Workshop Output Form to be submitted (max. 4 pages)

Title of workshop: WS 1.1.A Climate Information for Impact Modeling

Prepared by Mathias Rotach

Moderators	**Brigitta Goger**
Participants*	**Maussion, Kayano, Pritchard, Malygina, Bertoldi, Kotlarski, Anquetin, Hofer, Dabhi, Fiddes-Caduff, Proksch, Beck, Rottler** (all with corresponding initials, academic titles and co-authors, of course)

* Workshop participants that have submitted contributions to the workshop

General questions to please be answered in the workshop reporting

1) What was the focus of the workshop? Methodological issues and advancements or thematic issues (systems knowledge, transformation knowledge, target knowledge). Please check and fill in the matrix in the output section.

Methodological issues and advancements	**Thematic issues**		
	System knowledge	Transformation knowledge	Target Knowledge
Is climate model output (including 'downscaling') good enough to serve the needs of impact-oriented modelers (e.g., hydrology, renewables, health, ..)		Do the impact-oriented modelers know what is available? Do climate modelers know what is needed?	

1) Which key points were discussed in the workshop as a whole? (This should be more a synthesis and not simply a summary of the key points in each presentation)
   Preliminaries:
   The workshop started from the background of recent (last decade or two) developments in climate modeling on the one hand, and impact-oriented modeling on the other hand:
   - Regional climate modeling has – due to ever increasing computing power – started to reach 'high spatial grid spacing', i.e. order (10 km) horizontal 'resolution' for internationally coordinated efforts like CORDEX, and even exploratory studies into 'convection resolving climate modeling', on the order of a few km horizontal grid spacing. While more coarse model grids – order 100 km grid spacing – of earlier (even regional) climate simulations, necessarily led to the need of downscaling approaches (only valid for the location where observations were available), the high-resolution climate model output has led the impact-oriented modeling community to expect more accurate and reliable, spatially distributed regional climate information (better resolution → better output).
   - Triggered by similar developments in Numerical Weather Prediction (NWP) – where order (1 km) model grid spacing is becoming standard (at least in the Alpine countries) - impact-oriented modelers (hydrological, agricultural, health, renewable energy, …), have started to

use model output rather than point observations (climate data, long time series) as their 'atmospheric input'.

These preliminaries were not explicitly worked out in the workshop – but were implicitly assumed at the outset.

The discussion revealed that

- The high-resolution regional climate models have not yet been validated for other variables than temperature and precipitation (and some of their extreme value statistics) – while impact-oriented modelers require information on variables such as 'snow water equivalent of the snow pack', spatial variation of albedo (examples from hydrological modeling – which was the topic of the majority of impact modelers).
- The expectation of the impact-related community with respect to accuracy and reliability of atmospheric data is not 'automatically fulfilled' by increased grid resolution. In mountainous terrain, in particular, many physical parameterizations (turbulent exchange, radiation, …) are adjusted for coarser grid spacing of the old-generation climate models. It is pertinent to many impact-oriented models, however, that - next to temperature and precipitation - the variables treated in those parameterizations are the relevant input variables that are required for an 'accurate' prediction.

These are therefore the recommendations emerging from the workshop.

- Climate modelers and impact modelers need to talk (exchange) more about their needs and opportunities
  → before national scenarios (or alike) are being produced, 'end-users' (i.e. impact-related modelers) need to be involved
  → scenario information should come with explanations (or even a team answering user questions).
  Explanations should especially address limitations of the provided climate information.
  → Reference information is needed – how does the climate information relate to information from other sources (e.g., scenarios)?
- Before an impact model (scenario) evaluation is performed, an evaluation on present day climate is required
  → not only use 'direct model output', but rather return periods, advanced variables.
  → stress test for extreme events
- Impact-related modeling often requires point, grid (profile) information: → end-user interaction (see first point).

2) What is your opinion on the current state of knowledge concerning your topic(s) (focusing on mountain regions)? *Please check and fill in the matrix on the following page.*

Overall assessment of the state of: Quality (accuracy, reliability) of atmospheric model output in mountain areas good enough for impact-oriented users

What is your personal opinion on the current state of knowledge concerning the topic(s) addressed in your workshop. Please tick the appropriate field. Brief explanations are appreciated.

State of knowledge	Very good	Good	Poor	Very poor	Not appropriate	*Comments*
Global				x		
Regional			x			*Which region? (Alps a little better than very poor)*
Scattered case study-based knowledge		x				*Where? (Alps again better than many of the other regions)*
Knowledge about past states/trends			x			*Globally speaking*
Knowledge about current situation			x			*Globally speaking*
Knowledge about future states/trends/thresholds				x		*Worse than the global trends*
Knowledge about the system			x			
Knowledge about shaping pathways to more sustainable development (transformation knowledge)		x				
Knowledge about envisaged goals (target knowledge)		x				