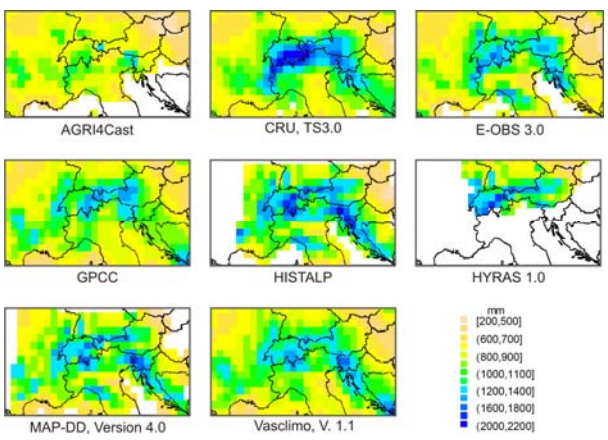
2nd KLIWAS Status Conference
25./26. October
Berlin, Germany

AdaptAlp
Adaptation to Climate Change in the Alpine Space

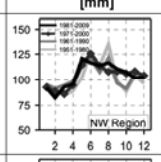
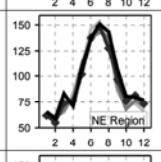
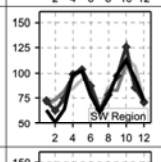
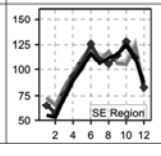
# Meeting the risk of climate change and natural hazards in the Alps

## Contributions of KLIWAS to Workpackage "Water Regime" of the AdaptAlp project

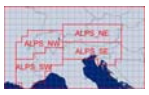
## Observations

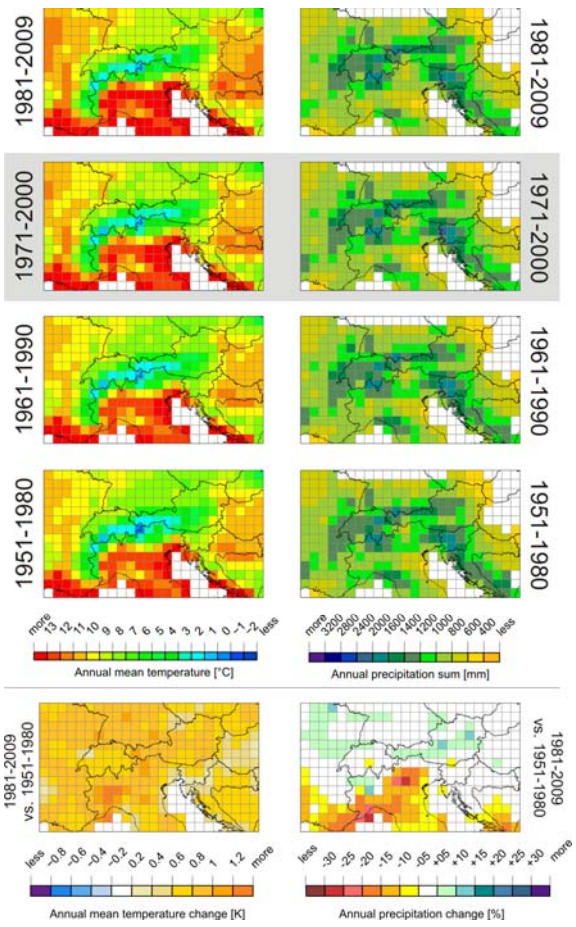



Validation: Comparison of annual precipitation sums in period 1971-2000 given by 8 different meteorological observation products (part of the „MOBS project“ of BfG)

| Subregion (short) *Size (area)* | Basic climate characteristic | Multi-annual cycle of precipitation [mm] | Description of multi-annual cycle of precipitation |
|---|---|---|---|
| Northwest (NW) *29 grid cells (72500 km²)* | Atlantic |   | Relatively small intra-annual differences with moderate summer peak |
| Northeast (NE) *30 grid cells (75000km²)* | Continental |   | Strong intra-annual differences with dry winters and wet summers |
| Southwest (SW) *34 grid cells (85000 km²)* | Mediterranean-Subtropical |   | Bipolar annual cycle with peaks in spring and fall and dry summers and winters. |
| Southeast (SE) *33 grid cells (82500 km²)* | Mediterranean-Continental |   | Winter dyrer than summer, winters relatively snowy |

Past climate: Observed shifts of annual cycle of precipitation since 1951 in four hydrome-teorological subregions of the Alpine region




Past climate: Observed patterns of annual temperatures and precipitation sums since 1951. Reference period used in AdaptAlp is shaded grey. Bottom: Change between periods 1951-1980 and 1981 and 2009

## Background:

Over the course of the last hundred years, the temperature in the Alps has risen by 1.5°C. This is twice the global average. The inhabitants of this highly sensitive ecosystem are already experiencing the consequences of this rise in temperature. They have to cope with increasingly frequent incidents caused by natural hazards such as floods, debris flow or avalanches.

## Key Questions:

What actions can be taken jointly by Alpine countries to deal with the consequences of climate change? To what extent can the Alps be made into a safer place for humans to live? How robust are available information on future climate change in the Alps?

## Cooperation:

Funded by the European Union (Interreg IV) 16 project partners from ministries, local authorities, research institutes and NGOs in different Alpine countries combined their data and expertise to support answering the key questions. The German Federal Institute of Hydrology (BfG) brought in concepts and experiences obtained in the **KLIWAS** program to evaluate the current knowledge on projected future changes in the alpine “Water Regime”

## Results:

The project partners agreed on a **Common Strategic Paper** summing up the major findings intended to guide decision makers in the tricky terrain of Alpine natural hazards and climate change.

In addition, AdaptAlp gave many new insights in the complex fields of observed past and simulated future climate and water regime change (see figures in this poster), as well as natural hazard mapping, and risk management. These results together with descriptions of data and methods are described in a **series of regional and technical reports** intended for readers with scientific background.

All documents can be retrieved from the project web page:

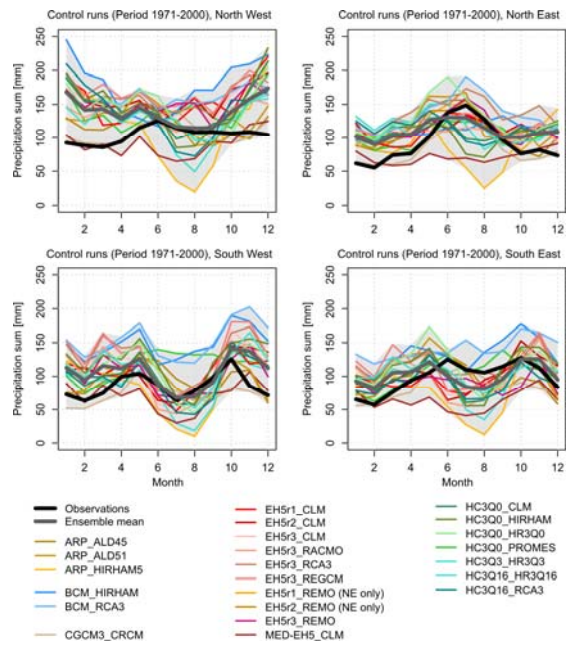
**www.adaptalp.org**

| Measure of change | Near Future | Far Future |
|---|---|---|
| **Mean air temperature** | +0,75 to +2,5°K (+1.5°K) | +1,75 to +4.5°K (+3.5°K) |
| **Mean JJA precipitation** | -25% to +25% (0%) | -5% to -45% (-30%) |
| **Mean DJF precipitation** | -15 to +15 (0%) | 0% to +35% (+10%) |
| **Increased flood disposition** | no | SW, SE in DJF<br>NW, NE in MAM and SON |
| **Increased drought disposition** | no | all sectors in JJA<br>NW sector in SON<br>SW sector in MAM |

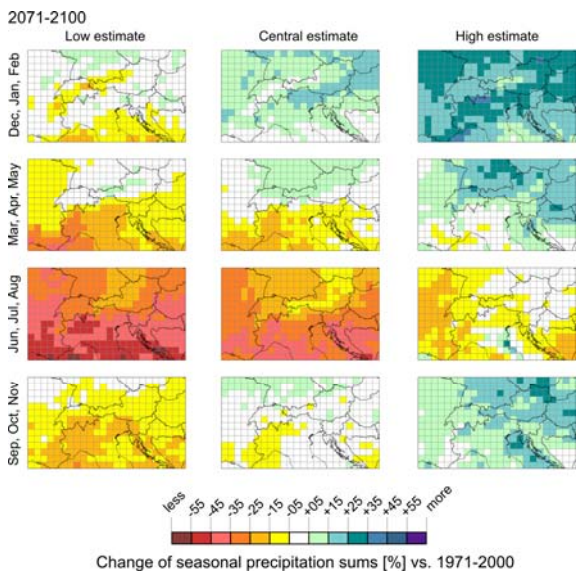
Policy guidance:
- **Grey**: no robust change signal
- **Colours**: robust direction of change

✓ Aggregated information from multiple models
✓ Robust fundings incl. uncertaity statement
✓ More details: see reports

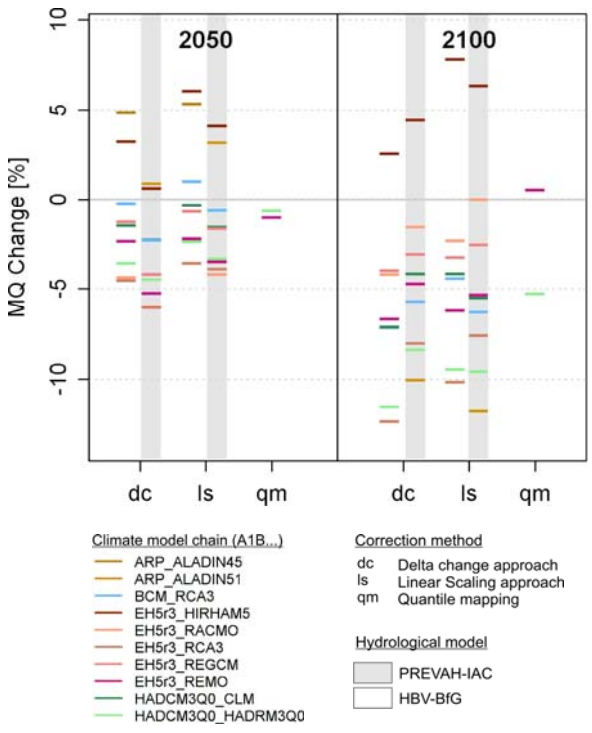
## Simulations




Validation: Annual cycle of precipitation as simulated by 23 RCM runs for the period 1971-2000. One run (EH5r3-HIRHAM) did not match the scale and was not plotted




Future climate: Change of precipitation sum per meteorological season as estimated using an ensemble of 12 RCM runs




Future discharge: Change of annual MQ at Diepoldsau (Alpine Rhine) according to various combinations of climate models, bias correction methods, and hydrological models


**Contact :**
**Krahe P., E. Nilson, B. Klein, M. Carambia, C. Rachimow and T. Horsten**
**Federal Institute of Hydrology, Am Mainzer Tor 1, 56068 Koblenz, Germany**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