FORCeS

Bolin Centre for Climate Research | Stockholm University

Constrained aerosol forcing for improved climate projections FORCeS

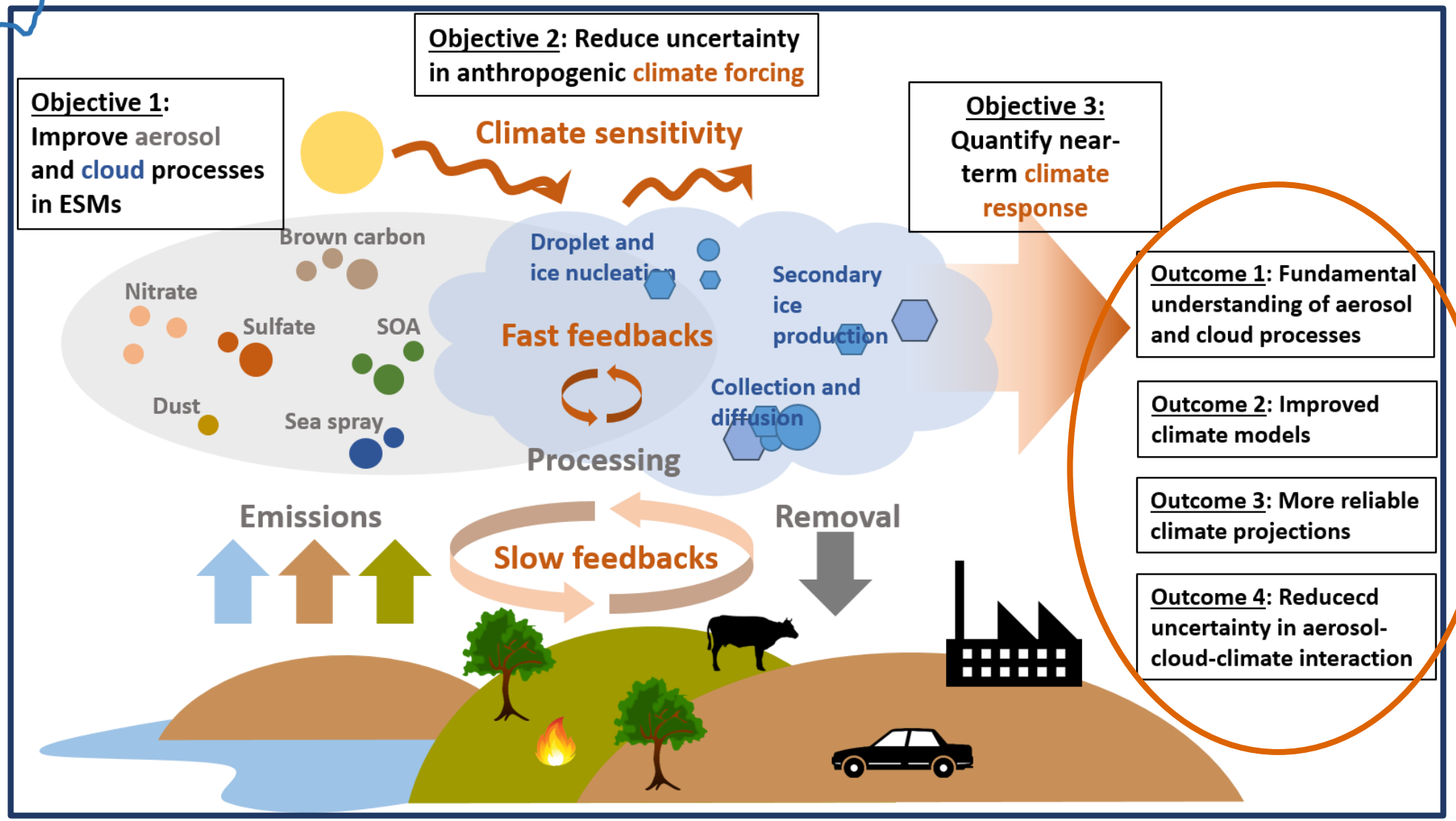
Coordinator: Ilona Riipinen
Scientific coordinator: Annica Ekman

Funding received from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No 821205

Project consortium

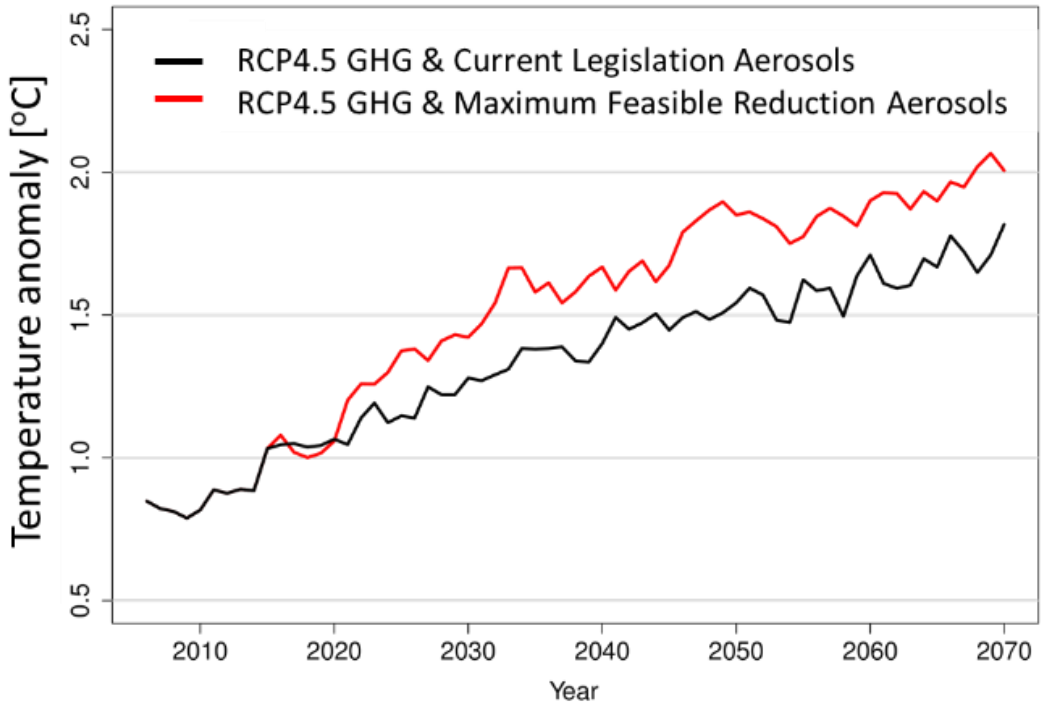
Participant organization name	Country
Stockholms Universitet (SU)	Sweden
ETH Zürich (ETH Zürich)	Switzerland
Karlsruher Institut für Technologie (KIT)	Germany
Foundation for Research and Technology Hellas (FORTH)	Greece
Koninklijk Nederlands Meteorologisch Instituut - KNMI (KNMI)	Netherlands
Universität Leipzig (ULEI)	Germany
Helsingin Yliopisto (UHEL)	Finland
Consiglio Nazionale Delle Ricerche (CNR)	Italy
Barcelona Supercomputing Centre – Centro National de Supercomputacion (BSC)	Spain
Meteorologisk Institutt (Met Norway)	Norway
Uita-Suomen Yliopisto (UEF)	Finland
University of Leeds (UNIVLEEDS)	United Kingdom
Universitetet i Oslo (UiO)	Norway
Forschungszentrum Jülich GMBH (FZJ)	Germany
The Chancellor, Masters and Scholars of the University of Oxford (UOXF)	United Kingdom
Ilmatieteen Laitos (FMI)	Finland
Sveriges Meteorologiska och Hydrologiska Institut (SMHI)	Sweden
Institut National de l'Environment et des Risques INERIS (INERIS)	France
Internationales Institut für Angewandte Systemanalyse (IIASA)	Austria
The University of Exeter (UNIEXE)	UK
EPFL	Switzerland
University of Sheffield	UK

What did we promise to do?



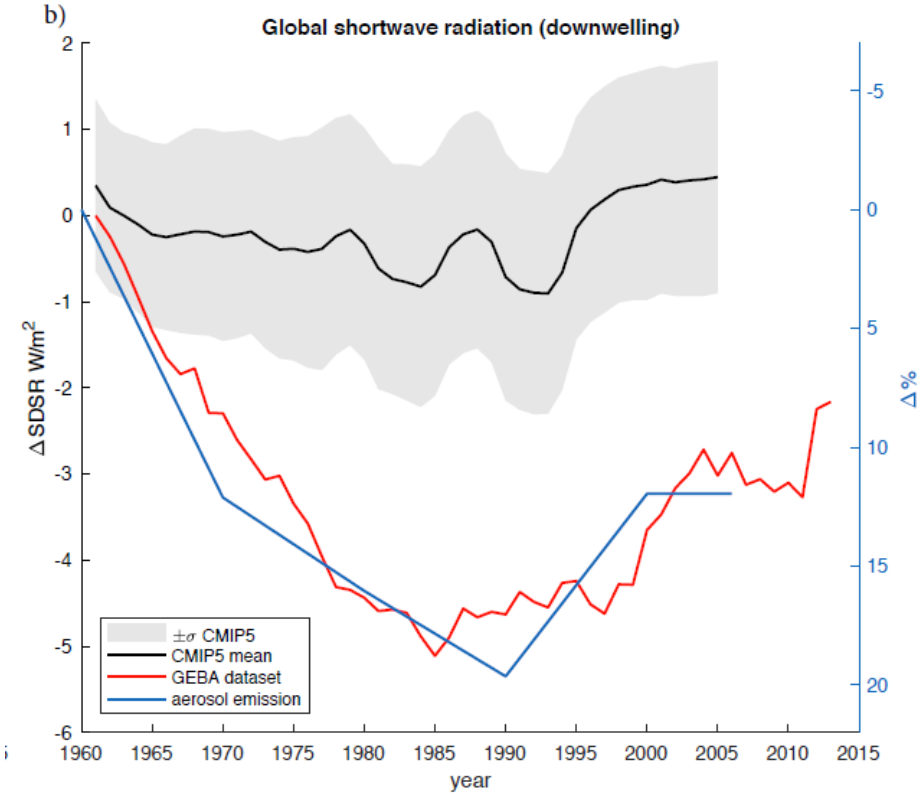
Why did we promise to do this?

Future temperature development (relative 1880-1900 mean)



Acosta-Navarro et al. (2017)

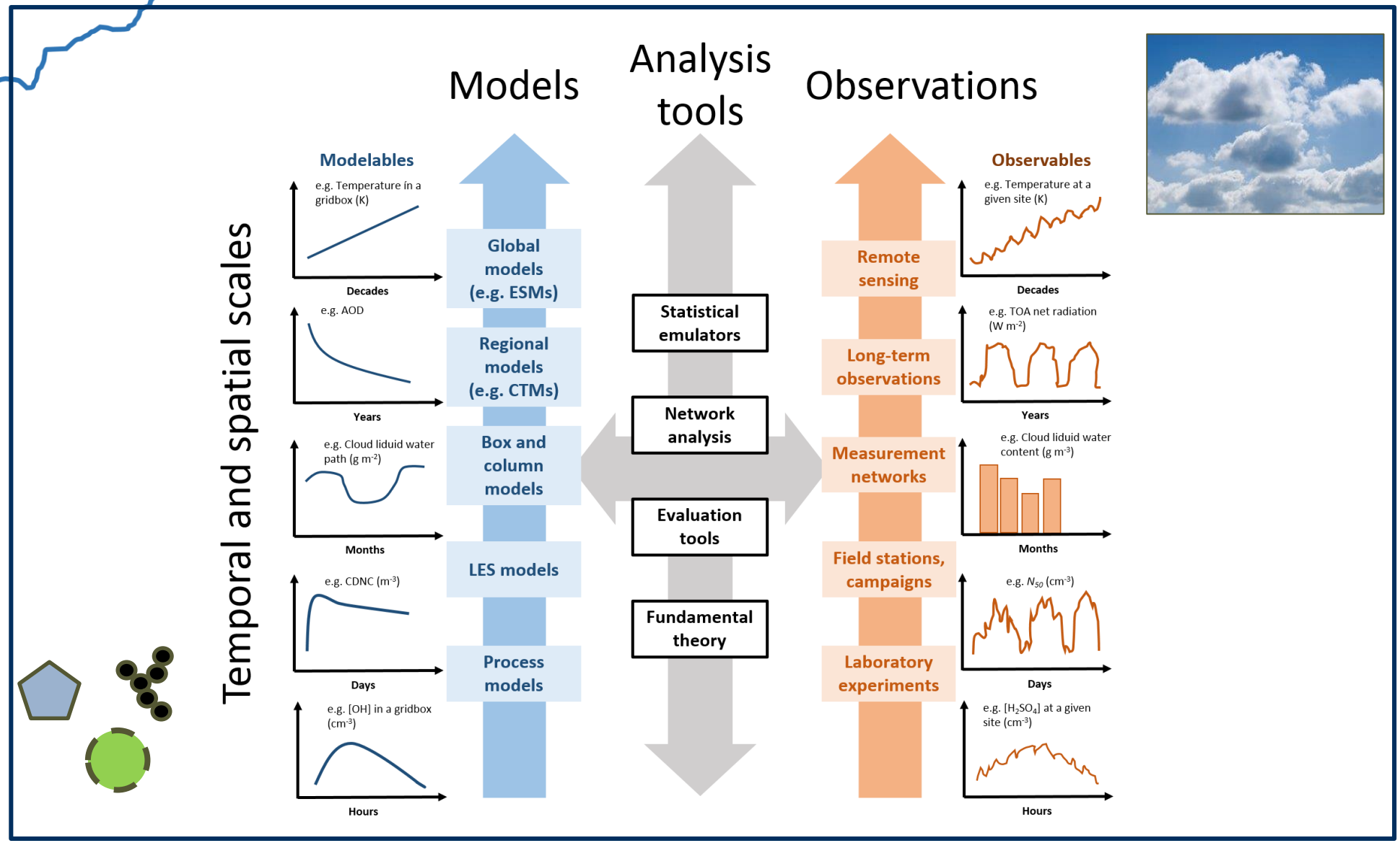
Global average shortwave downwelling radiation



Storelvmo et al. (2018)

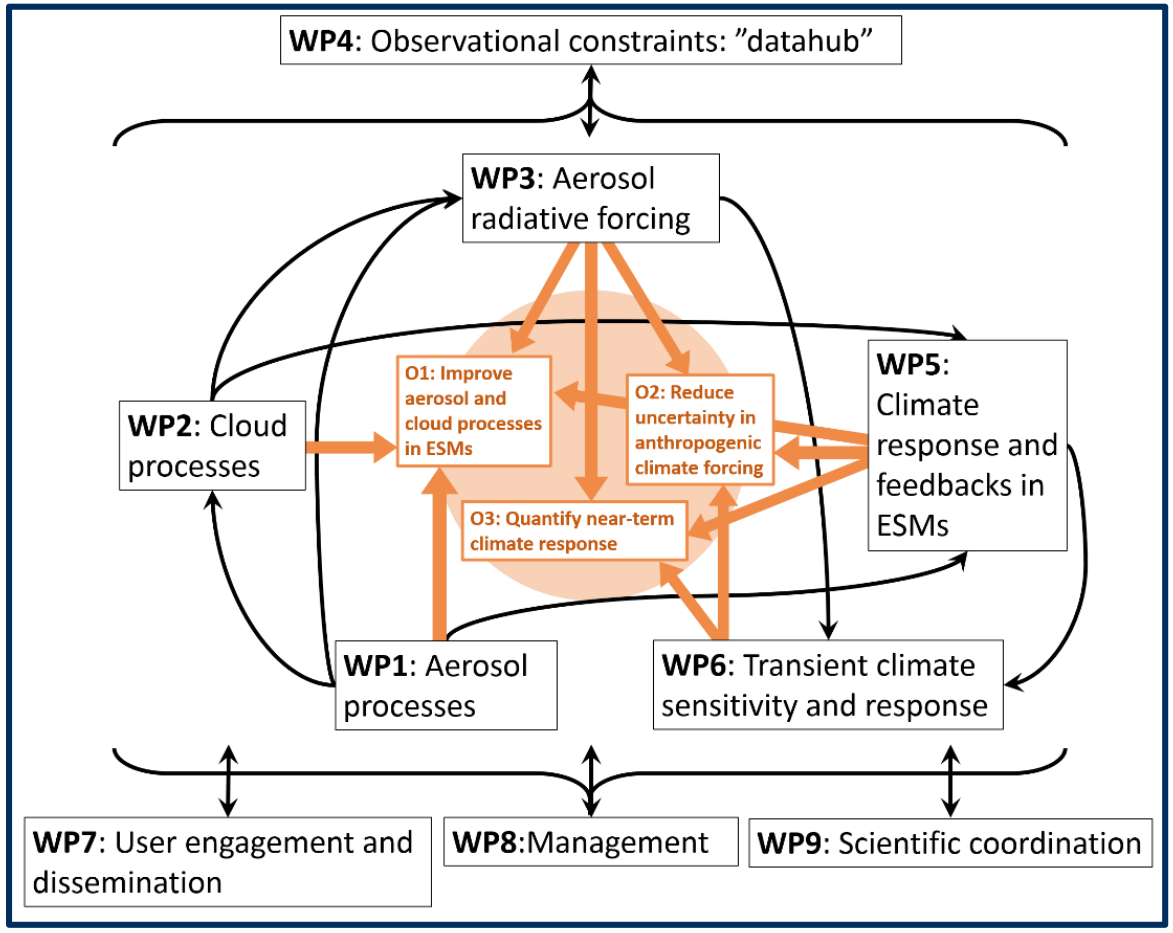
FORCeS

How will it be done?



FORCeS: integrating scientific expertise, methods and data

Work packages and leaders



WP1:
Astrid Kiendler-Scharr (FZJ)
Spyros Pandis (FORTH)

WP2:
Annele Virtanen (UEF)
Johannes Quaas (ULEI)

WP3:
Ulrike Lohmann (ETH Zürich)
Michael Schulz (Met Norway)

WP4:
Risto Makkonen (FMI)
Philip Stier (UOXF)

WP5:
Ralf Döscher (SMHI)
Øyvind Seland (Met Norway)

WP6:
Athanasios Nenes (FORTH)
Trude Storelvmo (UiO)

WP7:
Erik Kjellström (SMHI)
Hans-Christen Hansson (SU)

WP8:
Ilona Riipinen (SU)
Annica Ekman (SU)

WP9:
Annica Ekman (SU)
Ilona Riipinen (SU)

Project acronym	Full name and scope	Type of activity and time frame
AeroCom	Aerosol Comparisons between observations and models	Open international collaboration research initiative, ongoing.
ACTRIS I and II	European Research Infrastructure for the observation of Aerosol, Clouds, and Trace gases	EU FP7 and H2020 Research and Innovation, 2011-2015 and 2015-2019.
APPLICATE	Advanced Prediction in Polar regions and beyond: modelling, observing system design and LInkages associated with a Changing Arctic Climate.	EU H2020 Research and Innovation project, 2016-2020.
BACCHUS	Impact of Biogenic versus Anthropogenic emissions on Clouds and Climate: towards a Holistic UnderStanding	EU FP7 collaborative project 2013-2018.
CLOUD	Cosmics Leaving Outdoor Droplets	Experiment run by CERN, ongoing
CORDEX	Coordinated Regional Climate Downscaling Experiment	World Climate Research Program International Initiative, ongoing.
CRESCENDO	Coordinated research in Earth Systems and climate: experiments, knowledge, dissemination and outreach	EU H2020 Research and Innovation project, 2015-2020.
EUCAARI	European Integrated Project on Aerosol Cloud Climate and Air Quality Interactions	EU FP6 Integrated project 2007-2010.
EUCP	The European Climate Prediction system	EU H2020, Research and Innovation project, 2017-2021
EUROCHAMP 2020	Integration of European Simulation Chambers for Investigating Atmospheric Processes – Towards 2020 and beyond	EU H2020, Research and Innovation project, 2016-2020.
GAP	GEWEX Aerosol Precipitation initiative	Open international collaboration research initiative, ongoing.
GASSP	Global Aerosol Synthesis and Science Project	UK-funded (NERC, NCAS, N8, CEDA) project, 2013-2016.
GEWEX	The Global Energy and Water Exchanges project	Open, international collaboration research initiative, ongoing.
PEEX	Pan-Eurasian Experiment	Open international collaboration research initiative, ongoing.
PEGASOS	Pan-European Gas-aeroSOls-climate interaction Study	EU FP7 Large-scale integrating project 2011-2014.
PRIMAVERA	PRocess-based climate sIMulation: AdVances in high resolution modelling and European climate Risk Assessment	EU H2020 Research and Innovation project, 2015-2019.

Some possible synergies with AeroCom

1. Encouraged participation and exchange of FORCeS ESMs (NorESM, EC-Earth and ECHAM / ICON) into AeroCom
   - Evaluating the outcomes of process improvements within FORCeS

2. Common meeting in Stockholm in the following two years (e.g. 2021 or 2022)?

3. Collaboration on data sharing and utilization for atmospheric aerosol (FORCeS WP4) + making the data from FORCeS process available to the AeroCom community

4. See https://forces-project.eu/ to get some more ideas!

5. Thoughts?

Highlights of ongoing work: Process improvements in FORCeS ESMs

- Iterative exchange between FORCeS ESMs (NorESM, EC-Earth, ECHAM / ICON) and process work divided into process-centred working groups:

WG1: Organic aerosol Astrid Kiendler-Scharr and Claudia Mohr

WG2: Nitrates Spyros Pandis and Claudia Mohr

WG3: Aerosol (number) size distribution and dynamics, including NPF Risto Makkonen, Tuomo Nieminen and Pauli Paasonen

WG4: Aerosol absorption Thanos Nenes, Maria Kanakidou and Stefano Decesari

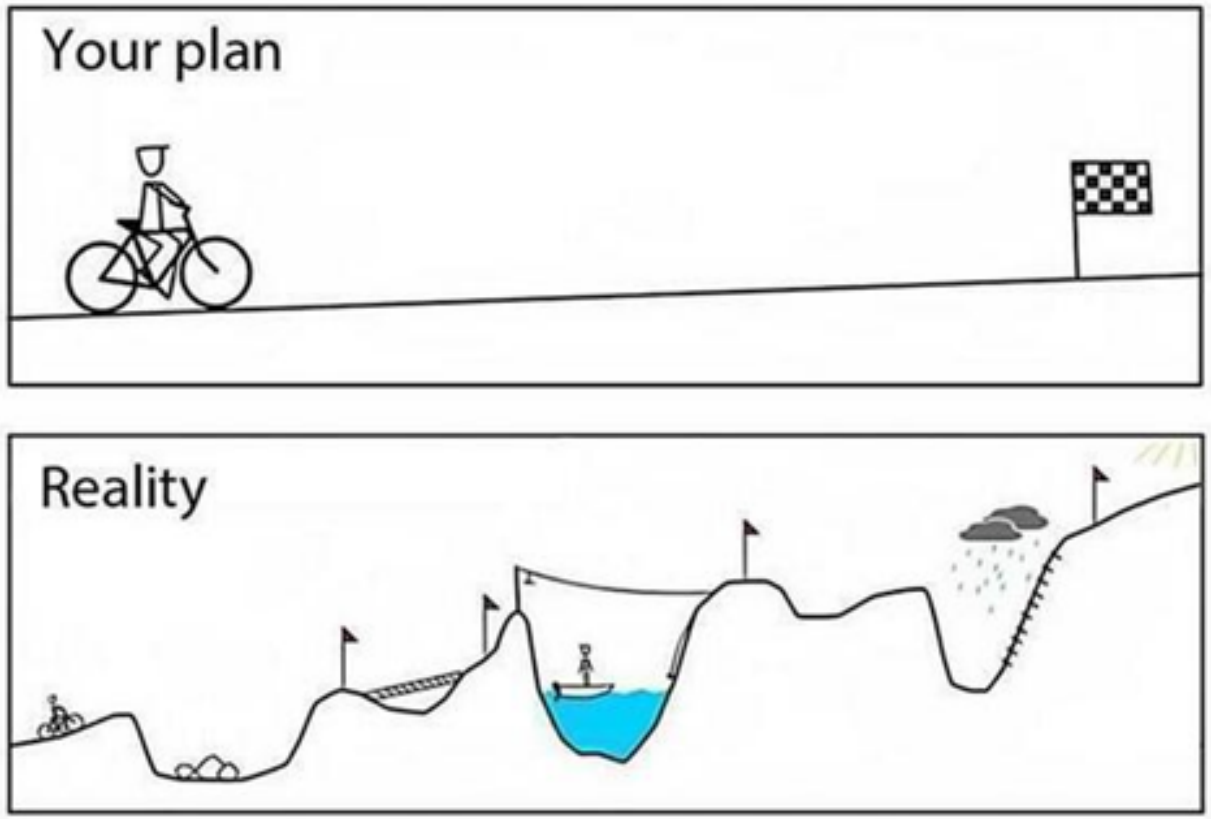
WG5: Cloud droplet activation, aerosol processing and aerosol scavenging Annele Virtanen and Thanos Nenes

WG6: Processes affecting warm cloud droplet growth and precipitation formation: Johannes Quaas and Philip Stier

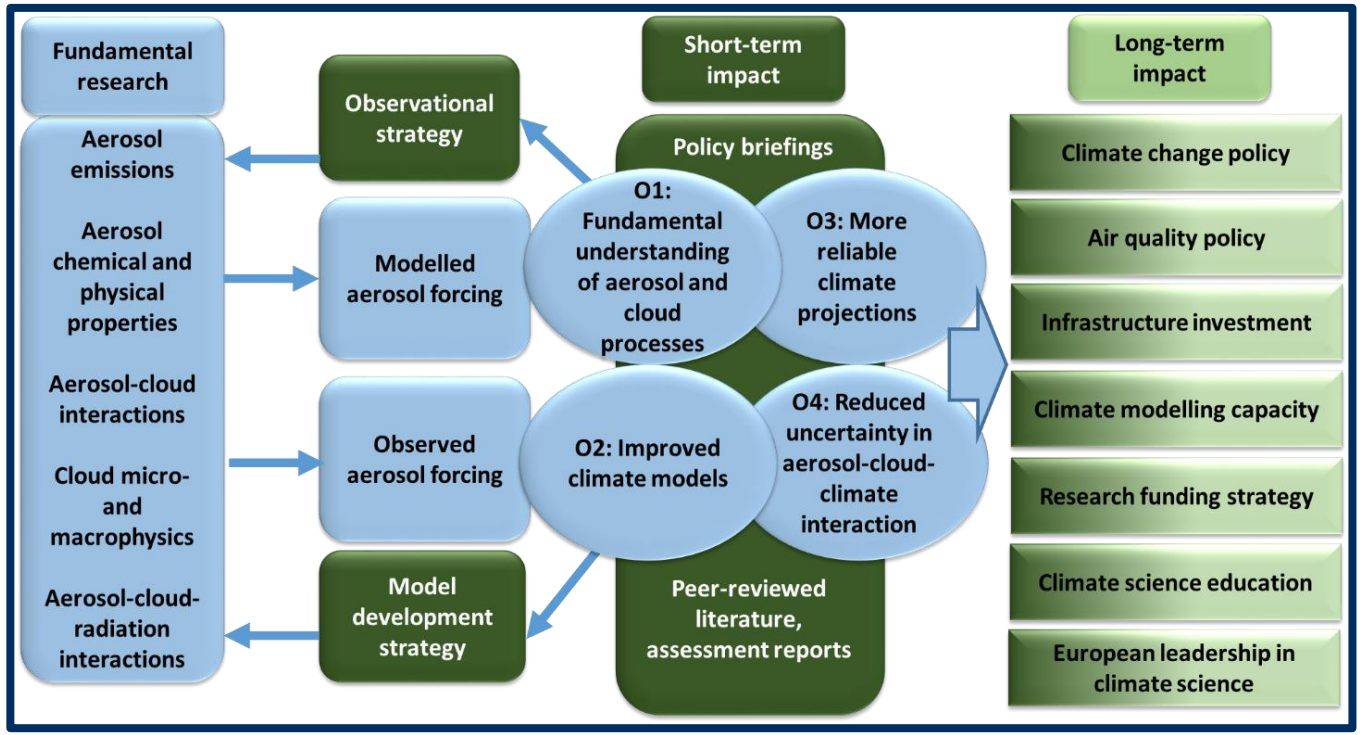
WG7: Ice nucleation, secondary ice formation, freezing Ulrike Lohmann and Corinna Hoose

Thank you!

See https://forces-project.eu/

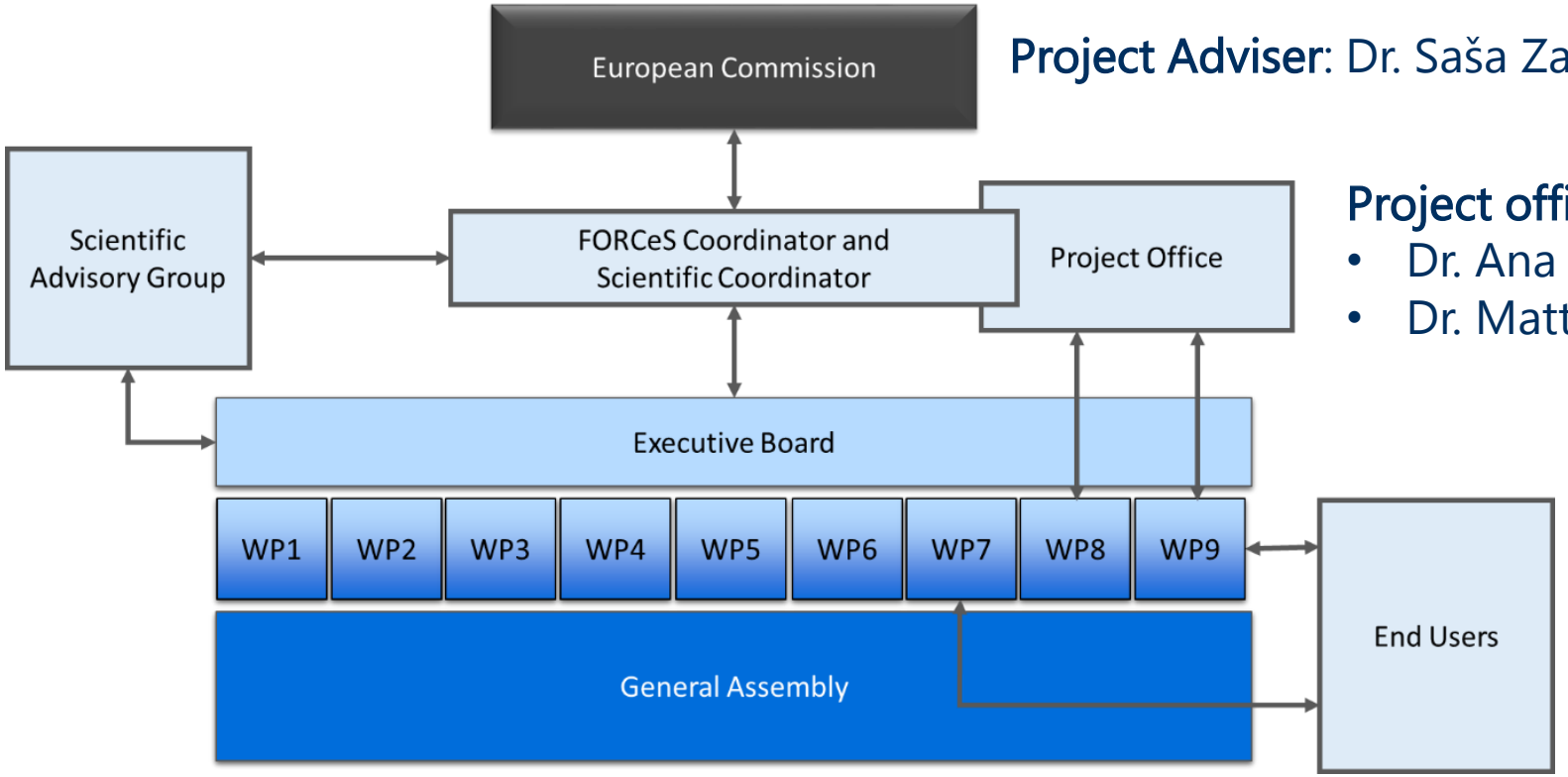


Short- and long-term impacts



Objective No.	Expected impact
1	Increased confidence in climate change projections and strengthening and affirmation of Europe's leadership in climate science.
2	Invaluable new knowledge gained for upcoming scientific assessments, clarity with respect to the role of aerosols and greenhouse gases in the climate evolution of the industrial era.
3	Provide added-value to decision and policy makers, facilitating cost effective multi-beneficial mitigation strategies. Reduce complexity in interpreting and applying climate model results.

General structure and advisers



Project Adviser: Dr. Saša Zavadlav

Project office
- Dr. Ana Cordeiro
- Dr. Matt Salter

End users
- Swedish Environmental Protection Agency

Scientific Advisory Group
- Prof. Nicolas Bellouin, University of Reading UK
- Prof. Hong Liao, Nanjing University of Information Science and Technology, China
- Dr. Elisabeta Vignati, The European Commission Joint Research Center, Italy
- Prof. Piers M. Forster, University of Leeds, UK