimum extent in the 1950s

past



**Observed and projected Arctic September sea-ice extent 1900-2100**

**The 2007 minimum sea-ice extent**

- Summer ice is projected to continue to shrink and may even disappear at the height of the summer melt season in the coming decades
- There will be still substantial ice in winter

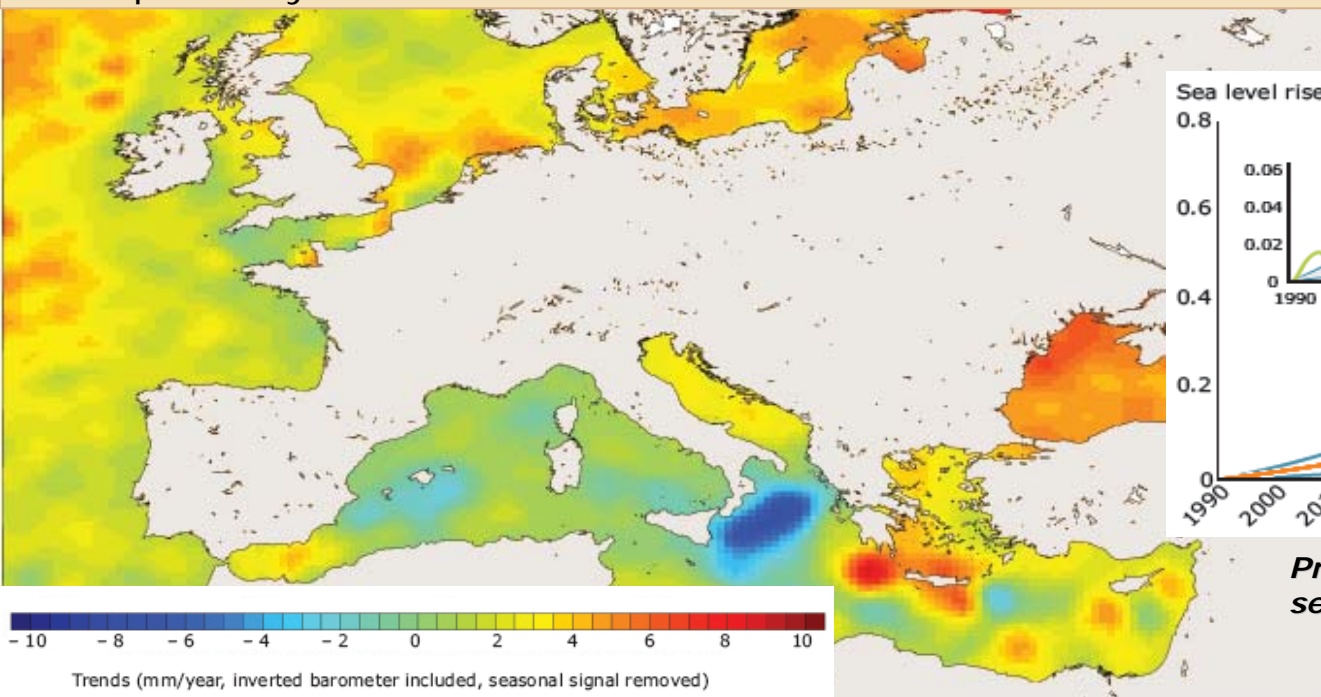
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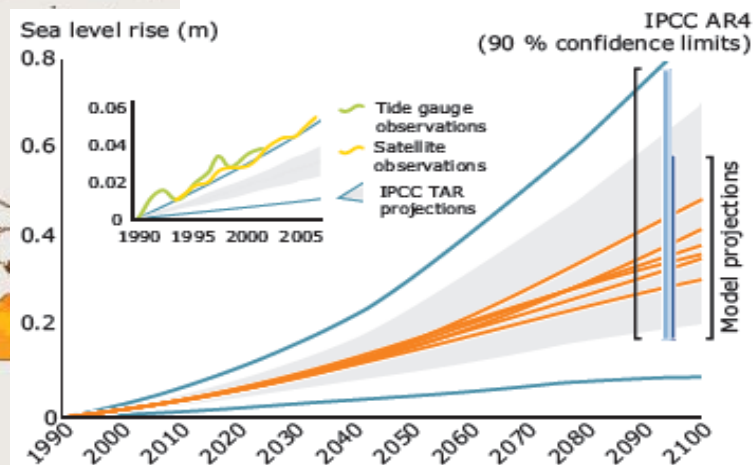
# Sea level rise

- Global average SLR during the 20<sup>th</sup> century was about 1.7mm/year
- Recent satellite and tide-gauge data indicate a higher average rate of about 3.1 mm/year in the past 15 years

past



*Sea level changes in Europe 1992-2007*



*Projected global average sea-level rise 1990-2100*

- Sea level will rise 0.18 to 0.59 m from 1980-2000 to 2100 (IPCC)
- Recent projections indicate a future SLR that may exceed the IPCC upper limit

future



# EEA 2009/2010 activities on CC IVA

- Climate change indicators
- Support GMES data user needs analysis
- Vulnerability indicators and disaster risk mapping
- Monitoring adaptation actions (indicators)
- Contribute to EU Clearinghouse
- Contribute to EEA reports:
  - **EU State of the Environment and Outlook 2010 report**
  - Progress towards the EU 2010 target of halting biodiversity loss by 2010 (2009, and 2010)
  - Eureka (European Ecosystem Assessment), 2012
  - Freshwater assessment, 2012
  - Coastal assessment, 2012
- Annual EIONET workshop, expert meetings
- Support new Impact and Adaptation Steering Group (IASG) organised by EC

# Current GMES services

## *Essential climate variables (ECVs):*

- Atmosphere: greenhouse gases (CO<sub>2</sub>, CH<sub>4</sub>); ozone and aerosols
- Marine: sea ice, sea level, sea surface temperature, salinity
- Land: fine-resolution global land cover map (Globcover)
- Emergency: natural disasters, technological accidents, humanitarian crises

## *Temporal resolution:*

- Often near real time and short term (days) forecasting (combining remote sensing and in-situ)
- Current GMES reanalyses: too short time period and limited coverage for trend analysis

# Possible GMES climate change contribution

EEA paper on environmental assessment needs to GMES advisory group, June 2009

Operational service:

- Easily accessible for the general public
- Expert interpretations and integrated assessments

Observations:

- Long-term time series (incl extreme events), need for reanalysis
- Spatial resolution (e.g. river catchments)
- Pan-European
- Consistency (time, space and between variables)
- Quality (fit for purpose)

Projections (modelled):

- Climate change and impacts (for vulnerability and adaptation assessments)

*Consistent with the WCC-3 recommendations for a Global Framework for Climate Services*



# EU vulnerability indicators/maps (expert meeting, 1 July 2009)

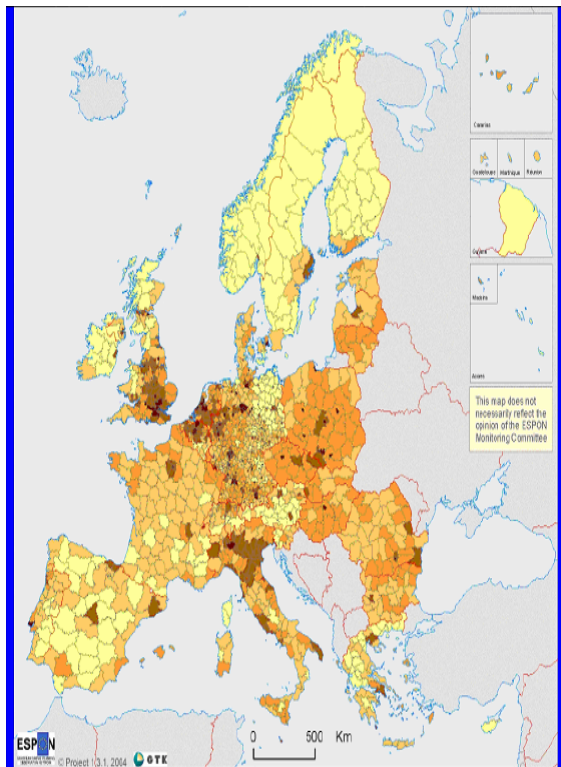
- Define the objective and purpose of indicators (key policy questions) with involvement of stakeholders, and clarify where in the policy cycle these are needed
- Potential use:
  - Raise awareness of vulnerability to climate change across EU (and highlight need for priority local/regional action)
  - Assess the effectiveness of adaptation actions in reducing vulnerability to ecosystems, society or economy to CC impacts
  - Help to determine allocation of public funds for adaptation (in addition to other indicators like GDP)
  - Monitor the progress of implementation of adaptation (at different governance level)

# Mapping vulnerabilities (indicators) to climate change impacts and disaster risks, some issues

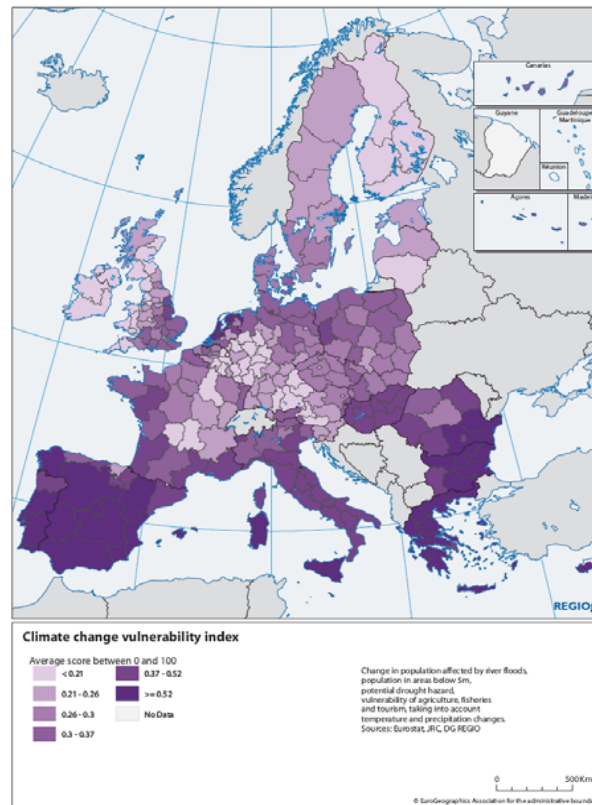
- **Definition:** vulnerability = (exposure x sensitivity = potential impacts) x adaptive capacity ?
- Right **spatial** scales: river basins; ecosystems and/or biogeographic regions; NUTS2/3 (administrative); grids (climate models)
- **Extreme events:** return period, projections difficult
- **Time period for projections:** seasonal, decadal, centennial
- **Mitigation and adaptation scenarios:** +2 / +4o C T-increase
- **Adaptive capacity** the most difficult to estimate especially for the future (socio economic data and scenarios)
- **Harmonized methodologies** (different communities: climate change adaptation/disaster risks)
- **Communicate** uncertainties transparently (e.g. probabilistic scenarios)
- **Combined vulnerability indices** how to weight the components (be transparent)

# Examples of vulnerability indices based on various methods

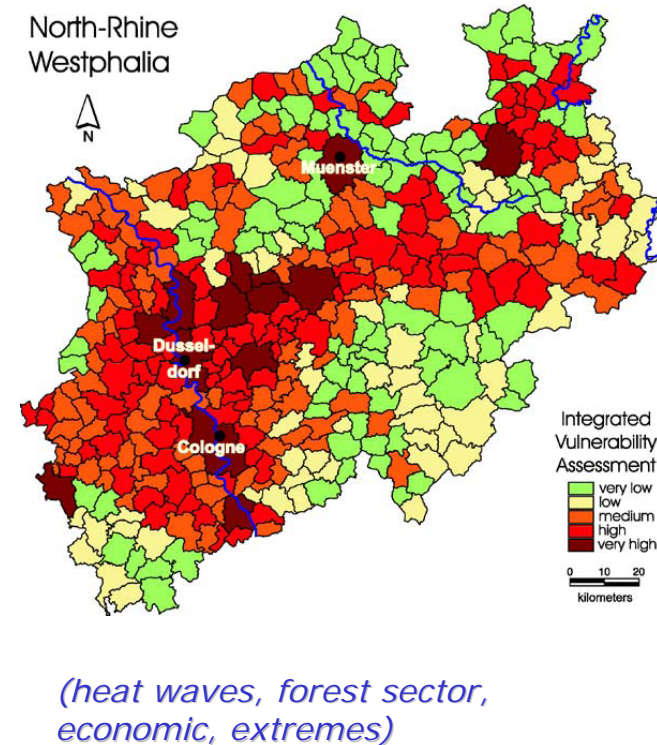
*Natural & technological hazards (ESPON, 2006)*



*Regions 2020 study (DG REGIO, 2008)*



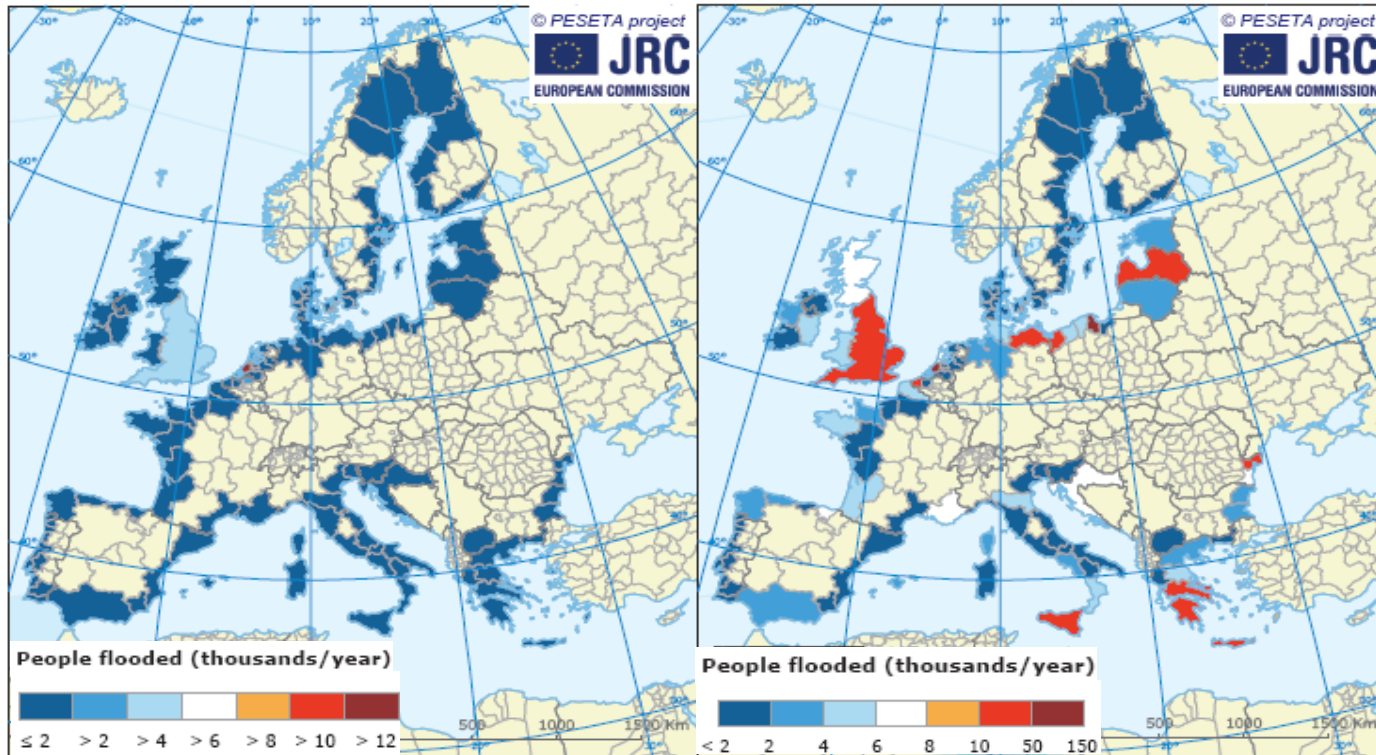
*PIK – Tyndall study (2006)*



# Example: Coastal areas

- One third of the EU population is estimated to live within 50km of the coast and some 140,000 km<sup>2</sup> of land is currently within 1m of sea level.

past



*Modelled number of people flooded across Europe's coastal areas in 1961-1990 (left) and in the 2080s (right)*

- 12-18 billion Euro/year economic damages in European coastal areas by 2080 (high emission scenario)
- Adaptation could significantly reduce the risk to around EUR 1 billion

future

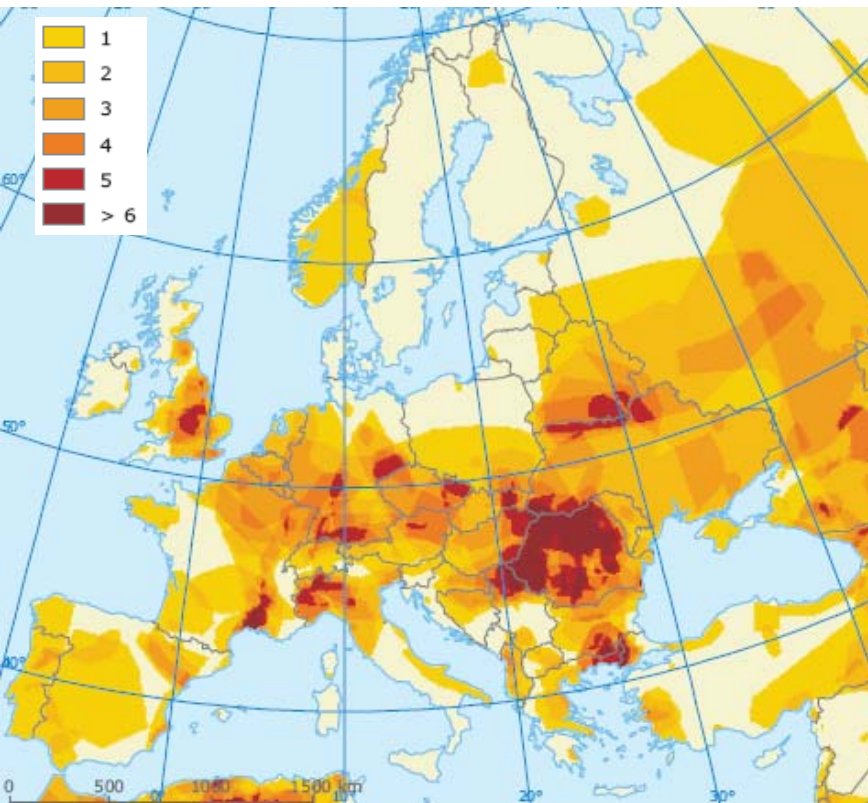




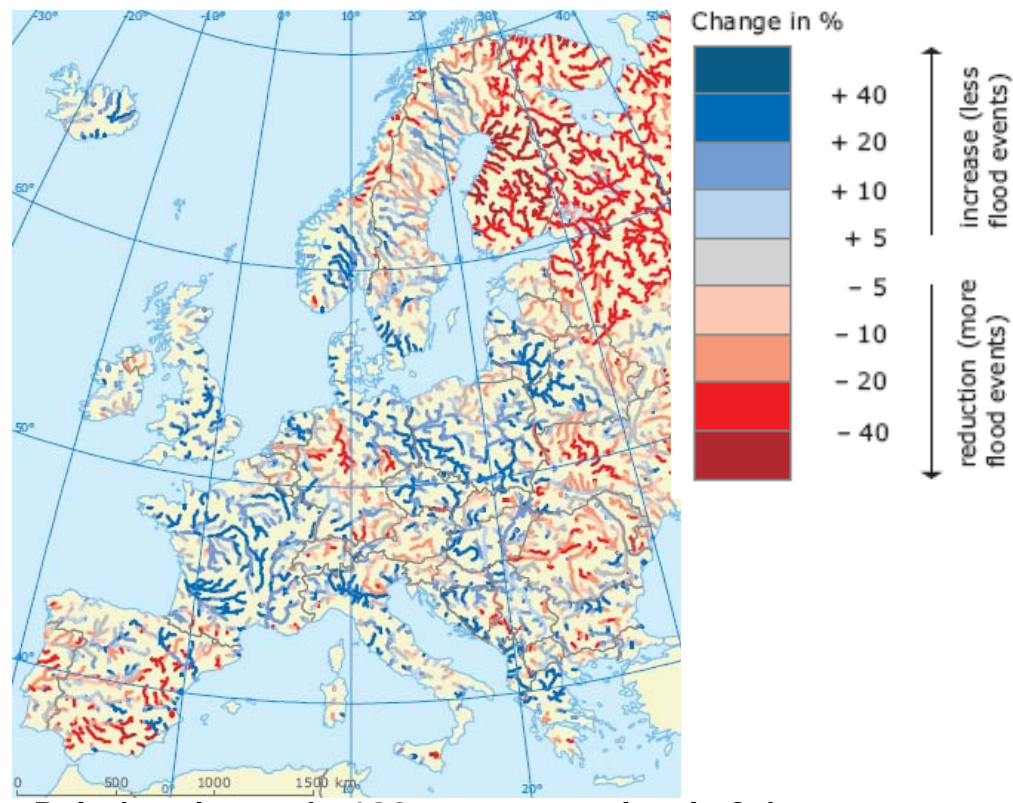
# Example: River floods

- Since 1990, 259 major river floods have been reported in Europe (165 since 2000), the increase is mainly because of better reporting and land-use changes

past



***Occurrence of flood events 1998-2008***



***Relative change in 100-year return level of river discharge between 2071-2100 and 1961-1990***

- Increase in the occurrence and frequency of flood events in large parts of Europe
- Less snow accumulation in winter and lower risk of early spring flooding

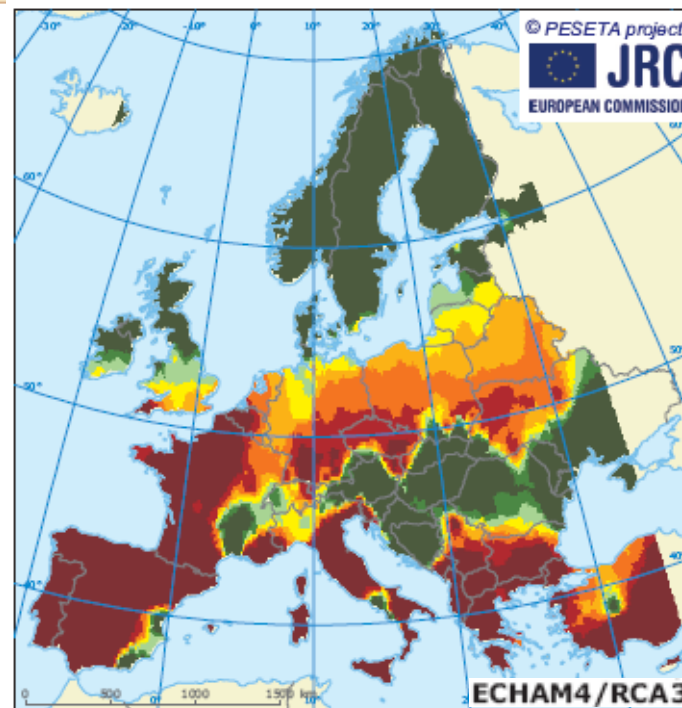
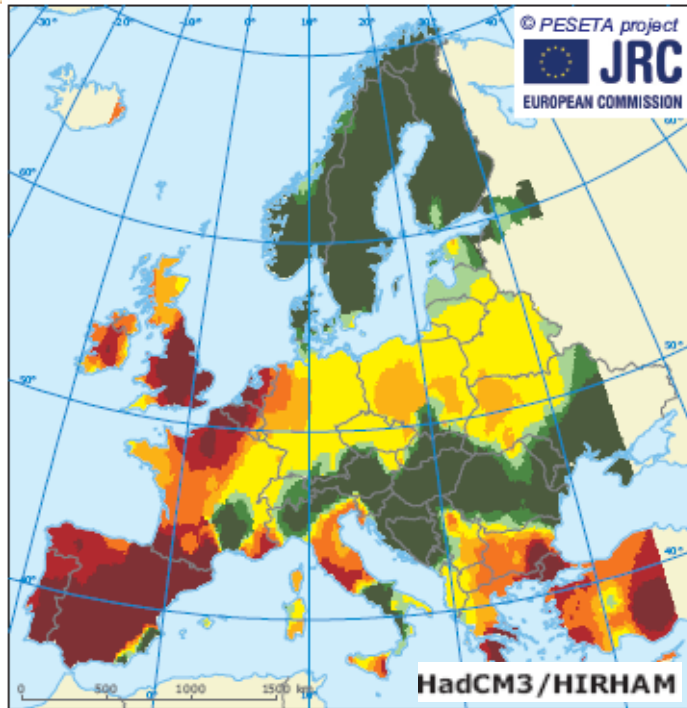
future



# Example: Agriculture and forestry

- In summer of 2003 economic losses to farming, livestock and forestry from the combined effects of drought, heat stress and fire were EUR 10 billion

past



*Projected crop yield changes (%) between the 2080s and the reference period 1961-1990 by two models and A2 scenario*

- Economic consequences of climate-related increases in crop yields, mainly in northern Europe and reductions in the Mediterranean, are unknown
- Also economic consequences of projected changes in forest growth are unknown

future

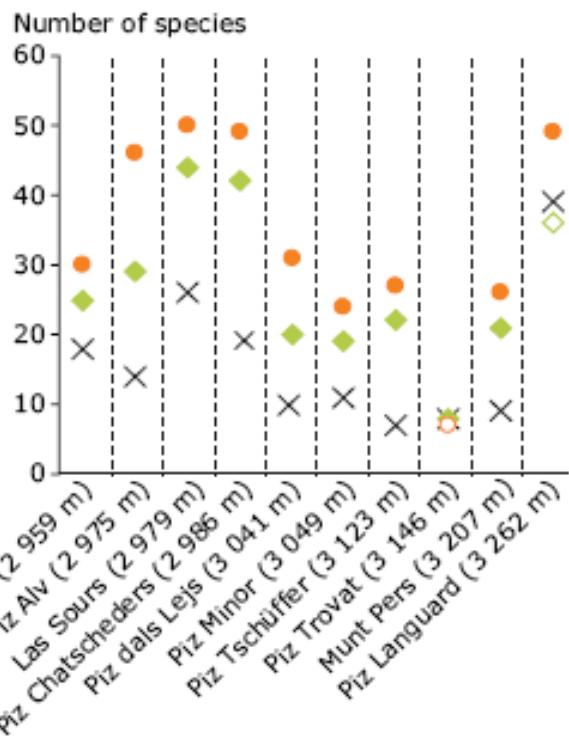


# Example: Distribution of plant species

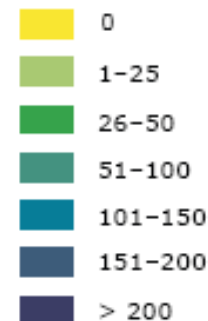
- Climate change causes northward and uphill shift of many European plant species
- Mountain ecosystems are changing as pioneer species expand uphill and cold-adapted species are driven out of their ranges

past

Increase in species richness on Swiss Alpine mountain summits in 20<sup>th</sup> century



Number of disappearing plant species in 2050



- Shift of European plant species by hundreds kilometres to the north (by the late 21<sup>st</sup> century)
- Forests are likely to have contracted in the south and expanded in the north
- 60 % of all mountain species may face extinction

future



# EEA 2009 report on biodiversity

EEA Report | No 4/2009

Progress towards the European  
2010 biodiversity target

www.eea.europa.eu



European Environment Agency 

- Indicator based report on progress towards the European target of halting biodiversity loss by 2010 (26 indicators, few linked to climate change)
- State of biodiversity and its loss in Europe based on the most recent data available, bridge to a comprehensive assessment of the 2010 target in 2010
- Need to enhance synergies between climate change and biodiversity, e.g. restoration of wetlands, forest and oceans, use of natural approaches to control and adapt to coastal erosion and greening of the cities, enhance connectivity/coherence of Natura2000 sites



# Status of development of national adaptation strategies

Adopted a NAS	Preparing a NAS	IVA assessments
Finland (2005)	Czech Republic	Austria
France (2006)	Norway	Greece
Spain (2006)	Romania	Iceland
Netherlands (2007)	Estonia	Ireland
Denmark (2008)	Latvia	Lithuania
United Kingdom (2008)	Portugal	Switzerland
Germany (2008)	Romania	
Hungary (2008)		
Norway (2008)		
Sweden (2009)		

<http://www.eea.europa.eu/themes/climate/national-adaptation-strategies>

# Data and information needs

- Improved **monitoring and reporting**:
  - National monitoring (GCOS essential climate variables)
  - Regular national or EU-wide monitoring at right scales (river basin etc)
- Improved and coordinated **scenarios**:
  - High resolution scenarios regional level
  - Consistency between climate and socio-economic scenarios
- Improved understanding of **vulnerability**
  - Models and methods
- Information on **good practices in adaptation**
  - Effective adaptation measures and costs
  - Avoid 'mal-adaptation'
- **Indicators to monitor** adaptation actions and effectiveness
- Better information **exchange mechanisms**

*EU and national research and GMES could help fill many of these gaps, while the proposed EU Clearinghouse can provide the existing information that can already now support adaptation actions*

## Clearinghouse (EIONET initial discussion, 30 June, EEA)

- Initially facilitator for collecting and disseminating information, gradually to include analytical tools
- Start with focussed users including the EIONET, EU level (EC, EP, EEA, transnational e.g. river basins)
- Content focussed on EU policies and transboundary issues (Observations and scenarios; Vulnerability assessments; Adaptation measures; Adaptation plans and strategies).
- Guidance on methodologies, data and scenarios
- Quality of content must be assured by providers
- Studies and Research – Strong interest in getting access to results
- Synergies with national portals to be further explored
- Synergies with EU-wide thematic platforms also to be further explored, e.g. Water Information System for Europe (WISE); Biodiversity Clearinghouse; JRC data centres on soil, forests

# Conclusions

- Need for enhanced national and EU-wide monitoring and reporting
- EU level climate change impact indicators (past and projected) can help raise awareness and identify sectors and regions most vulnerable to climate change.
- EU level indicators can also highlight the need to enhance monitoring (e.g. GMES but also on impacts, incl biodiversity) and reduce uncertainties in climate and impact modeling
- To assess vulnerability and adaptation options further information at (sub-) national level is needed
- Sharing existing information through the proposed EU Clearinghouse (EU White Paper) can have benefits for governments and other users at various levels
- Further EU and national research needs e.g.: high resolution climate data and scenarios at regional level; enhanced consistency with socio-economic scenarios; improved vulnerability methods, data and indicators; good practices and costs of adaptation; indicators on effectiveness of adaptation

