6th MeteoMeet: Studying Meteorology in Cologne

Susanne Crewell, Institute for Geophysics and Meteorlogy, University of Cologne, 10 December 2012

Overview

University of Cologne

- Founded in 1388
- > 600 professors
- 50.000 students
- 4 excellence cluster

Institute for Geophysics and Meteorology

- 2/5 professorships in geophysics/meteorology
- Associated professor from FZ Jülich
- BSc “Geophysik und Meteorologie”
- MSc “Physics of the Earth and Atmosphere”

Institute for Geophysics and Meteorology
3. floor, Pohligstr. 3

https://geomet.uni-koeln.de/

Master „Physics of the Earth and Atmosphere“

- Offered since winter term 2009/2010 in english
- Duration of regular course: 4 semesters
- Cooperation with the University of Bonn

1. Part: Lectures and excercises
(semester 1 & 2)

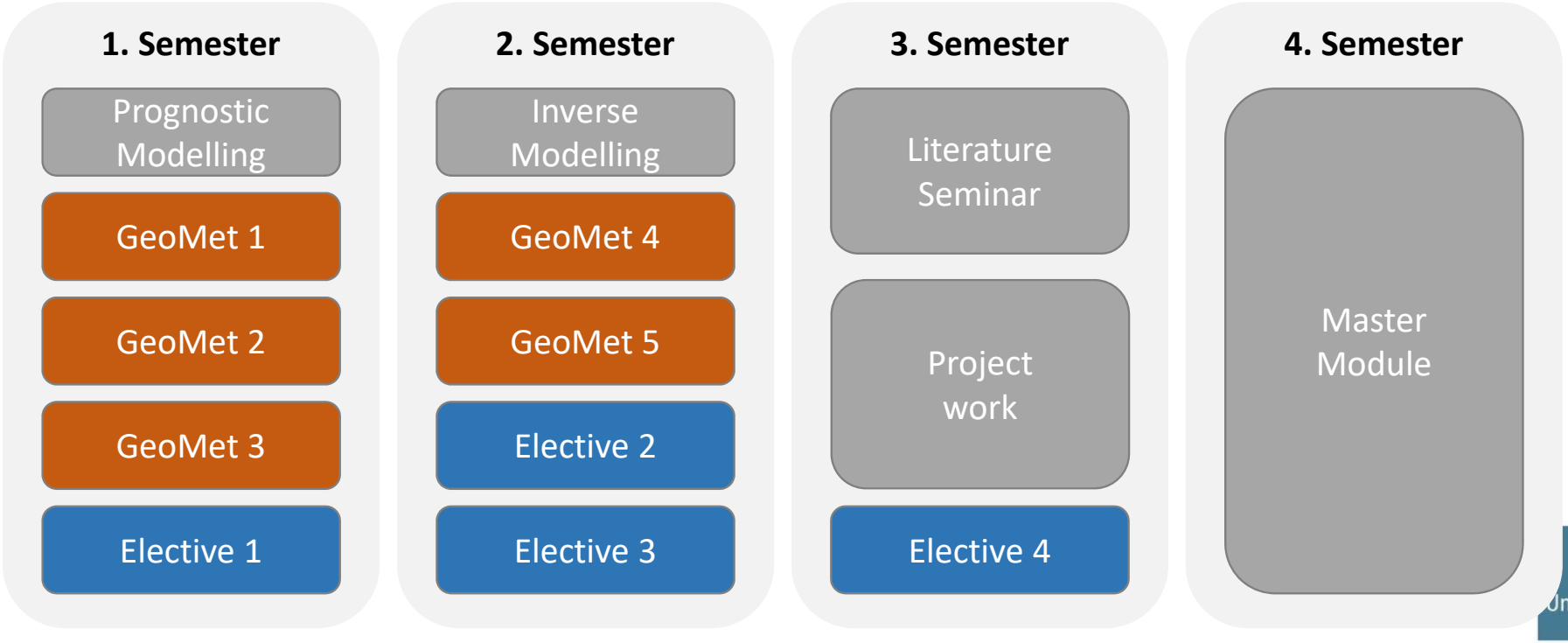
- 2 common compulsary modules
  - Prognostic modelling (winter term)
  - Inverse modelling (summer term)
- 5 subject-specific compulsory modules
- 4 elective modules

2. Part: Research orientation
(semester 3 & 4)

- Literature seminar
- Project work
- Master thesis

Master „Physics of the Earth and Atmosphere“

- Two focus areas: Geophysics or Meteorology. Change of focus is possible in the 1. semester
- First part contains 11 modules, each having 6 credit points.
- 42 / 24 credit points in mandatory / elective modules



Compulsory Courses for Main Focus

- Module “Physics of the Atmosphere” for students with little meteorological background
- Courses are offered once per year – start in winter and summer term possible
- About 30 % international students

Meteorology

- Atmospheric Boundary Layer
- Clouds and Precipitation
- Physical Climatology
- Atmospheric Dynamics and Modelling
- Atmospheric Radiation

Geophysics

- Electromagnetic Exploration Methods
- Advanced Geophysical Field Course
- Seismology
- Geophysics of the Solar System
- Space Physics

Elective Modules

- All modules of the other main focus
- Broad others from astrophysics, biology, computer sciences, geosciences, physics..
- One module also possible from other faculty
- Other master modules from Cologne and Bonn

Meteorology Cologne

- Advanced Remote Sensing
- Atmospheric Chemistry
- Energy Meteorology
- Polar Meteorology
- Future Challenges of Meteorology

Research oriented part

BMD seminar features talks by bachelor, master, doctoral students.

- **Literature seminar (9 CP):**
  - subject is selected in agreement with the advisor, if the topic of the master thesis is close to the Bachelor‘s thesis broader presentation required
  - presentation in a working group seminar, questions and answers (Q&A) and written elaboration
- **Project Work (15 CP):**
  - Preparation of the Master‘s thesis, e.g. feasibility study
  - Completed by a talk with Q&A.
- **Master‘s thesis (30 CP):**
  Duration 6 months, terminated by a colloquium with Q&A

Dr. Frank Steffany
Consultation
Meteorology

Dr. Lex Wennmacher
Consultation
Geophysics

Example Master Theses

15 / 16 in theses in geophysics / meteorology since 2019

- Characterization and Application of Electrochemical Sensors for Ambient, Airborne Measurements of CO, NO, NO_2, and O_3
- Characterization of stationary Rossby waves and their predictability
- Variability of Clouds over the Svalbard Region from a Satellite Perspective
- Analysis of wind power ramps associated with atmospheric fronts
- Model Intercomparison between DALES and MIMICA: An ASCOS Case Study
- Moisture Variability at Cerro Paranal
- Temperature profiling with ground-based microwave radiometers during the SoFog3D campaign
- Benefit of microwave remote sensing for analysing the thermodynamic structure of Atmospheric Rivers
- Impacts of meteorological data and power rating models on solar resource assessment
- Process-oriented study on events of unusual winter time CO_2 fluxes at the Bayelva site, Spitsbergen
- Investigation of the diurnal cycle of stratocumulus clouds at the northern coast of Chile
- Development of an automatic radar-based storm identification, tracking, and nowcasting algorithm
- How does the snowflake structure affect its scattering properties?
- Snowfall rate retrieval from ground-based in situ and radar measurements
- Potential of high resolution ICON-LEM simulations for wind power forecasts

Research Groups at Cologne

Prof. Susanne Crewell

Prof. Stephanie Fiedler

Prof. Ulrich Löhnert

Prof. Roel Neggers

Prof. Yaping Shao

Prof. Andreas Wahner
Research Center Jülich
IEK-8

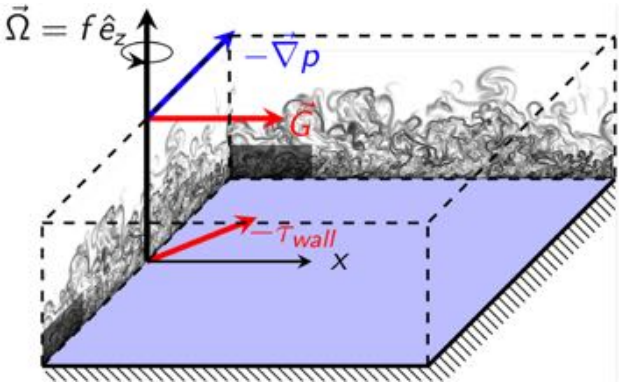
Dr. Cedrick Ansorge

2 Junior
research groups

Dr. Stefan Kneifel

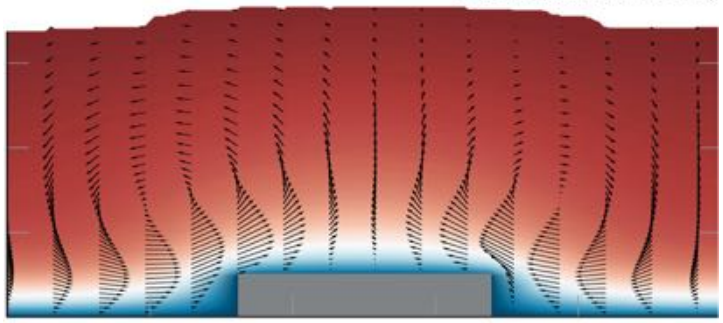
RG Ansorge: Turbulence-Resolving Simulation of the Atmospheric Boundary Layer

Steven van der Linden



Set-up and turbulent field for a DNS at large scale separation (image: C. Ansorge)

Jonathan Kostelecky



Secondary flow over a single roughness element (DNS / image: J. Kostelecky)

Collaboration

ForWind

CRC 1114

Compute Ressources

JÜLICH Forschungszentrum | JÜLICH SUPERCOMPUTING CENTRE

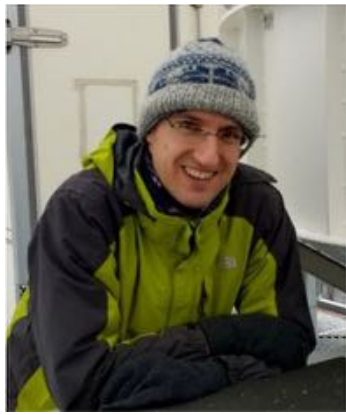
HLRS

Observations used

MOSAiC International Arctic Drift Expedition

Project "trainABL"

OPTIMIce DFG Emmy-Noether Group Kneifel



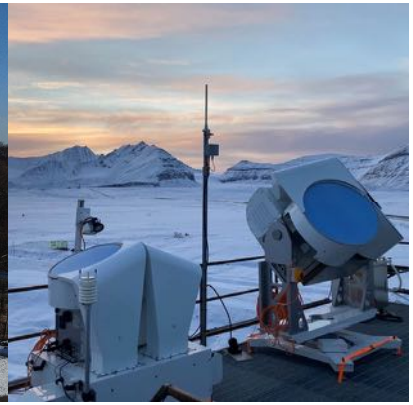
Optimal combination of Polarimetric and Triple frequency radar techniques for Improving Microphysical process understanding of cold clouds

Key research areas:

- Radar remote sensing
- Ice and snow cloud microphysics
- Radiative Transfer
- Scattering properties of ice & snow particles

Key Methods:

- Multi-frequency radar
- Radar polarimetry and Doppler spectra
- 1D Lagrangian Modelling
- Numerical scattering simulations



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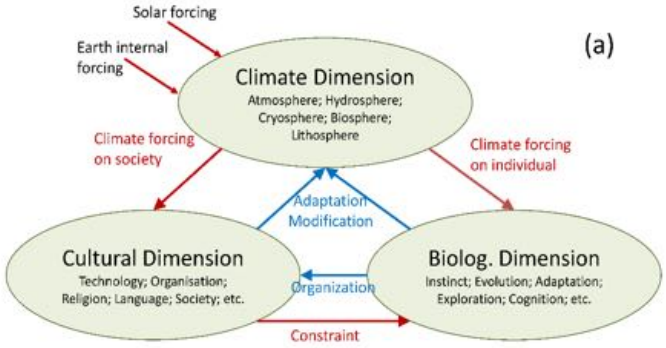
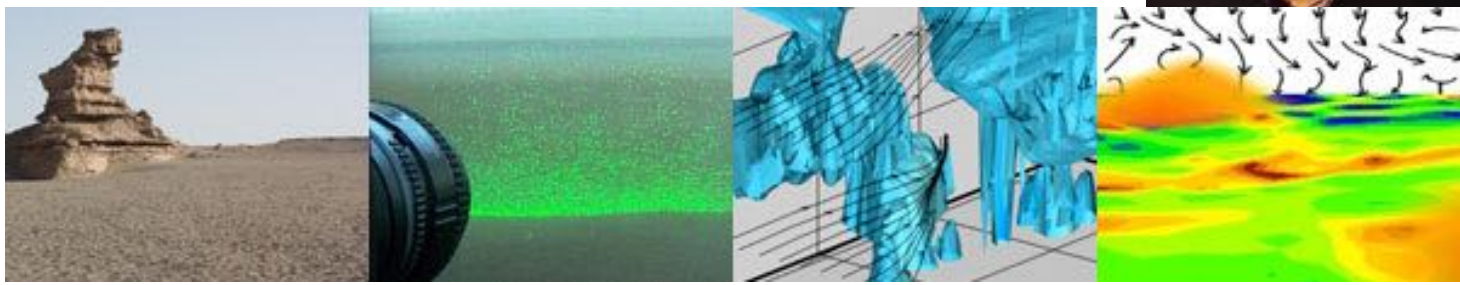
RG Shao: Atmospheric Modelling





Research Activity I: Human System Model

Human System is a complex system of three dimensions, including the climate dimension, cultural dimension and biologic dimension

Activity II: Dust Cycle and Intermittent Fluxes

Dust deposition is poorly studied. Turbulence intermittency influences deposition.

Activity III: Extremely Heterogeneous Surface

New DFG project on extreme heterogeneity.

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RG Neggers: Integrated Scale-Adaptive Parameterization and Evaluation (InScAPE)

- develop **scale-adaptive parameterizations** of small-scale turbulent/convective processes & clouds for larger-scale models,
- constrain those with relevant measurements as obtained from permanent meteorological “supersites” → **Testbed**
- Investigation of the role of **boundary layer** clouds in a larger context
- coupling to the Earth's surface and the role they play in global climate change

ASR Atmospheric System Research

Research Highlights

- Arctic Clouds
- Cloud geometry
- EDMF (Eddy Diffusivity Mass Flux)
- Convective Grey Zone

zu Köln

RG Löhnert: Exploiting Observations in Meteorology (ExOb)

Process understanding

New measurement techniques

Jülich Observatory for Cloud Evolution

In collaboration with

Weather and climate observation network of the future

Coupling to high-resolution models

RG Stephanie Fiedler

Fundamental meteorological research for renewable power from wind and solar energy

Research themes:

- Climate change from the past into the future
- Desert-dust and anthropogenic aerosols
- Peak winds and storms
- Meteorological potential and risks for renewables

Hans-Ertel-Zentrum
für Wetterforschung

DFG Deutsche Forschungsgemeinschaft

Bundesministerium für Verkehr und digitale Infrastruktur

CARBON TRUST

esa

Deutscher Wetterdienst

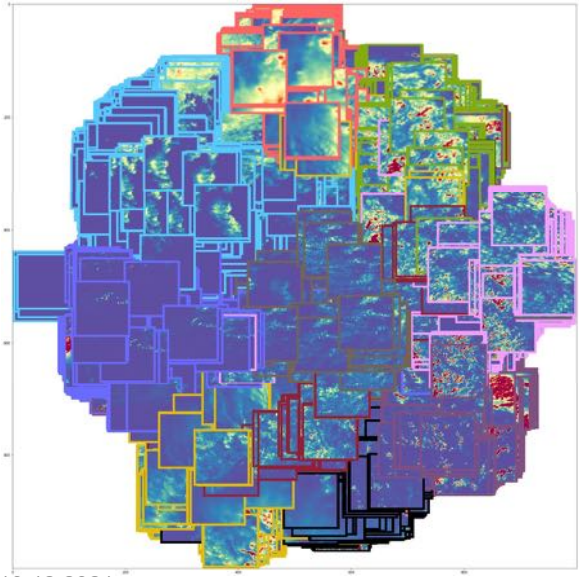
Universität zu Köln

DKRZ

zu Köln ewi

RG Crewell: Atmospheric Remote Sensing & Water Cycle

- From understanding processes to global assessments
  - Water vapor: radiative effect, *moisture transport, cloud formation*
  - Clouds: radiative effect, microphysics, precipitation formation
  - Precipitation: drivers, climatology
- From high resolution airborne measurements to global satellite studies for improved weather and climate models



Earth – Evolution at the dry limit

FLUXES · CLOUDS · SURFACE · TRANSPORT · ARCTIC AMPLIFICATION (AC)³

ATMOSPHERIC AND EARTH SYSTEM RESEARCH WITH HALO · DFG · SPP 1294

KI : STE

…more Cologne

- Vibrant international city
- interdisciplinary environment, collaborations with mathematics and computer sciences
  → New professorships in data assimilation and Computational Earth Sciences
- Strong geoscience department
  → CRC 1211 “Earth – Evolution a tits dry limit”

Master Computational Sciences with Earth Science focus

Dr. Vera Schemann

Earth – Evolution at the dry limit

CESOC

CENTER FOR EARTH SYSTEM OBSERVATIONS AND COMPUTATIONAL ANALYSIS

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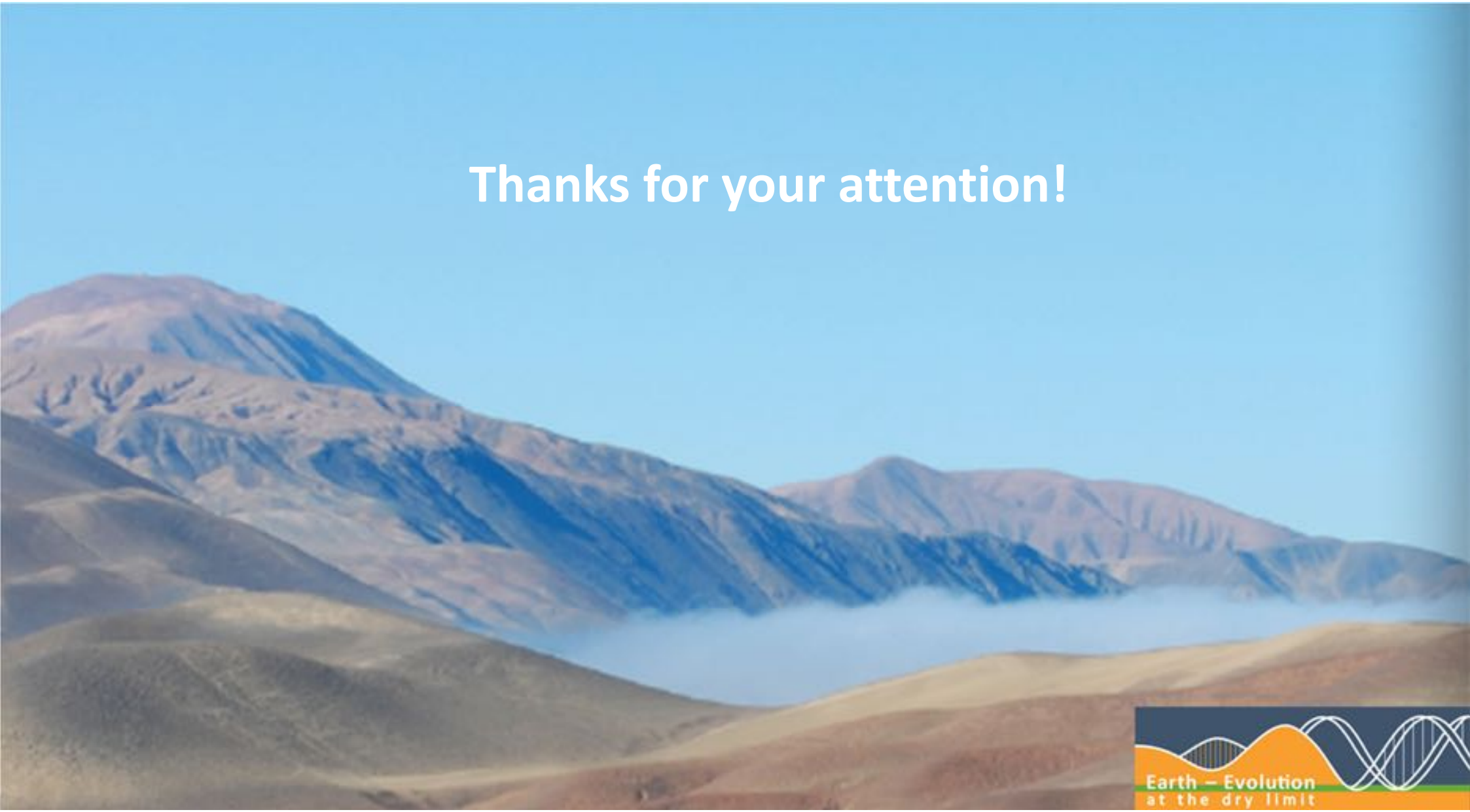
Thanks for your attention!
Earth – Evolution
at the dry limit