HERCULES : Health, risk and climate change: understanding links between exposure, hazards and vulnerability across spatial and temporal scales

Jukka Käyhkö (UTU), Sirkku Juhola (UHEL), Antti-Ilari Partanen (FMI) & Jussi Vahtera (UTU)

INTRODUCTION

Direct and indirect impacts of climate change on individual persons' well-being and health through long-term, complex, and often concealed processes. A sudden hazard - such as a prolonged heat wave - may increase instantaneous mortality and morbidity, but such casualties may represent only a small fraction of all those adversely affected by climate change, and the underlying societal processes.

In HERCULES project, we examine the associations of people living in various urban environments with the development of diseases of major public health importance and their risk factors, and how these associations may alter under climate change. We study this nationwide and focus on the six largest cities in Finland. The overall aim of HERCULES is to provide ground-breaking, yet actionable knowledge about climate related health risks.

RESEARCH QUESTIONS

- How has the spatial pattern and intensity of selected climatic hazards and other environmental exposures changed since the 1980s, and how these will change during the coming decades?
- How do health and health-related risk factors develop over the life course of vulnerable people in changing living environments?
- In what ways do urban development and climate policy drive exposure and vulnerability?
- How is the climate induced health risk distributed spatially in the six largest cities in Finland, and how will the risk areas change during the coming decades?

DATA

We will use national level geospatial datasets including climate layers of the current climate conditions and future climate change scenarios (Fig 1), to estimate climatic health risks. The data will be statistically downscaled to finer resolution for the six largest Finnish cities. Additionally, geospatial environmental and socioeconomic data will be used for a health vulnerability assessment.

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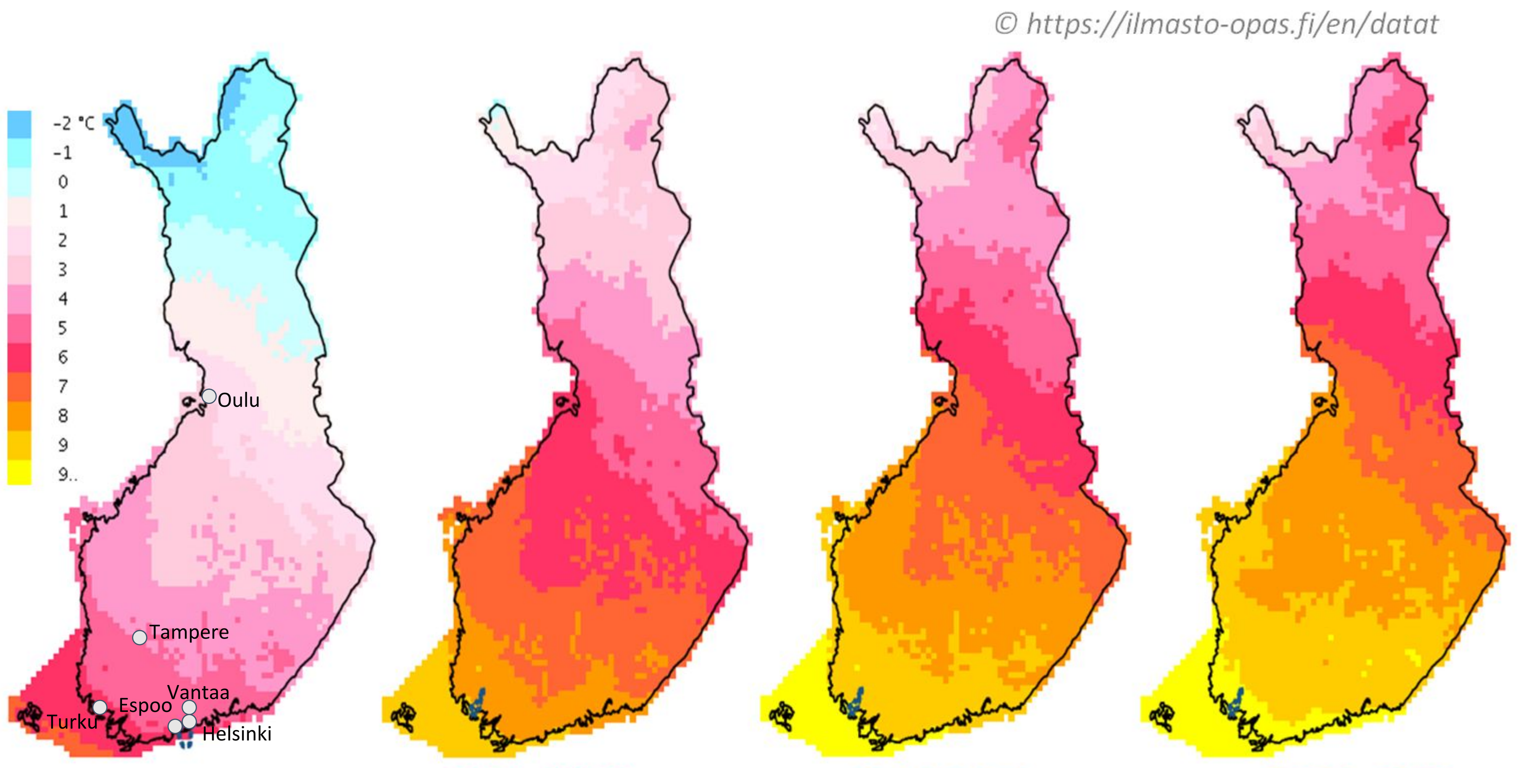
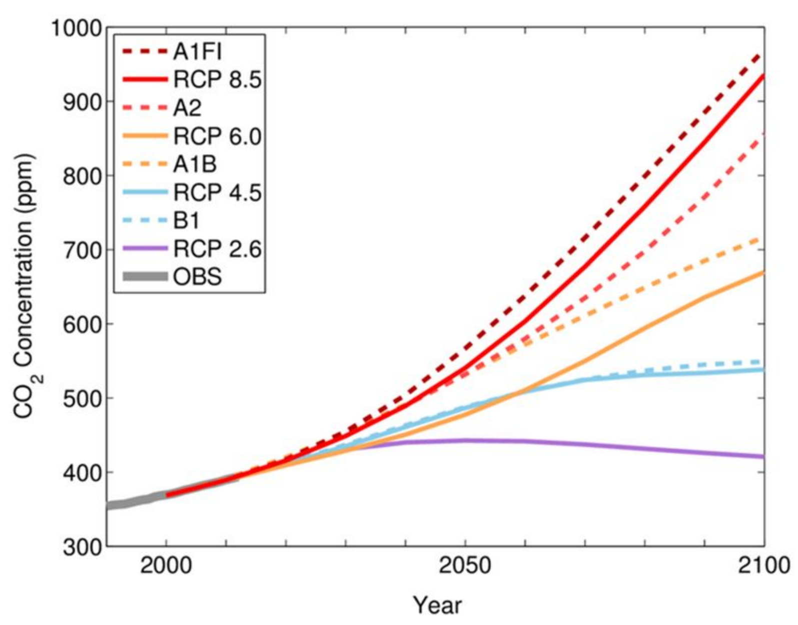
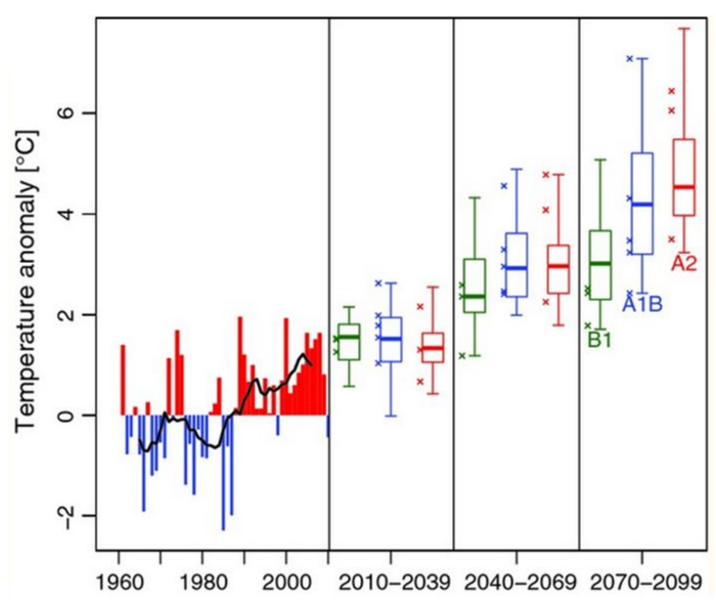




Emissions scenarios (SRES) and Representative Concentration Pathways (RCP) scenarios for projecting increase of atmospheric CO_2 (Snover, 2013)



Observed and climate change projected (SRES) anomalies in annual average air temperature in Finland (Rötter et al. 2013)

Fig. 1. Annual average air temperature (maps) and temperature anomalies for diferent climate change scenarios

METHODS

HERCULES will adopt a novel approach and interdisciplinary nature of the research by combining expertise from climate, environment, geography and health science. We will perform novel spatio-temporal integration and analysis of four datasets: longitudinal cohort data, socio-economic and policy data, environmental land cover data, and fine-resolution climate scenarios.

HERCULES is structured into four thematic work packages (WPs)(Fig 2):

WP1 Exposure: High-resolution modelling of climate, other environmental exposures, and socio-economic parameters (led by FMI)

WP2 Health: Health effects of direct and indirect climate-related environmental exposures over the life course (led by UTU Public Health)

WP3 Policy: Vulnerability/exposure drivers and urban and climate policy (led by UHEL)

WP4 GI-Synthesis: Climate-induced health risk, geographic information synthesis of the data and processes analysed in other WPs (led by UTU GEO).

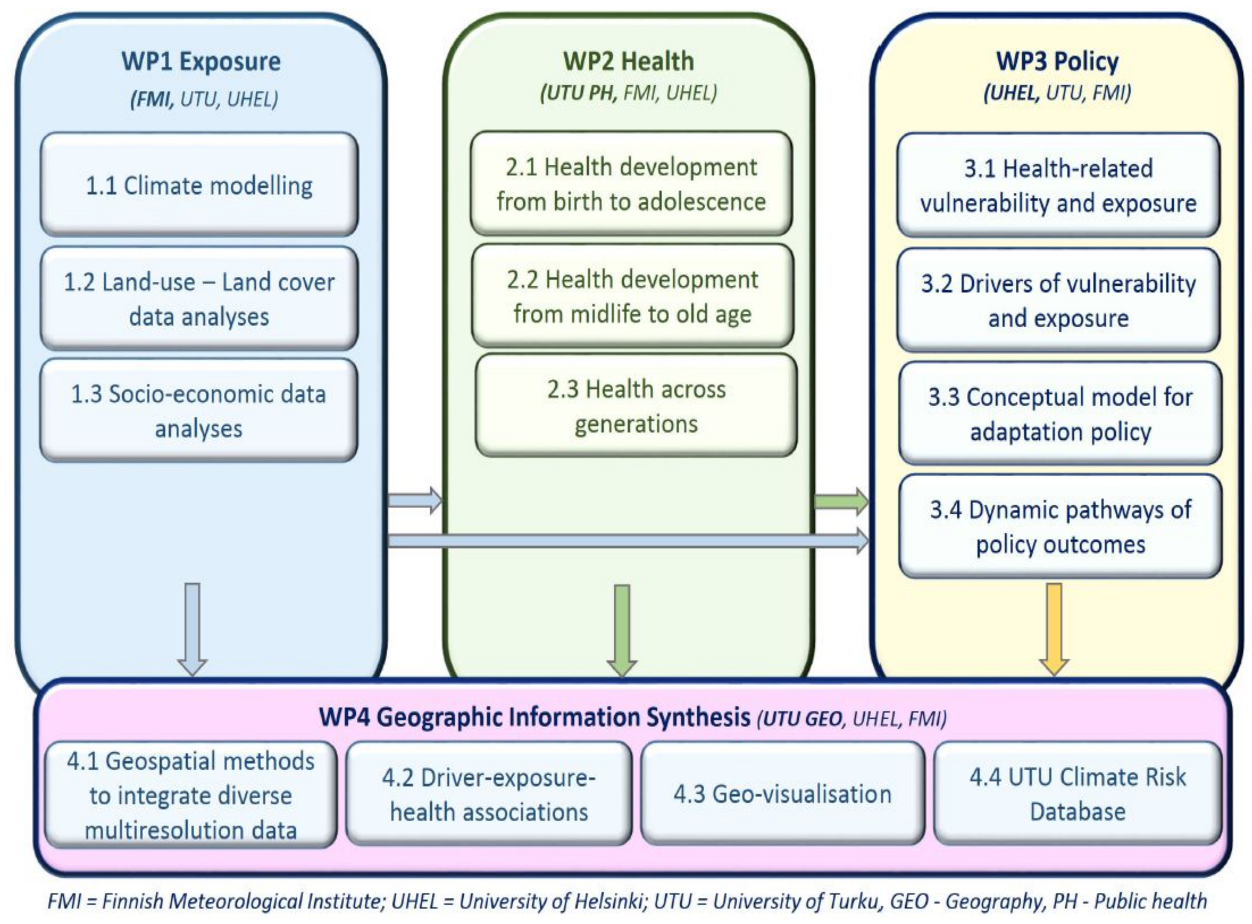


Fig. 2. HERCULES research work packages

EXPECTED RESULTS

- We provide information of spatio-temporal distribution of acute hazardous weather conditions, such as heat stress (UHI) and slipperiness, as well as long-term average conditions in the past, present and in the future, and how these conditions relate to changing LULC parameters (e.g. greeneess, imperviousness) that form our physical living environments.
- We provide information on the development of health and health-related risk factors at various life stages (infancy, childhood, adolescence, middle age, old age) in different residential neighbourhoods by adopting a life course of place-health approach.
- We provide novel information on the associations between environmental health data and broader trends of urban development, individuals' behaviour, and climate policy.
- We produce synthesised information of the exposure data on the environmental, climatic and socio-economic parameters. Our research reveals spatially and temporally explicit information of climate-related health risks and relevant affecting factors.

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