





TEAMx and its relation to applications in Earth system modelling

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Outline

- TEAMx in a nutshell
 - what is it?
 - 'who' is it?
 - what do we do?
- Weather and Climate Service providers





Multi-scale Transport and Exchange Processes in the Atmosphere over Mountains Programme and experiment

- ...a bottom-up financed research programme on weather, climate
 & air pollution in mountain areas
- In the 'tradition' of international mountain meteorology programmes (ALPEX, PYREX, MAP)
- Institutional 'crowd funding' for a Programme Coordination Office (PCO - @ UIBK)



Multi-scale Transport and Exchange Processes in the Atmosphere over Mountains Programme and experiment

- Embedded in international programmes
 - \rightarrow <u>Crosscutting project</u> within the GEWEX Hydroclimatology Panel (<u>GHP</u>)
 - \rightarrow endorsement sought within WWRP (pending)
 - \rightarrow WMO High Mountain Summit
- Coordination with other international activities
 → e.g., COST action PROBE

TEAMx – 'who' is it?



A group of institutions...

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- 'crowd funding' for a Programme Coordination Office (PCO)
 - → sponsors: Karlsruhe Institute of Technology KIT, Météo France, MeteoSwiss, National Center for Atmospheric Science (NCAS), University of Innsbruck, University of Trento, ZAMG, Center for Climate Systems Modeling (C2SM)
 - \rightarrow Progamme Coordinator: Helen Ward (UIBK)



A group of institutions...

TEAMx – 'who' is it?

- Memorandum of Understanding
 - → signed by interested institutions
 - → support research topic, liaise projects, contribute to discussion, workshops,
 - → open for signature (contact Helen)







TEAMx – 'who' is it?



- Coordination and Implementation Group (CIG)
- Individuals from (mostly) sponsoring insitutions
- Marco Arpagaus, MeteoSwiss
- Joan Cuxart, Universitat de les Illes Balears
- Stefan De Wekker, University of Virginia
- Vanda Grubišić, NCAR
- Norbert Kalthoff, Karlsruhe Institute of Technology (KIT)
- Daniel Kirshbaum, Mc Gill University
- Manuela Lehner, University of Innsbruck
- Stephen Mobbs, University of Leeds (NCAS)
- Alexandre Paci, Meteo France (CNRS)
- Elisa Palazzi, ISAC CNR
- Mathias Rotach, University of Innsbruck (chair)
- Stefano Serafin, University of Innsbruck (former PC)
- Dino Zardi, University of Trento

,runs the programme'

TEAMx – 'who' is it?





TEAMx – what do we do?



foster research on Multi-scale Transport and

Exchange Processes in the Atmosphere over Mountains





Foster research on Multi-scale Transport and Exchange Processes in the Atmosphere over Mountains

→ orography impacts the atmospheric flow
 → the global water cycle

 carbon cycle
 energy budget
 momentum budget

 → meso-scale flow modification

 \rightarrow local exchange processes

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 \rightarrow orography creates conditions for air pollution





https://scied.ucar.edu/longconten t/energy-budget





TEAMx – what do we do?

- foster research on Multi-scale Transport and
 - Exchange Processes in the Atmosphere over Mountains

TEA

- Many of the atmospheric processes over mountains
 - \rightarrow gaps in knowledge
 - \rightarrow especially with respect to exchange processes



unstable stratification (daytime)

Exchange processes over mountains TEAAX

- Many of the atmospheric processes over mountains
 - \rightarrow gaps in knowledge
 - \rightarrow especially with respect to exchange processes
- ➢ Boundary Layer → Mountain Boundary Layer (MoBL) → layer influenced by surface (trad) & mesoscale processes
- Numerical models
 - → parameterize exchange using an assumption of horizontally homogeneous and flat



Exchange processes over mountains TEAAX

- > Boundary Layer \rightarrow **M**ountain **B**oundary Layer (MBL)
 - \rightarrow layer influenced by surface (trad) & mesoscale processes
- Numerical models
 - → parameterize exchange using an assumption of *horizontally homogeneous and flat*
- Data sets are sparse

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- → inhomogeneity <-> data density
- \rightarrow especially turbulence data





- Knowledge gaps
 - \rightarrow White Paper (Serafin et al. 2020), soon on the website
 - → working groups on specific processes (land-atmosphere exchange, MoBL, convection, mountain climates, ...)
- Prepare for a joint observational experiment
 - \rightarrow 2023-2024, yearlong observational programme
 - \rightarrow summer and winter IOP
 - \rightarrow 3 'superboxes' (target areas) north/south of the Alps
 - \rightarrow seek obs. support from outside Europe
- Numerical experimentation
 - \rightarrow idealized & real-terrain modelling
 - \rightarrow reference cases
 - \rightarrow short and long time scales

| Objective | Primary Focus | Target |
|---|--|---|
| Process understanding | Micro- and meso-scale processes within and above the <i>mountain</i> <i>boundary layer</i> (MoBL); Interaction between scales. | Quantitative understanding of momentum, energy and mass exchange over mountainous terrain |
| TEAMx Joint Experiment(s) | Collaborative use of multi-platform instrumentation to sample the spatial heterogeneity of turbulence and mesoscale circulations over and near mountains | Quality-controlled observational data pool, available for process investigation, high-resolution model verification, parameterization development |
| Improving Weather and Climate Models | Models right for the right reason, i.e., identification and reduction of model biases and uncertainties over complex terrain | Weather forecasts and climate simulations over mountains as good as over flat terrain, and less reliant on model output post- processing |
| Support to Weather and Climate Service Providers | Air pollution, hydrology, climate change scenarios (e.g., elevation- dependent warming). | Smaller uncertainty of impact models, due to reduced errors in weather and climate information. |
| | Se | rafin et al. 2020, TEAMx-White Paper |

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W&C Services over mountains



- Depend on exchange processes

 → not only PTU (but also turbulence, meso-scale flow, interaction)
- air pollution / hydrology / renewable energy / climate diagnostics / health / weather diagnostics / agricultural & ecological modelling / ... over mountains
- today's topic...



Goals for today



- Learn from Earth Systems Service providers
 - \rightarrow most urgent needs
 - \rightarrow critical variables / data sets / physical processes
- Foster potential collaboration
 - \rightarrow among/ across disciplines
 - → specific (data) needs for experiment / numerical modelling
- Discussion: how can the community of Earth System Service providers [in mountain areas] be involved in TEAMx?









Thank you for your attention!

- TEAMx Website: http://www.teamx-programme.org
- \blacktriangleright PCO: Helen (\rightarrow see web site for contact information

Funding



- TEAMx is bottom-up financed
- While applying for funding, project PIs may request TEAMx "endorsement". Endorsement implies contributing and accessing to common data pool. Data policy in preparation.
- Projects can be individual, bi- or multi-lateral.
- TEAMx CIG/PCO supports coordination and initiation of new collaborative projects.







