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KEY MESSAGES

A multi-sectoral assessment

PESETA IV uses state-of-the-art biophysical impact models to quantify the effects of climate change on several sectors across Europe.

Modelling uncertainty

The project considers uncertainty by using 11 climate models runs with two different emissions scenarios and for some sectors the effects of future socioeconomic change.

Impacts on welfare

PESETA IV integrates the direct human and economic impacts for some sectors into an economic model to estimate corresponding welfare losses.

About PESETA IV

The JRC PESETA IV project aims to better understand the biophysical and economic consequences of climate change. It does this by using projections of climate change for Europe from several climate models along with a set of climate change impact models. The project covers several sectors that are relevant to society and the natural environment, such as freshwater, agriculture, and coasts.

ec.europa.eu/jrc/en/peseta-iv

The JRC PESETA IV approach

The primary purpose of the JRC PESETA IV study is to better understand the implications of climate change for the EU. Looking at a range of impact categories PESETA IV communicates what sectors and regions of the EU could be most affected and how mitigation and adaptation options can avoid the adverse effects of climate change. The analyses look at effects on people, the economy and the environment. The project further assesses the overall impact of climate change on the welfare of EU citizens, including the spill-over effects of climate change consequences outside the EU.

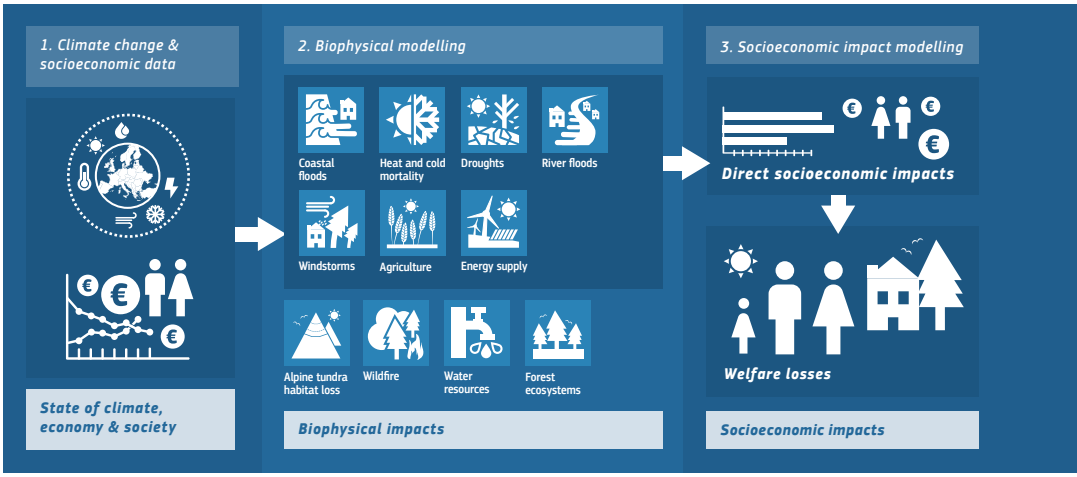

Figure 1. The PESETA IV approach. Climate change and socioeconomic data (Stage 1) feed a set of biophysical impact models to project biophysical impacts (Stage 2). Direct human impacts and economic losses are estimated for a subset of the projected biophysical impacts and integrated into an overall economic model to estimate welfare losses (Stage 3).

Overall approach

PESETA IV evaluates the benefits (avoided negative impacts) of reducing greenhouse gas emissions and the potential of adaptation measures at the EU sectoral level. This is done by assessing the sectoral climate change impacts (damages) in the future when mitigation and adaptation policy actions take place, compared to a situation where no policy actions are undertaken. For the scenario without climate policy actions, impacts are assessed at global warming of 3°C and no adaptation. The benefits of mitigation policy, from achieving the Paris Agreement warming goals, are evaluated by estimating impacts with 1.5°C and 2°C global warming. Various sector-specific adaptation mechanisms are considered for some sectors.

The approach comprises three stages (Figure 1). In stage 1 a common set of climate change and socioeconomic data are used to feed a set of biophysical impact models. In stage 2 separate biophysical models are run in order to quantify how the projected changes in climate variables affects agriculture, energy supply, river floods, coastal floods, heat and cold waves effects on human mortality, droughts, forest ecosystems, alpine tundra habitat loss, wildfires, water resources and windstorms. In stage 3 a subset of the biophysical impacts are analysed in terms of direct human impacts and economic losses; in particular, for agriculture, energy supply, river floods, coastal floods, heat and cold waves, drought and windstorms. Finally, the direct human and economic impacts are integrated into an overall economic model in order to estimate corresponding welfare losses.

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Climate modelling

The climate models used in PESETA IV simulate physical climate processes on a grid that covers the whole of Europe. The climate models used are known as 'regional climate models', which mean that they produce climate projections at a relatively fine scale.

Simulations of the climate will differ between climate models, even when the forcings that drive the climate, such as greenhouse gas emissions, are the same. This is known as climate modelling uncertainty. To account for this uncertainty, PESETA IV uses an ensemble of 11 regional climate models that took part in a large, on-going climate model inter-comparison project called Coordinated Regional-climate Downscaling Experiment over Europe (EURO-CORDEX).

The three warming levels used in PESETA IV (1.5°C, 2°C and 3°C) were estimated from two greenhouse gas emissions scenarios (RCP4.5 and RCP8.5) for each of the 11 regional climate models, to account for the effects of different warming rates on average global temperature, as the year when any given warming level is reached (e.g. 2°C) will differ between both climate models and emissions scenarios. Figure 2 shows the change in annual temperature and precipitation across Europe between the present (1981-2010) and the three warming scenarios.

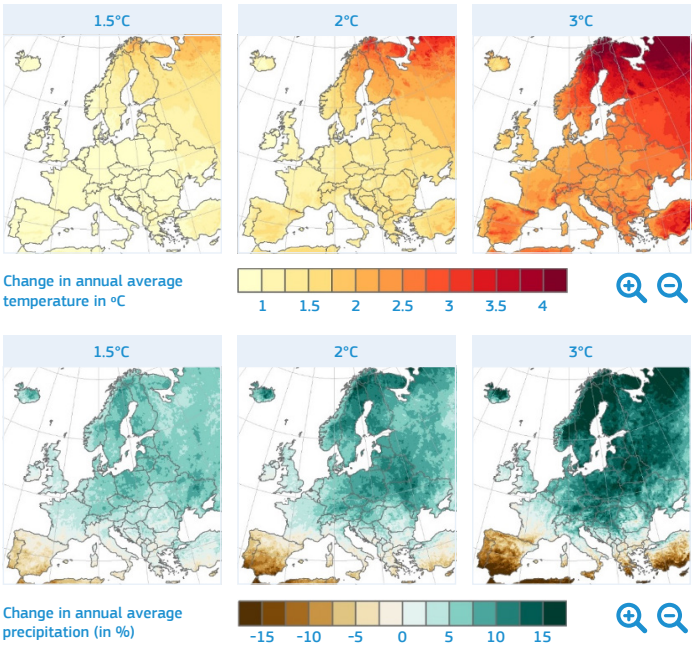

Figure 2. Changes from present (1981-2010) in annual temperature (top panels) and precipitation (bottom) for the three global warming scenarios used in PESETA IV (1.5, 2 and 3°C warmer than pre-industrial).

Impact models

PESETA IV uses state-of-the-art impact models to quantify the effects of climate change on several sectors across Europe (Figure 3). Some of the models are used across multiple sectors because the projections from one impact model can be used as input to another model, e.g. the hydrological model projections are used to estimate the impact of climate change on river flooding, drought, water availability and energy (for hydropower).

Agriculture	WOFOST and CAPRI
Energy	POLES
River floods	LISFLOOD and inundation mapping
Coastal floods	Flood inundation mapping
Droughts	LISFLOOD
Habitat loss	Climate characteristic zoning
Forest fires	Fire Weather Index (FWI) system
Water resources	LISFLOOD
Heat & cold extremes	Empirical statistical model
Wind storms	Empirical statistical model

Figure 3. The impact sectors investigated by PESETA IV and the impact models used.

Socioeconomic scenarios

PESETA IV primarily aims to assess impacts as if future climate change occurs in the present, affecting today's economy and population. Therefore, most of the sectors assume that current levels of population and gross domestic product (GDP) do not change in the future. This is known as a 'static' analysis.

However, in some cases, it is interesting to also understand the sensitivity of impacts to future socioeconomic change. To this end, impacts under different assumptions of future socioeconomic change are also estimated at 2050 and 2100, for coastal and river flooding, drought, windstorms, health and market adjusted assessment of crop production. For these sectors high-resolution population projections were derived from the ECFIN 2015 Ageing Report to account for population dynamics. Comparison of these 'dynamic' impacts with the 'static' impacts allows disentangling the effects of climate and socioeconomic changes on future climate risk.

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