Horizon
Europe

FOCI

THE FOCI PROJECT: NON-CO2 FORCERS AND THEIR CLIMATE, WEATHER, AIR QUALITY AND HEALTH IMPACTS

E-mail: tomas.halenka@mff.cuni.cz

Tomáš Halenka, Charles University, Faculty of Mathematics and Physics, Dept. of Atmospheric Physics, Prague, Czech Republic
Ranjeet Sokhi, Department of Physics, Astronomy and Mathematics; School of Physics, Engineering and Computer Science; University of Hertfordshire, Hartfield, United Kingdom

Motivation

1. Horizon Europe Call HORIZON-CL5-2021-D1-01-01 Improved understanding of greenhouse gas fluxes and radiative forcers, including carbon dioxide removal technologies
   a) greenhouse gas fluxes and Earth system feedbacks
   b) global warming contribution of different, non-CO2 radiative forcers
   c) climate and Earth system responses to climate neutrality and net negative emissions
2. IPCC AR6 WGI: Well mixed CO2, and its impacts on global to continental scales well understood with a high level of confidence, however, there are knowledge gaps concerning the impact of many other non-CO2 radiative forcers leading to low confidence in the conclusions:
   a) anthropogenic and natural precursor emissions of short-lived GHGs, aerosols effects
   b) subsequent effects on atmospheric chemistry and climate, through direct emissions dependent on changes in e.g., agriculture and technologies based on scenarios for future development as well as feedbacks of global warming on emissions, e.g., permafrost thaw
   c) albedo changes connected to land-use and land-cover can play a role, depending on the adaptation or mitigation measures included in different scenarios.
3. Strong group based around air quality modelling (R. Sokhi), with some contacts to ESM groups

FOCI basic info

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

Partners: 17 (14+3), cooperating institutes over the world

Charles University (CU) - cooerdinator	Czech Republic
Max Planck Institute – Chemistry (MPI-C)	Germany
Finnish Meteorological Institute (FMI)	Finland
University of Hamburg (UHam)	Germany
Consejo Superior de Investigaciones Científicas (CSIC)	Spain
Koninklijk Nederlands Meteorologisch Instituut (KNMI)	The Netherlands
Barcelona Supercomputing Center (BSC)	Spain
World Meteorological Organization (WMO)	International
University of Helsinki (UHel)	Finland
Tel Aviv University (TAU)	Israel
European Centre for Medium-Range Weather Forecasts (ECMWF)	International
World Health Organisation (WHO)	International
ARIANET (R&D Industrial partner)	Italy
Stockholm University (SU)	Sweden
University of Hertfordshire (UH) – co-coordinator	UK
Stockholm Environment Institute, University of York (SEI)	UK
World Energy and Meteorology Council (WEMC) – SME	UK

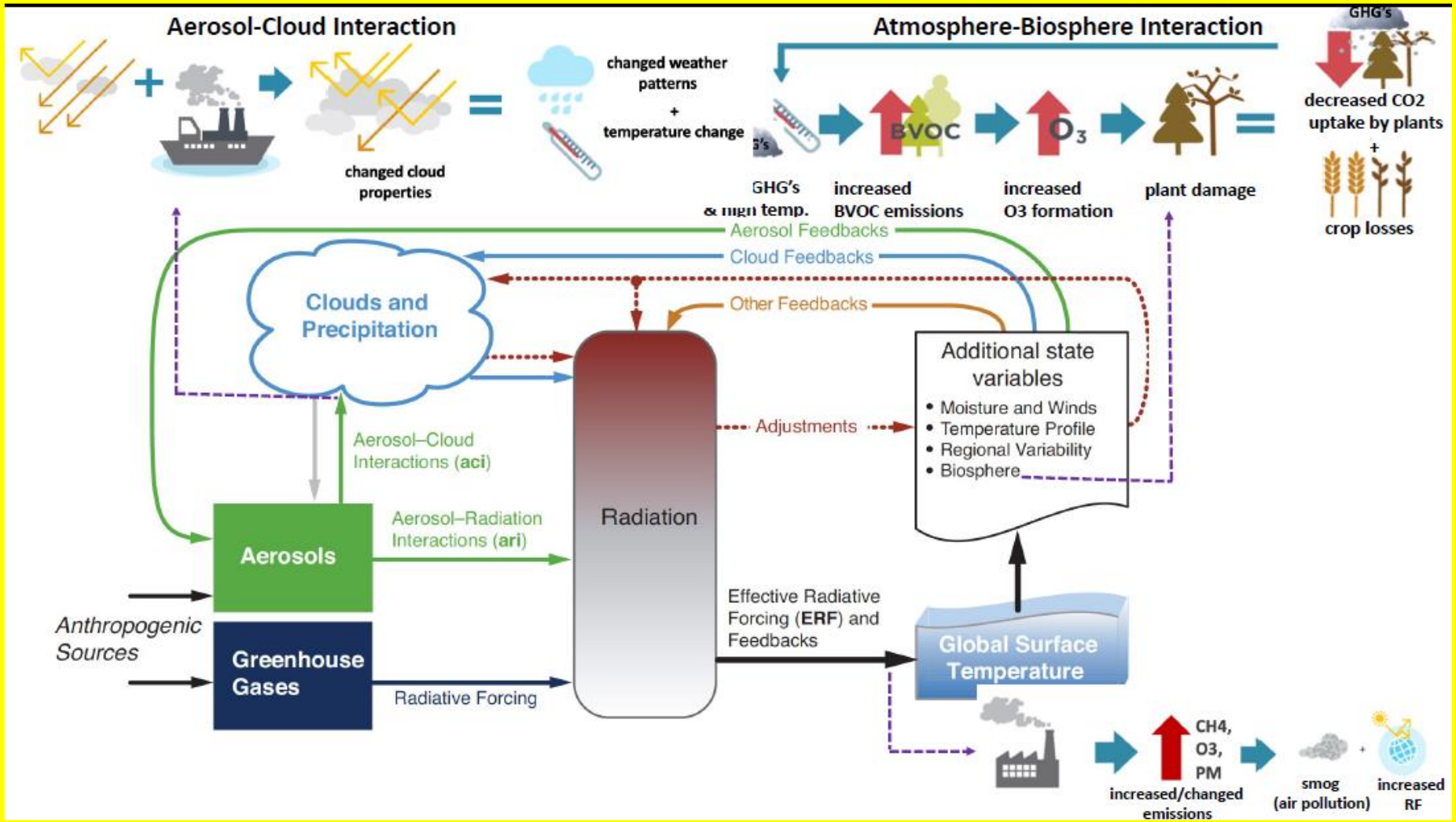
Budget: nearly 8 M€

Duration: September 2022 – August 2026

Specific tasks of the Call (part b)

- improve knowledge concerning the individual and cumulative contribution of short- and long-lived radiative forcers, including GHGs other than CO2, and their precursors, aerosols, refrigerants and other climate forcers, to climate change, including their impact on atmospheric and ocean circulation, as well as other environmental issues
- may focus on a subset of forcers, and should concentrate on those where the relationship between emissions, atmospheric lifecycle, climate system feedbacks, and global warming is least well understood
- assess the climate and non-climate impacts, over multiple time scales, of policies and measures targeting forcers other than CO2
- examine the application of this knowledge in relevant sectors (such as transport, industry, agriculture and health) with a view to better understand co-benefits and trade-offs of mitigation policies with other societal benefits, including human health

Need of full ESM with chemistry



adapted from IPCC AR5, 2013

FOCI Aims

- **The overall aim of FOCI is to improve our knowledge of individual and cumulative contribution of non-CO_2 radiative forcers and their precursors.**
- Main goals are to assess the impact of key radiative forcers, where and how they arise, the processes of their impact on the climate systém.
- We aim to find and test an efficient implementation of these processes into global Earth System Models and into Regional Climate Models, eventually coupled with CTMs, and finally 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.
- Specifically, we 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.
- Our integrated observational and modelling analysis will focus on the radiative forcing properties of $PM_{2.5}$/PM_{10}, CCN and their components (e.g., POA, SOA, BC/EC, SIA, dust), O_3 (and its precursors NO_x, VOCs, SO_2, carbon monoxide (CO)), CH_4, and N_2O in the wider context of the warming potential of all key GHGs.

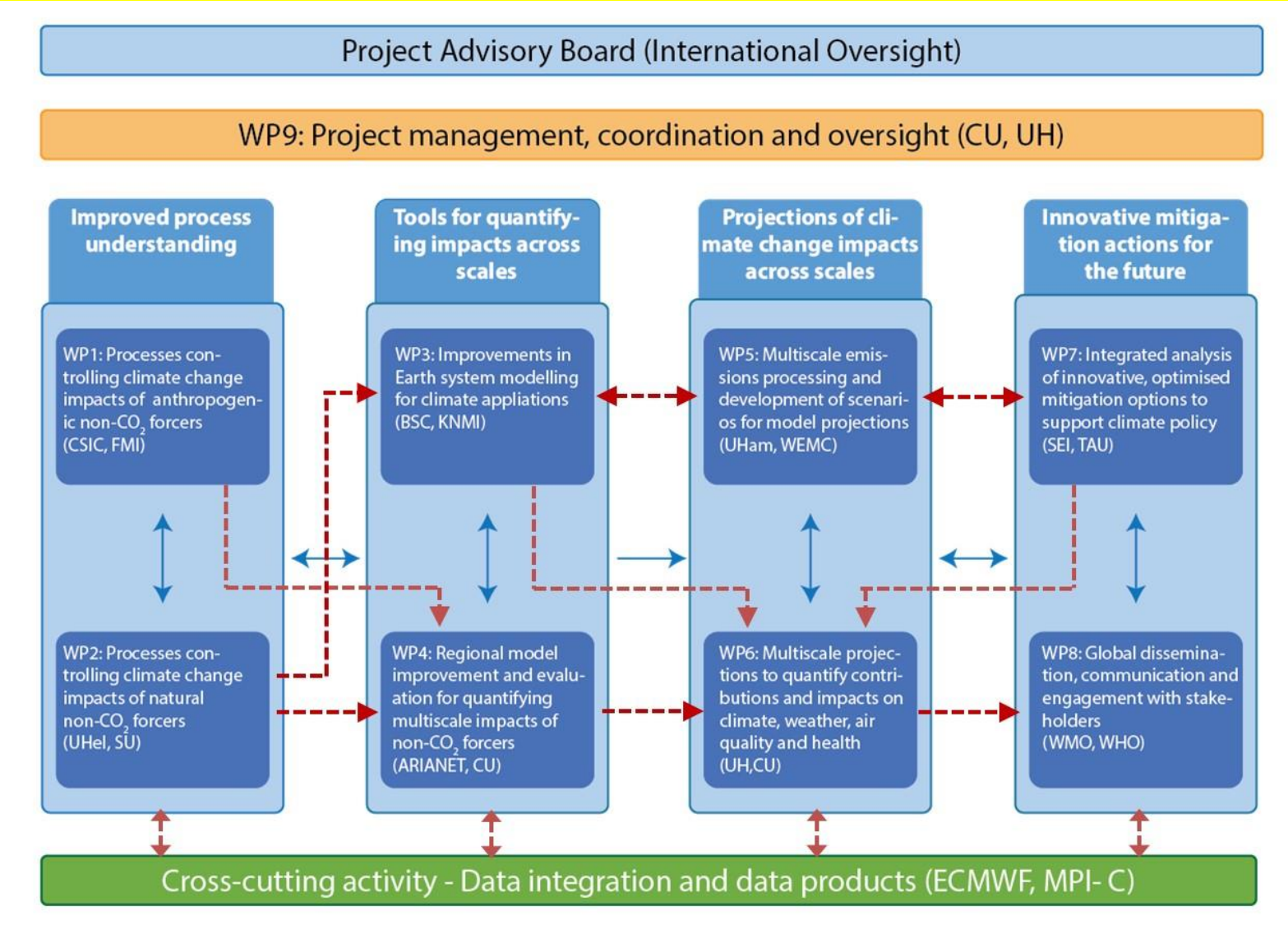
FOCI Objectives

1. **To examine and evaluate the climate relevant processes and feedbacks of anthropogenic primary and secondary radiative forcing species**, based on new and available observations datasets (WP1)
2. **To examine and evaluate the climate relevant processes and feedbacks of natural aerosols and BVOCs**, as precursors for SOA based on new and available observations datasets (WP2)
3. **To integrate observational and modelling datasets and data products** for improving and evaluating multiscale climate and atmospheric composition models (cross-cutting activity)
4. **To improve and evaluate state-of-the-art global ESMs** (WP3) **and regional climate and atmospheric composition models** (RCMs) (WP4), targeting specific critical processes with the largest uncertainties (WP6) for improving future next generation climate projections
5. **To improve tailored emission inventories for non-CO_2 radiative forcers and scenarios** for detailed, high-resolution, multiscale climate and associated impact projections for specific regions (e.g. Europe, South Asia, Africa and Arctic), using innovative coupled modelling frameworks (WP5 and WP7)

FOCI Objectives (cont.)

6. **To undertake innovative and regionally relevant integrated analysis** of optimised mitigation strategies, to support climate policy, deriving multiple benefits (e.g. climate mitigation and adaptation, human health, social, economic, and developmental), quantifying the sensitivity of climate system tipping points to non-CO_2 forcers and meeting the global challenge of stabilising global temperatures and minimising the associated impacts on climate, weather, air quality and health (WP6, WP7)
7. **To implement a global outreach, dissemination and stakeholder engagement strategy** targeted at providing updated scientific evidence on the impact from key non-CO_2 radiative forcers for supporting national and international policy and operational services, including formulating recommendations on the most efficient pathways supported by integrating climate, health, urban and energy services (WP8)
8. **To guarantee the efficient implementation of the project and delivery of its outcomes** through a robust coordination and management plan incorporating administrative, financial, operational and monitoring infrastructure and mechanisms with independent scientific oversight (WP9).

FOCI scheme


Project Advisory Board (International Oversight)
WP9: Project management, coordination and oversight (CU, UH)
Improved process understanding
Tools for quantifying impacts across scales
Projections of climate change impacts across scales
Innovative mitigation actions for the future
WP1: Processes controlling climate change impacts of anthropogenic non-CO_2 forcers (CSIC, FMI)
WP2: Processes controlling climate change impacts of natural non-CO_2 forcers (UHel, SU)
WP3: Improvements in Earth system modelling for climate appliations (BSC, KNMI)
WP4: Regional model improvement and evaluation for quantifying multiscale impacts of non-CO_2 forcers (ARIANET, CU)
WP5: Multiscale emissions processing and development of scenarios for model projections (UHam, WEMC)
WP6: Multiscale projections to quantify contributions and impacts on climate, weather, air quality and health (UH,CU)
WP7: Integrated analysis of innovative, optimised mitigation options to support climate policy (SEI, TAU)
WP8: Global dissemination, communication and engagement with stakeholders (WMO, WHO)
Cross-cutting activity - Data integration and data products (ECMWF, MPI- C)

Advisory Board

Name of PAB international member and organization	Membership of PAB and role within FOCI
Dr. François Dejean, EEA, Denmark	Joint workshop, advice on climate policy implications
Dr. Julian Wilson, JRC, Italy	Emissions inventory (EDGAR), co-benefits of climate/air quality policy measures (FASST); acting as a conduit for fast-tracking results from the consortium into the EU policy landscape
Praveen Bains, IEA, France	Energy bases scenarios and sharing of data and modelling approaches
Prof. Chandra Venkataraman, IIT Bombay, India	Provide access to improved emission inventories for non-CO_2 radiative forcers for climate and impact projections for South Asia, evaluate simulations from coupled modelling frameworks for South Asia, Contribute to the development of mitigation strategies for South Asia.
Prof. Shaofei Kong, CUG, Wuhan, China	Access to analysis of aerosol properties and their radiative forcing potential and impacts over South Asia
Prof. Greg Carmichael, Iowa State University, USA	Advice and inputs into WPs 1-4 and 7, including helping to design experiments, analyse data and contribute to publications/report.
Dr. Jean-François Lamarque, Director of the CGD Laboratory, NCAR, USA	Collaborative opportunities on the use of Community Earth System Model (CESM) to understand long-term changes of short-lived climate forcers (i.e. O_3, aerosols and CH_4)
Dr Rohit Mathur, USEPA	Advice and sharing of improving representation of composition, distribution and optical/radiative properties of non-CO_2 climate forcers, impacts on earth-atmosphere radiation budget, share modelling and measurement data sets
Prof. Paolo Laj, UGA, France	A coordinator of the European Research Infrastructure ACTRIS (Aerosol, Cloud and Trace Gases Research Infrastructure)

Cooperations envisaged

Relevant Project (Title and FOCI partner)	How the project feeds into the FOCI work programme (relevant WPs are shown)
TRANSPHORM FP7 (UH coordinator, FMI)	Downscaling strategies for climate simulations (WP4, WP6)
EMERGE H2020 (FMI Coordinator, UH)	High-resolution simulations of climate interactions for non-CO_2 species (WP6)
FORCeS H2020 (SU, BSC, KNMI)	Improvements in the description of aerosol and cloud processes in EC-Earth3-AerChem that will be brought into EC-Earth4 (WP3)
COST Action CA16109 COLOSSAL (CSIC coordinator)	Chemical On-Line cOmpoSition and Source Apportionment of fine aerosol (COLOSSAL) to consistently assess spatial and temporal variability, chemical composition and sources of fine aerosols across Europe (WP1).
ACTRIS (CSIC, BSC)	ACTRIS EU H2020 projects, ACTRIS IMP; ACTRIS PPP; ACTRIS-2 (Aerosol, Clouds, and Trace gases Research Infrastructure-2); ACTRIS is a pan-European RI producing high-quality data (WP1).
VEG-GAP LIFE18 (ARIANET)	Developing a strategy for urban air quality assessment considering urban vegetation characteristics, such as plant type, green area extension, etc. Compute species-dependent BVOC emissions (WP5).
PrepAIR LIFE15 (ARIANET collaboration through ARPA Lombardia)	The Italian Po Valley Regions and Slovenia aim to strengthen the sustainability and durability of Po basin air quality measures. The project includes actions dealing with biomass burning and agriculture (WP5).
MEGAPOLI FP7 (CU, UH, UHel, UHam, MPI-C, FMI, ARIANET, WMO)	MEGAPOLI, modelling tools and methodology will be used in WP4 and WP6 for estimation of the impacts of different scenarios of urban development on human health and climate change.
CORDEX FPS CP RCM, FPS URB-RCC (CU)	High resolution (CP) RCM, with urbanization and coupled to CTM

WP8 - Global dissemination, communication and engagement with stakeholders

The main objectives:

8.1 To ensure the impact and the relevance of the project outcomes to stakeholders, including the climate, weather, air quality and health communities.

8.2 To implement a global dissemination of the projects data and results among the scientific and other stakeholder community and promotion of their uptake in the international policy and operational services, including integrated health, urban and energy services.

8.3 To engage the international organizations in the communication, dissemination and user engagement, as well as connection with operational services will help to shape the project outputs that meet expressed requirements and promote the scientific project outputs with the network of operational centres that can benefit from the deliverables under all project WPs.

Wish us good luck!

THANKS FOR YOUR ATTENTION !