



## Climate projections: the missing link of regional and local adaptation processes ?

### Making CORDEX accessible to users

*Adaptation Futures Conference - SC 8.9 Use and usability of climate information in adaptation planning*

PROCLIM – Climate services for all

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## 1. Context

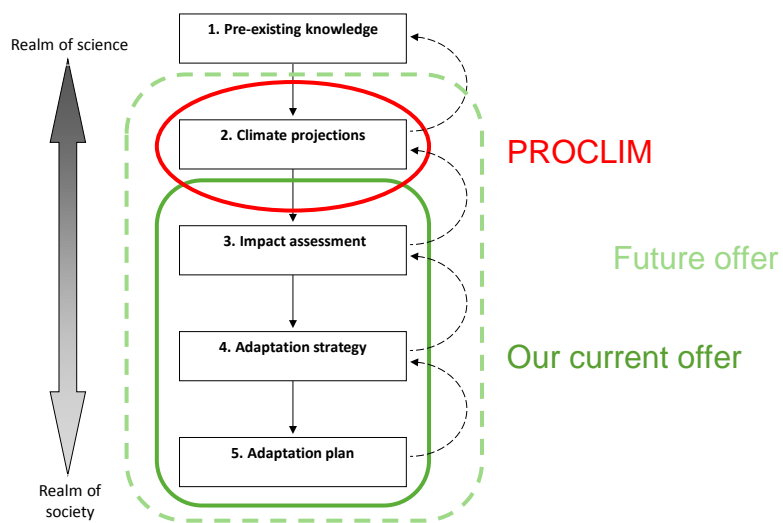
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### Climate projections, the missing link of climate change adaptation ?

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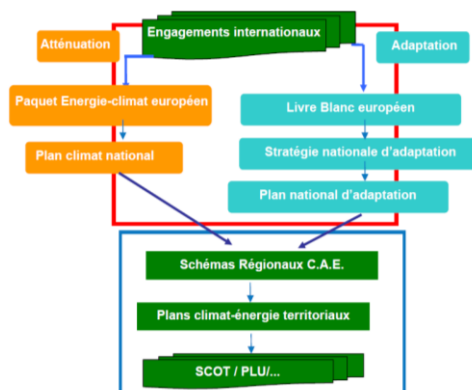
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## A good time to market: legislation



### International context, data opportunities

- International agreements and frameworks (UNFCCC, IPCC AR5...)
- EU strategy on adaptation
- National legislations (FR), incentives (DE, NL, UK)
- UNFCCC commitments (national communication on CC, NAP...)



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## A good time to market : climate services



- Structuration of climate services (WMO- GFCS, Climate service partnership, EU roadmap, EU calls...)
- ...with an obvious need of **private intermediaries**. Bridging the gap
- **CORDEX as an opportunity to rely on new datasets**

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## Climate services for whom ?

### A growing market

- ➔ In Europe
  - **Local and regional authorities climate action plan** Legal frameworks (FR), incentives (UKCIP), Klimabundies (Climate Compass)
  - **Specialised agencies** Water, agriculture, biodiversity management....
  - **Private operators** (in emergence)
  - ...
- ➔ Over the world
  - **Cooperation agencies** (GIZ, AFD, JICA, SNV, USAID, EuropeAID...)
  - **Countries** (national communications on CC, NAP...)

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## Our added value

- ➔ Adaptation to users needs (incl. guidance)
  - Insufficient interaction
  - Indices, spatial and temporal resolution, horizons
  - Lack of transparency
- ➔ Improvement of visualisation and communication
  - Too many maps !
  - Clear graphs and charts, with a true sense of semiotics
- ➔ A need to better assess and communicate uncertainty
  - Not enough multimodel ensembles (national models predominate)
  - New frontiers of research (members, spatial domains...)

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## 2. Products

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### Local climate projections

Committed in climate adaptation, at local, regional or national level? Our proprietary datasets, adapted from CORDEX, are specially designed for integrated climate change impact assessment. We help you understanding the climate future of your territory, in all its dimension



### Tailored indices and modelling

Dependent on specific climate features with precise thresholds? We define, in constant interaction, the indices you need: consecutive dry days in summer to identify risk for crop harvesting, intense precipitations, forest fires index...all this with a constant care of confidence levels and policy relevance

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### Seasonal forecasts

Your activity is by nature subject to seasonal rhythms? Seasonal to decadal projections are a new frontier of climate research. With the stewardship of the science community, we build prototypes providing you some unique competitive advantage



### Reference climatology

Interested in building a new infrastructure or framing an investment? We provide you reanalysis, station data, gridded products, so as to anticipate your risks or revenues

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### Vulnerability assessments

In search of precise answers for precise questions like flood prevention, crop yield anticipation of tourism attractiveness? We implement coupled climate-impact models to tell you all about it



### Adaptation services

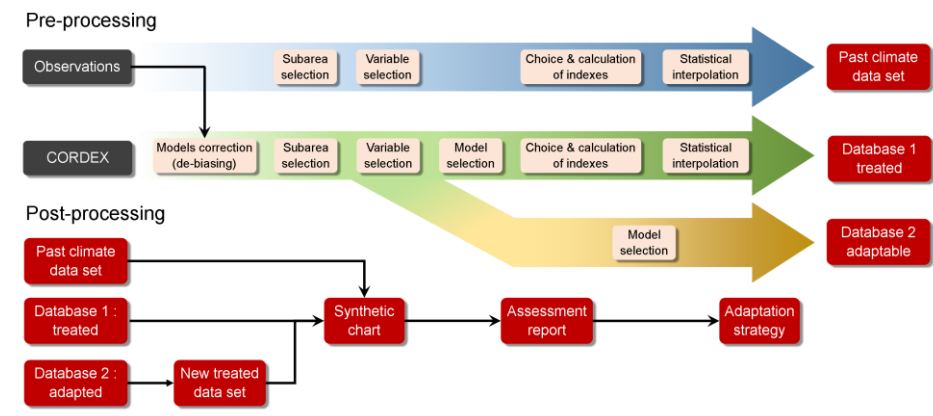
Not a specialist? We can implement the complete projections-impact-vulnerability-assessment chain (PIVA) facilitating your internal decision process, always in the spirit of transparency

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## Data processing chain : overview



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### 3. Jordan case study

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## Long term projections supporting the national communication on climate change

- ➔ Elaboration of the 3<sup>rd</sup> national communication on climate change
- ➔ IUCN expert group needed some updated projections
- ➔ Specific indices requires, with some attention of water resources
- ➔ Use of AFRICA-Cordex, bias corrected

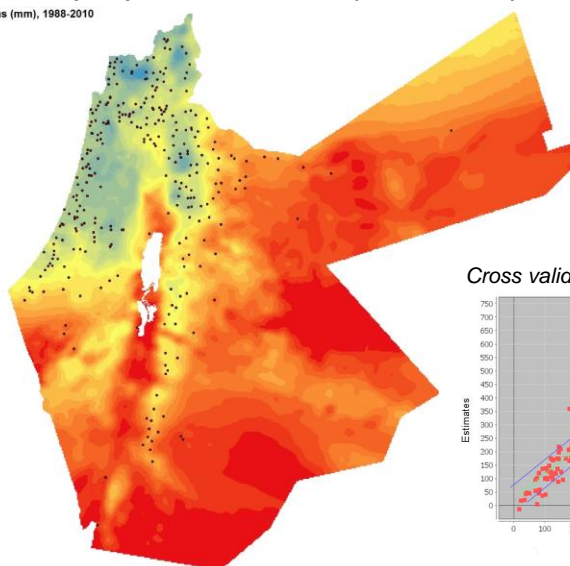
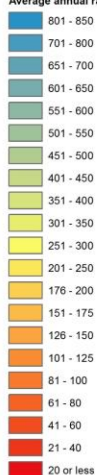
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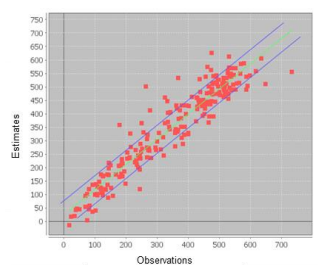
## Reference climatology – Geostatistical interpolation

### Average annual precipitation – 1988-2010 (1km resolution)

Average annual rains (mm), 1988-2010



### Cross validation





## Guidance and transparency in the choice of CORDEX datasets

	Data policy	Resolution	Data Center (one RCM)	Number of GCM	RCP
<b>MENA CORDEX</b>	All uses	0.22 ° (~ 25km)	SMHI(Sweden)	2	8.5
		0.44 ° (~50 km)	SMHI(Sweden)	3	2.6 4.5 8.5
<b>MEDCORDEX</b>	Restricted to non commercial use	0.44°	CNRM (France)	1	4.5 8.5
		0.11°	CNRM (France)	1	4.5 8.5
<b>EUROCORDEX</b>	All uses	0.11 ° (~12 km)	SMHI (Sweden)	5	2.6 4.5 8.5
			DMI (Denmark)	1	4.5 8.5
		0.44 °	SMHI (Sweden)	9	2.6 4.5 8.5
			DMI (Denmark)	1	4.5 8.5
<b>AFRICA CORDEX</b>	All uses	0.44 °	SMHI (Sweden)	8	4.5 8.5
			DMI (Denmark)	1	4.5 8.5

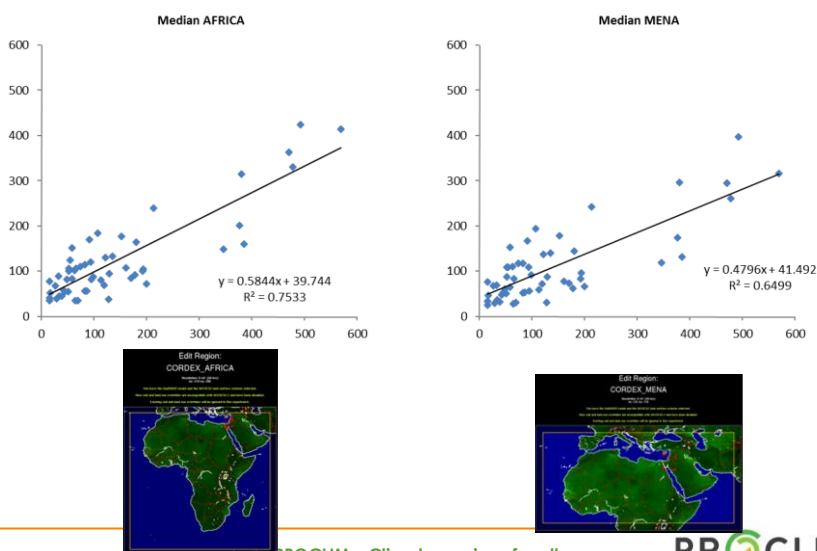
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## Choice of Cordex domain

**Results : AFRICA Cordex since**

- Performs better than MENA Cordex for precipitations
- More projections available for uncertainty assessment



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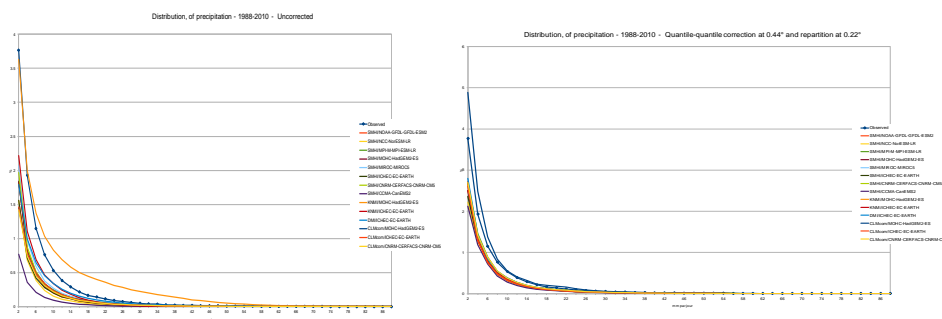
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## Data preparation : bias correction



Uncorrected data

Corrected datasets at 0.22°



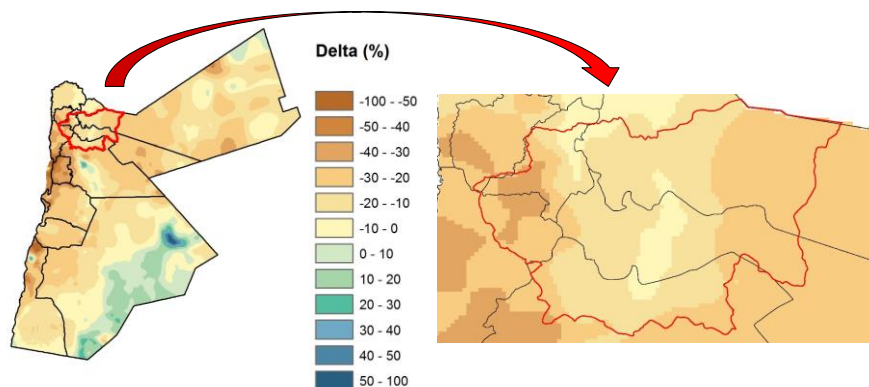
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## Additional statistical downscaling (quantile mapping and delta method)



Changes in precipitation in 2070-2100, compared to 1980-2010 (%), RCP 8.5  
Reference model- 1 km x 1 km geostatistic interpolation –  
Jordan and zoom on the Zarqa River Basin



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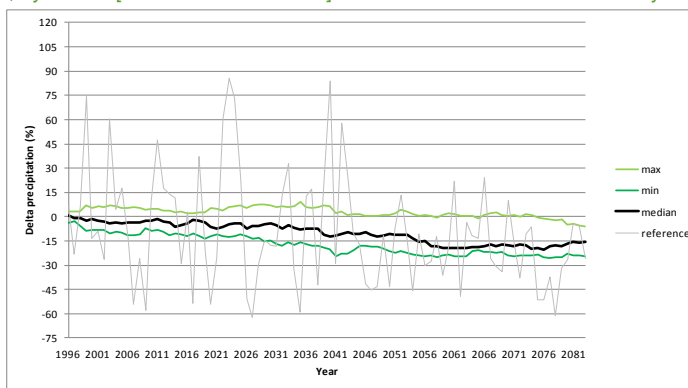
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## Trends and uncertainty assessment



### Changes in cumulated precipitation over Jordan

In 2070-2100, The cumulated precipitation could decrease by 15% [min -6% to max -25%] in RCP 4.5, by - 21% [min -9% to max -35%] in RCP 8.5- Interannual variability remains strong



Min: minimum values of the 9 GCMxRCM ensemble of projections, Max : minimum values of the 9 GCMxRCM ensemble of projections, Mediane: Mediane values of the 9 GCMxRCM ensemble of projections. Min, Max and Mediane for moving averages over 30 years periods. Ref : annual individual values of the reference model.

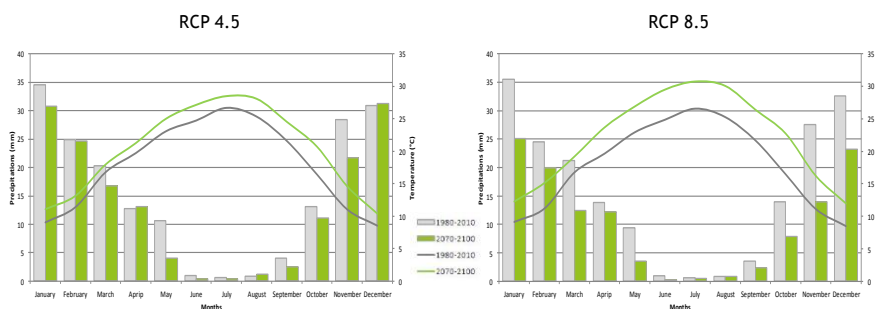
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## Seasonal evolutions: climatographs



### Changes in monthly temperature and precipitation

Line : temperature, Bars : precipitations.



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## Key messages and confidence levels



Trend	Details
A warmer climate	All models converge to increase in temperature, and AFRICACORDEX results are consistent with IPCC. In 2070-2100, average temperature increase could reach for RCP 4.5, +2,1°C [+1,7 to +3,2°C], and +4°C [3,8- 5,5°C] for RCP 8.5
A drier climate	Compared to the 2 <sup>nd</sup> national communication that used CMPI3 results, CMIP5 results coupled with regional climate models in CORDEX give a more consistent trend to a drier climate. In 2070-2100. The cumulated precipitation could decrease by 15% [-6% to -25%] in RCP 4.5, by - 21% [-9% to -35%] in RCP 8.5. The decrease would be more marked in the western part of the country
Warmer summer, drier autumn and winter	The warming would be more important in summer, and the reduction of precipitation more important in autumn and winter than in spring, with for instance median value of precipitation decrease reaching -35% in autumn in 2070-2100
More heat waves	The analysis of summer temperature, monthly values and the inter-annual variability reveal that some thresholds could be exceeded. For instance, in pessimistic but possible projections, for a summer month, the average of maximum temperature for the whole country could exceed 42-44°C.
More droughts, a contrasted water balance	The maximum number of consecutive dry days would increase in the reference model of more than 30 days for the 2070-2100 period. In contrast, annual values still show possible heavy rainy years at the end of the century. More intense droughts would be (partly) compensated by rainy years, in a context of a general decrease of precipitation. Evapotranspiration would increase. The occurrence of snow would strongly decrease. This will complicate water management.
No trend for intense precipitations or winds	The number of days with heavy rain (>10 mm) does not evolve significantly, nor does the maximum wind speed or the direction of winds

The colors give the level of confidence on trends and values (green = strong, yellow = medium, orange = low, red = very low)

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## A tentative vision of extreme events



Events	Trend	Degree of confidence
Intense precipitations and floods		Low
Droughts		Low
Heat waves		High
Snow event		High
Wind		Moderate

Still a lot to do on extremes (research, bias correction, further downscaling)

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*Thank you for your attention*

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