

Klima Prahy

- Mezinárodní modelovací aktivity a možnosti podpory klimatických služeb



World:

- From 1995 - more than 50% of the world's population living in cities (UN, 2009)
- 2030 – more than 60% expected
- Adaptation committee UN FCCC – \$1.8 trillion investment in 2020-2030 benefit of \$7.1 trillion, cities one of critical issues, expected IPCC AR7 cycle Special Report on Cities

Europe:

- 2008 - 73% of the population in cities
- mid 21th century - 84%, representing a rise from 531 to 582 millions (UN, 2008)

Clearly:

- Quite many atmospheric effects on population through the urban environment
- Especially extreme weather effects like heat wave and air-quality threshold exceedances

Moreover:

- Significant increase of the models resolution where large city's (megacities) scale achieved, thus urban infrastructures – atmosphere interactions processes can be resolved and should be considered
- Improvement of urban infrastructures data availability

Projekt URBI PRAGENSI



- Urbanizace předpovědi počasí
- Urbanizace předpovědi kvality ovzduší napojená na urbanizovanou předpověď počasí
- Urbanizace scénářů klimatické změny, nástroje pro zhodnocení účinnosti adaptačních či mitigačních opatření (např. pro strategické plány rozvoje města)
- Mikroměřítkové simulace hot-spotů



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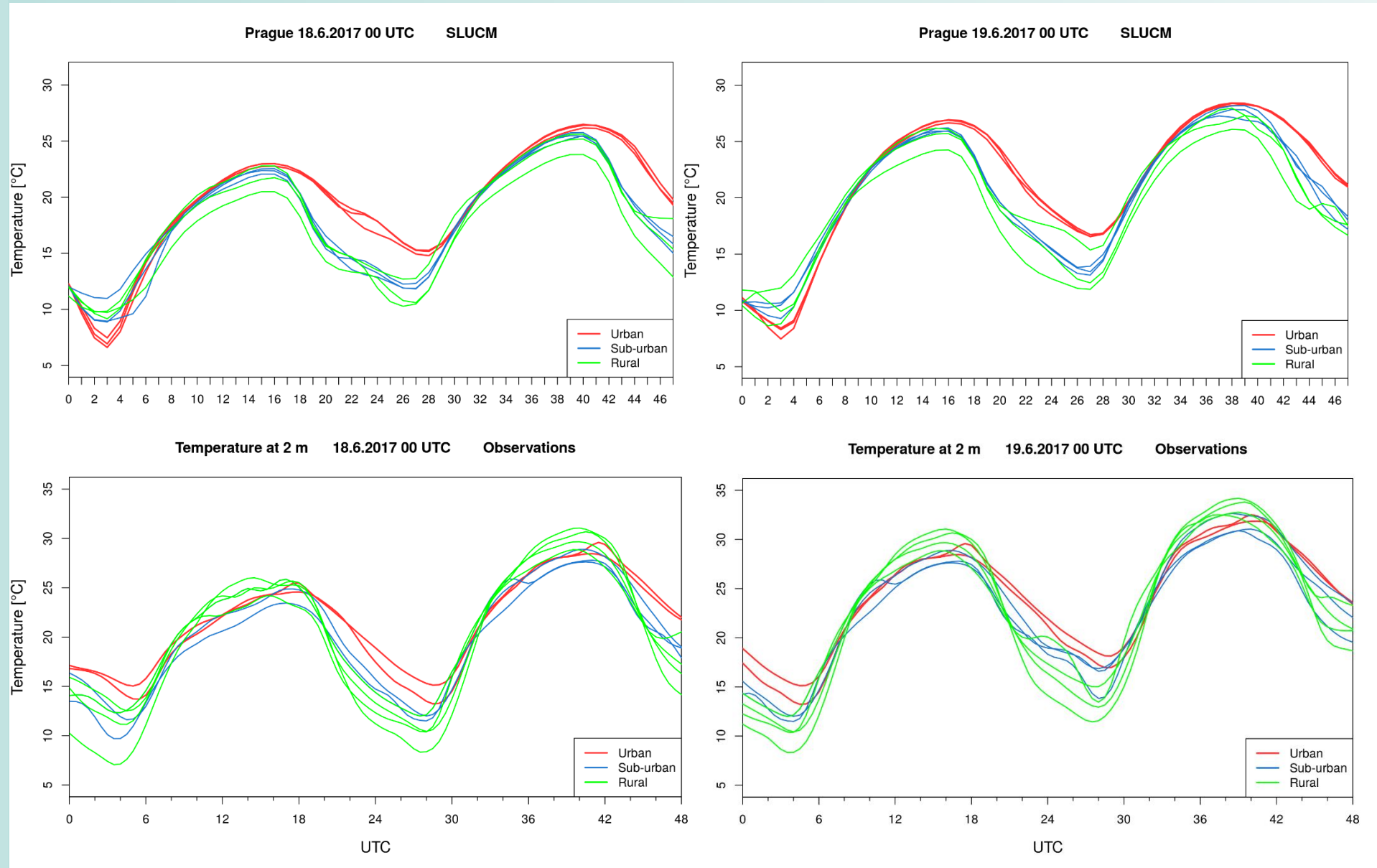


ČESKÝ
HYDROMETEOROLOGICKÝ
ÚSTAV

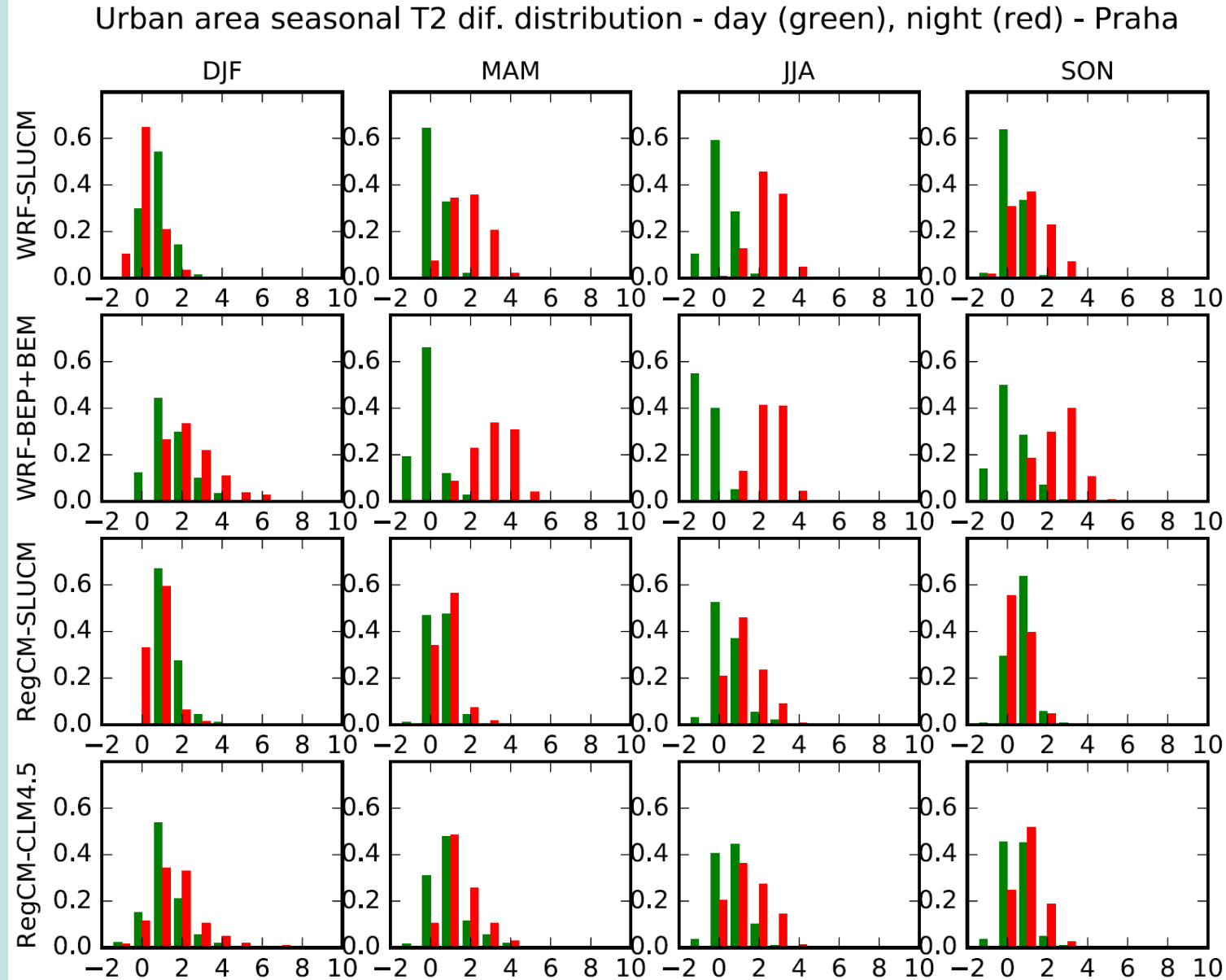
INSTITUTE OF COMPUTER SCIENCE
The Czech Academy of Sciences



URBI PRAGENSI - WRF forecast with SLUCM (3km)

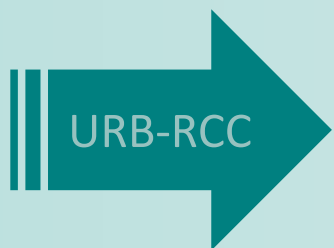


URBI PRAGENSI - UHI intensity in Prague (day vs. night)



Karlícky et al.
(ACP, 2018)

Climate
simulations:
10 years
resolution 10km
Central Europe



Understand the effect of urban areas on the regional climate, as well as the impact of regional climate change on cities, with the help of coordinated experiments with urbanized RCMs

Main Objectives:

- *Understanding and assessing urban climate change impacts.*
- *Investigating interactions of urban environment with local/regional climate for (mega)cities based on coordinated ensemble using urbanized RCMs in CORDEX experiments.*
- *Assessing options for urban parameterization (UP) schemes in high-res RCM simulations for further use in CORDEX.*
- *Better understanding the urban environment's vulnerability under CC and providing the urban CC science to underpin climate services for cities.*

Phase 1: (started May 2021)

- Overview of urban effects/parameterization schemes incorporated
- Analysis of available simulations outputs to understand CC impacts in different big cities
- Co-developing simulation protocols and criteria for city(ies) selection for coordinated (convection permitting (CP)) experiments.

Phase 2:

- Coordinated (CP) experiments - validation
- Identify urban processes needed to be included in future RCM simulations

Phase 3 (for selected experiments):

- Coupling to Chemical Transport Models
- Include urbanization scenarios

Phase 4:

- Coordinated (CP) experiments with full complex urban effects under future scenarios
- Comparison and added value assessment of urban effects in regional/local CC
- Assessment of knowledge on urban regional climate and CC impacts, and connection to climate services development



Share of population living in urban areas is projected to reach about 70% of the world population up to 2050



Urban environments are vulnerable to climate change



Improved scientific understanding and robust assessment of CC impacts in the urban environment supports:

- ***urban climate services development,***
- ***risk management,***
- ***city planning,***
- ***development and proposing adaptation or mitigation measures to minimize e.g. the health effects, air-pollution exceedances, ...***

Demonstrated connection to end-users will play important role for city selection

- 30 partners, about 2/3 EURO-CORDEX (/MedCORDEX) partners, some overlap with FPS Convection and LUCAS, which are close to the topic
- 9 partners outside of Europe (Africa, N/S-America, Australia, Asia)
- Remains open to additional partners, especially for Phase 1 and for coordinated experiments
- Mainly RCM community, complemented with urban climate community to add expertise in the subject

- **Candidate Cities:** Paris, London, Shanghai, Buenos Aires, Johannesburg, Beijing
- **Supporting characteristics:** available measurement campaigns, other data, urban infrastructure data, urbanization trends, other studies for comparison, specific climate features
- Potential „satellite“ cities of individual interest of participating groups
- Preliminary results, for some of the cities we can achieve quite reasonable number of simulations to get more robust results

Non-CO2 Forcers and their Climate, Weather, Air Quality and Health Impacts

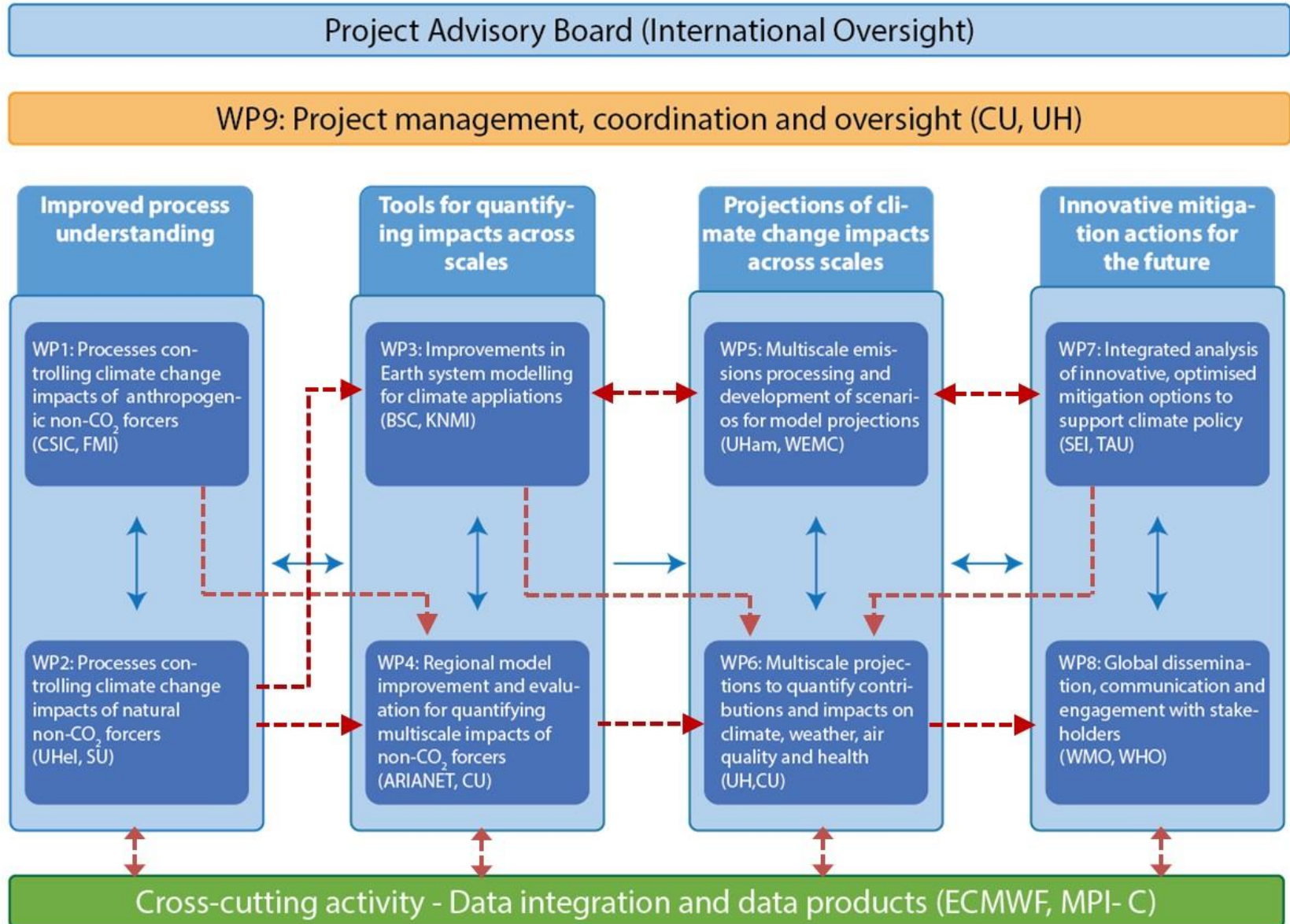
Goal: to improve our knowledge of individual and cumulative contribution of non-CO2 radiative forcers and their precursors.

- to assess the impact of key radiative forcers, where and how they arise, the processes of their impact on the climate system
- to find and test an efficient implementation of these processes into global ESMs and into RCMs, eventually coupled with CTMs, down to urban scales, and to use the tools developed to investigate mitigation and/or adaptation policies incorporated in selected scenarios of future development targeted at Europe and other regions of the world
- to target species with the greatest uncertainty in determining their impact on climate change and the associated influence on weather patterns (e.g., atmospheric and ocean circulation and extreme weather events), air pollution episodes and health impacts
- To focus on the radiative forcing properties of PM2.5/PM10, CCN and their components (e.g., POA, SOA, BC/EC, SIA, dust), O₃(and its precursors NO_x, VOCs, SO₂, carbon monoxide (CO)), CH₄, and N₂O in the wider context of the warming potential of all key GHGs.



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FOCI - Scheme





EC Horizon Europe – IMPETUS4CHANGE



Improving NearTerm Climate Predictions for Societal Transformation

Overarching goal „ to improve the quality, accessibility and usability of near-term climate information and services at local to regional scales – where impacts are most keenly felt and on-the-ground adaptation is implemented“

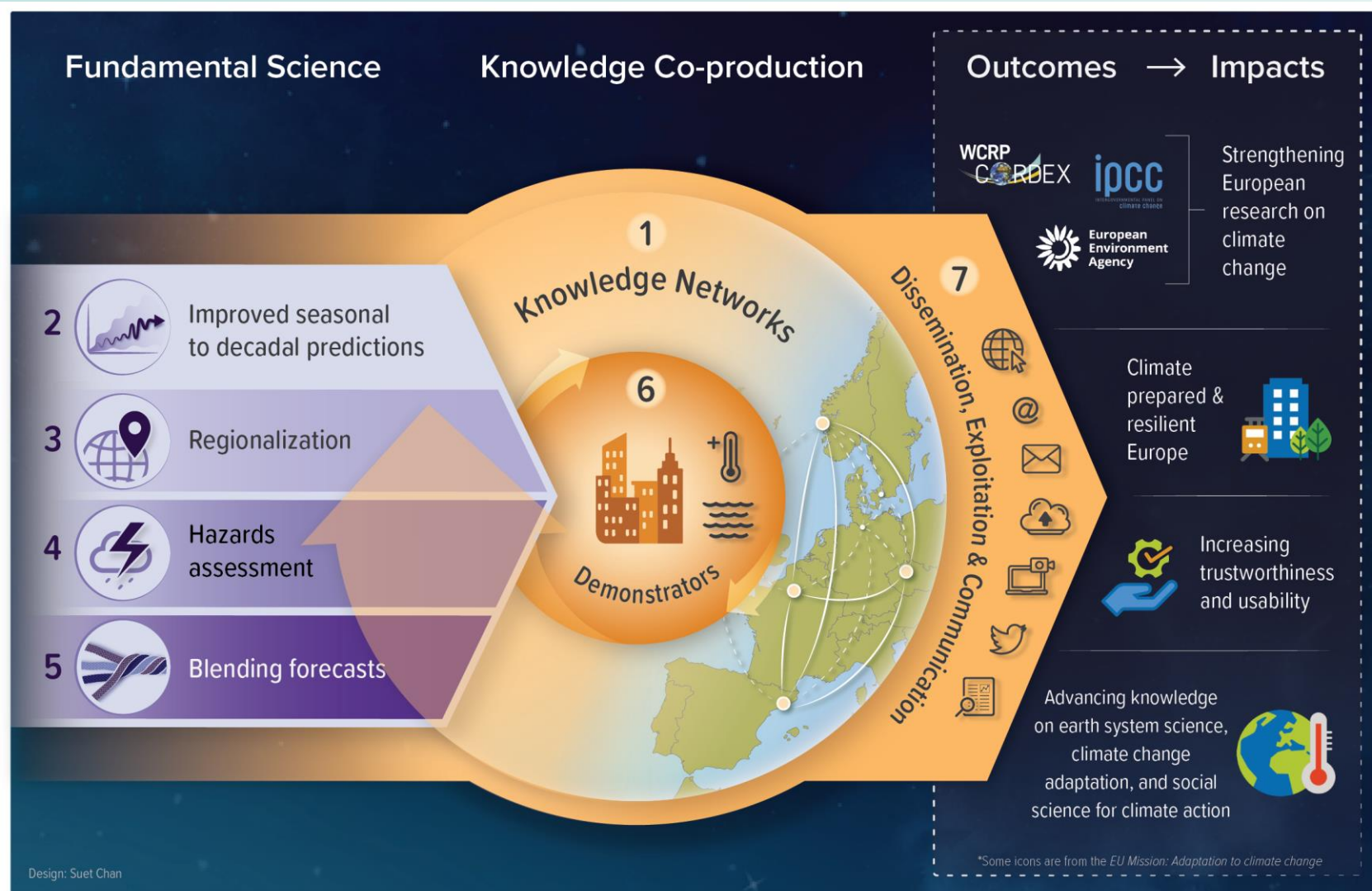
Developed in some specific urban related objectives

- Develop novel methods to downscale predictions to local scales
- Improve assessments of hazards and translate this into usable information for local risk assessments
- Make advances towards the goal of end-to-end seamless climate services
- Through transdisciplinary co-production approaches develop fit-for-purpose "Adaptation support packs" at municipal scales through our so-called urban Demonstrators (Prague included)
- Prague – test to infrastructure characteristics setting (urban zones vs. direct values), air quality effects



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IMPETUS4CHANGE - Scheme





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EC Project – Destination Earth (DestinE)

Destination Earth – Digital Twins Concept

Overarching goal „ to develop a highly accurate digital model of the Earth (a ‘digital twin’) to monitor and predict environmental change and human impact to support sustainable development“

Why:

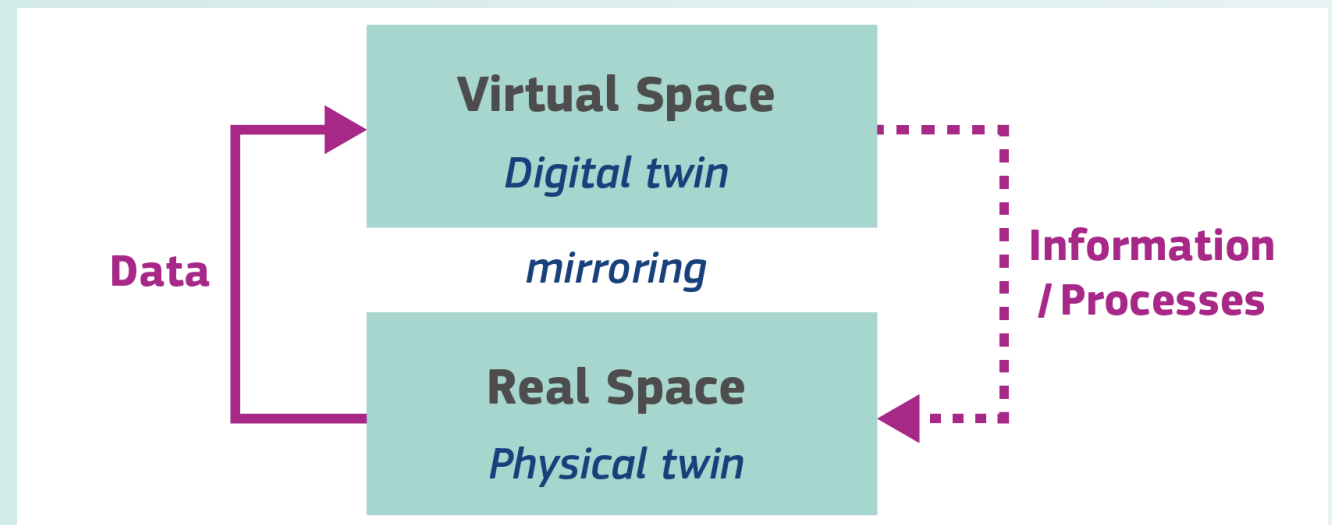
- Evidence-based policy development
- Contribution to the European Green Deal
- Accessing data and benchmarking models
- User-Specific and Actionable Predictions

Main Partners:

[European Space Agency](#) (ESA),

[European Centre for Medium-Range Weather Forecasts](#) (ECMWF)

[European Organisation for the Exploitation of Meteorological Satellites](#) (EUMETSAT)





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DestinE – Urban Digital Twin

virtual representation of a city's environment: buildings, streets, parks, and trees

Using cutting-edge technologies such as cloud storage and HPC, they integrate real-time data through sensors (e.g. traffic signals, power grids) for use by city departments and policymakers through real-time visualisations to:

- improve urban planning and infrastructure management
- manage urban traffic
- predict extreme weather events
- improve waste collection
- reduce energy consumption

Shrnutí

- Významný efekt městského prostředí na atmosférické podmínky a klima, jehož význam s rostoucím podílem populace žijící ve městech roste
- Současné technologie umí tento vliv dobře zachytit, tepelný ostrov je jasně identifikován v modelových simulacích v souladu s pozorováním, tedy především v létě a noční době, a zvláště za významných termických extrémních situací, tj. především v tzv. horkých vlnách
- Vysoké rozlišení současných numerických modelů dosáhlo měřítka města, nelze je nadále ignorovat, možnost lokalizovaných simulací, předpověď počasí pro města realitou, scénáře klimatické změny s vyhodnocením adaptačních a mitigačních opatření
- Pro zachycení všech procesů, zvláště pro účely modelování kvality ovzduší, je třeba komplexnějších parametrizací

„Proof of concept“ a další zhodnocení v rámci projektu URBI PRAGENSI a jeho udržitelnosti, tématika vnesena do mezinárodní aktivity CORDEX – FPS URB-RCC, EC Horizon Europe projekt FOCl, EC Horizon Europe projekt IMPETUS4CHANGE, WMO koordinace, IPCC AR7 cyklus – Speciální zpráva k městům, projekt PERUN – TAČR/MŽP Prostředí pro život



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