# Bias corrected, high resolution climate scenarios for Austria

Chimani B., Heinrich G., Kienberger S., Leuprecht A., Lexer A., Hofstätter M., Kerschbaumer M., Salzmann M., Peßenteiner S., Poetsch M.S., Spiekermann R., Switanek M.B., Truhetz H.
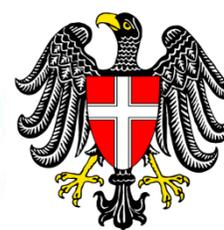
- Concepts to adaptation to climate change need high quality, high resolution climatological data

- Funded by Federation of Austria and all provinces

- Creation and Interpretation of high resolution climate information on past, present and future and climate changes

Observational data

1961 – 2010

1961 – 2011
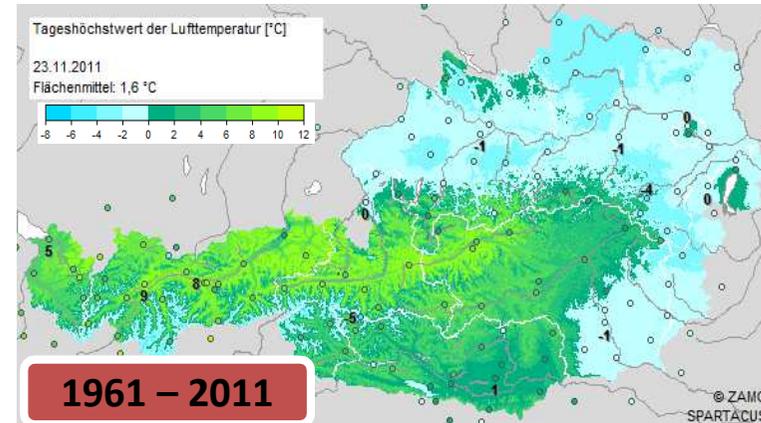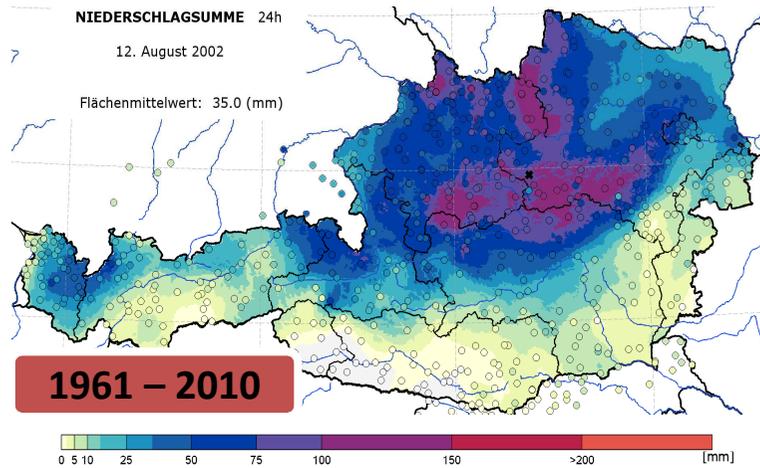
88 weather stations:
1.1.1961 – 30.6.2015

~40 „longterm"
stations (T and/or R)
1.1.1936 – 30.6.2015

5 „flag-ship" stations
(all parameters)
1.1.1900 – 30.6.2015

5 Parameters – daily base:
- Temperature min/max
- Precipitation
- Global Radiation
- Sunshine Duration

1980 – 2012
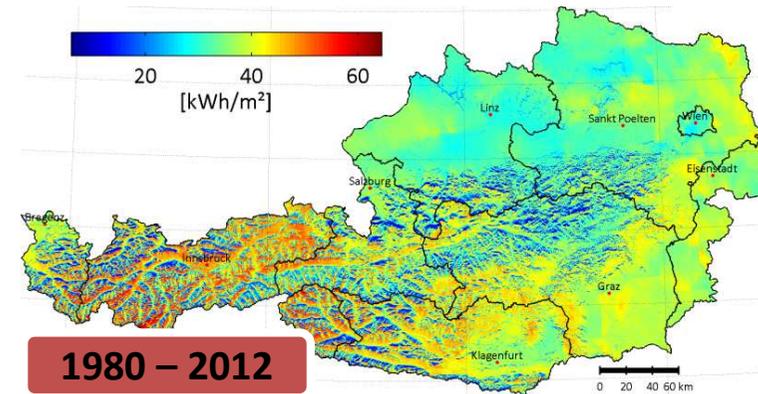
Climate Model Data

EURO-Cordex:

29 groups, 10 RCMs,13GCMs (from CMIP5) =>

simulations in 50km resolution

simulations in 12.5km resolution

Used in Project:
12.5km resolution
2 representative concentration pathways:
- RCP 4.5: 13 model results
- RCP 8.5: 13 model results
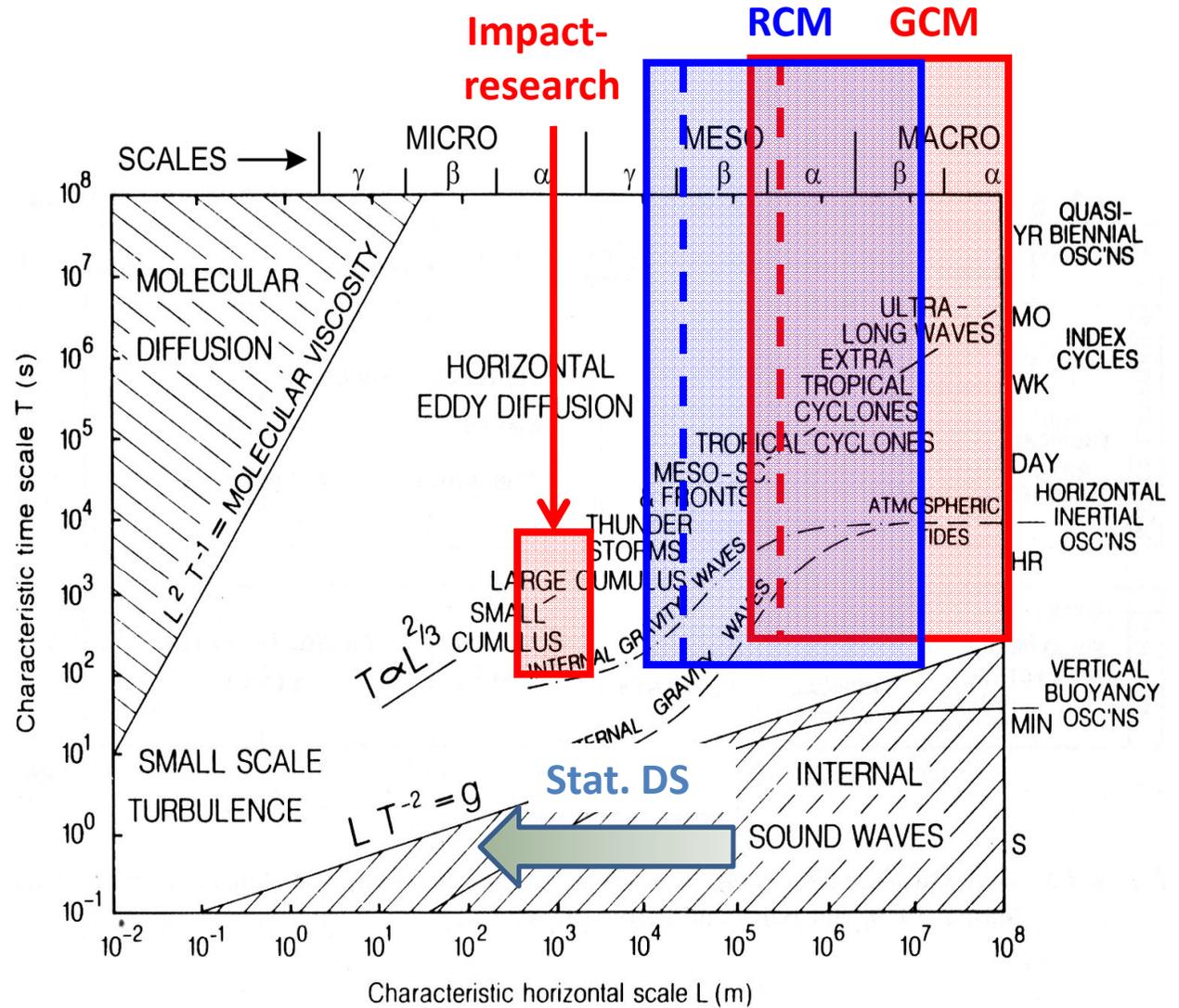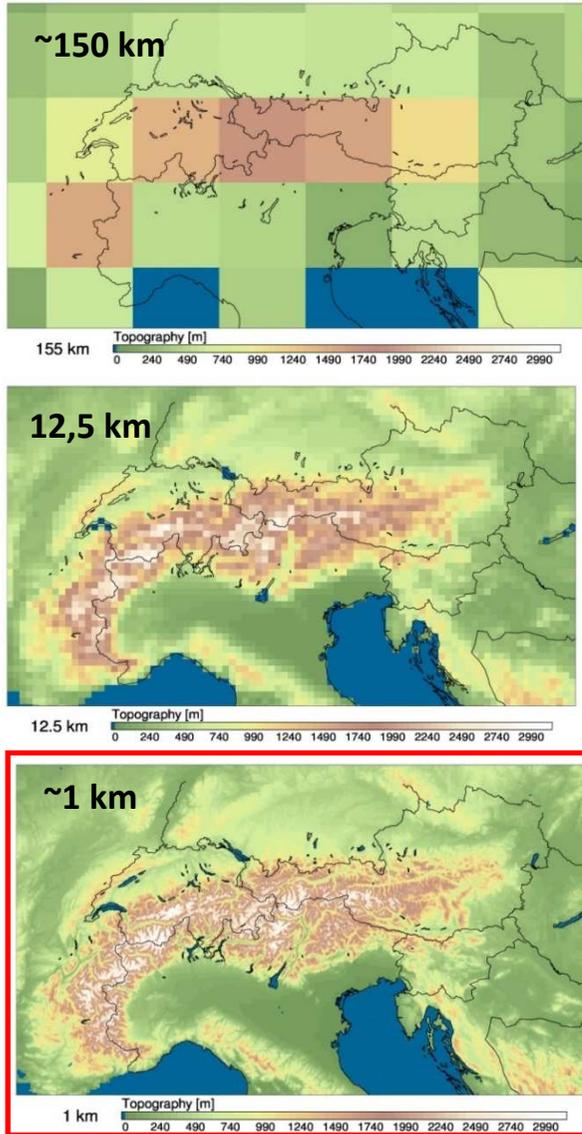
(from Orlanski, 1975; Barry and Carleton, 2001)

Downscaling to 1km
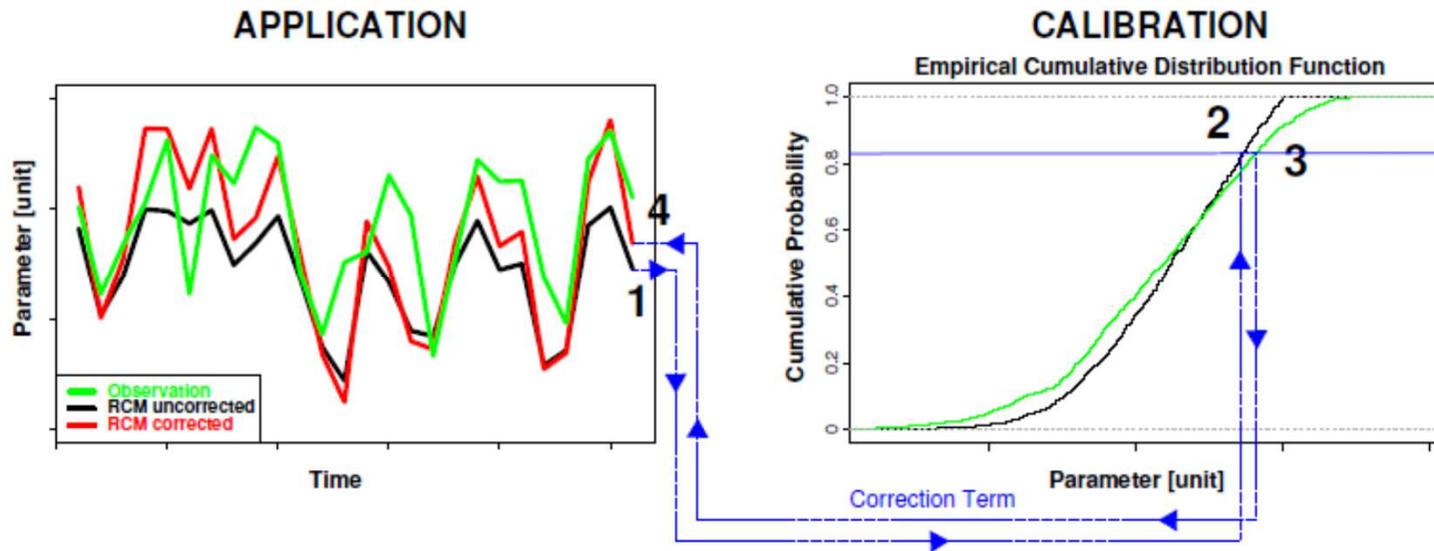
Quantile Mapping:
Statistical characteristics of model (bias) are corrected
Physical characteristics (e.g. consistency) are unchanged
Possible of station data and gridded datasets.

But QM changes climate change signal

→ „Scaled Distribution Mapping (SDM)" (Switanek et al,., 2016)

Correction terms of QM are scaled, so that climate change signal is not changed.
Error correction values using QM are not stationary. Therefore, we cannot justify altering the climate change signal with QM. We need a method that better preserves the raw model projected changes.
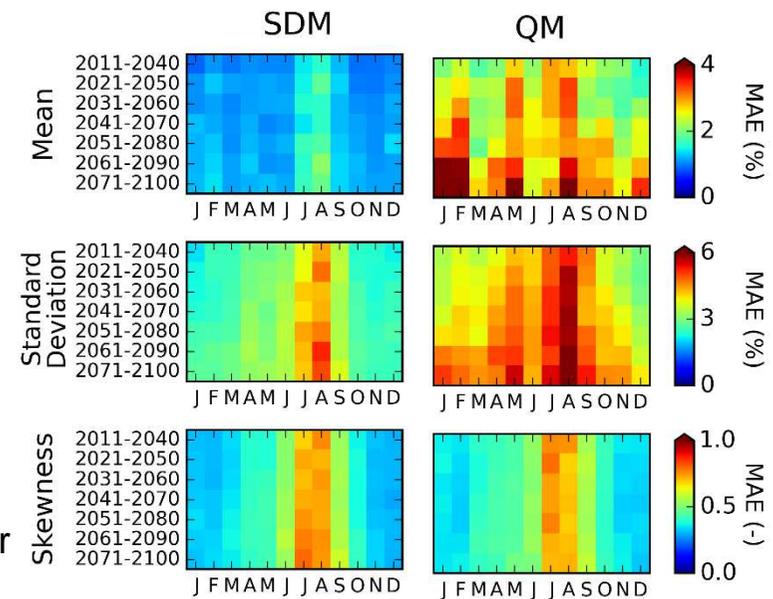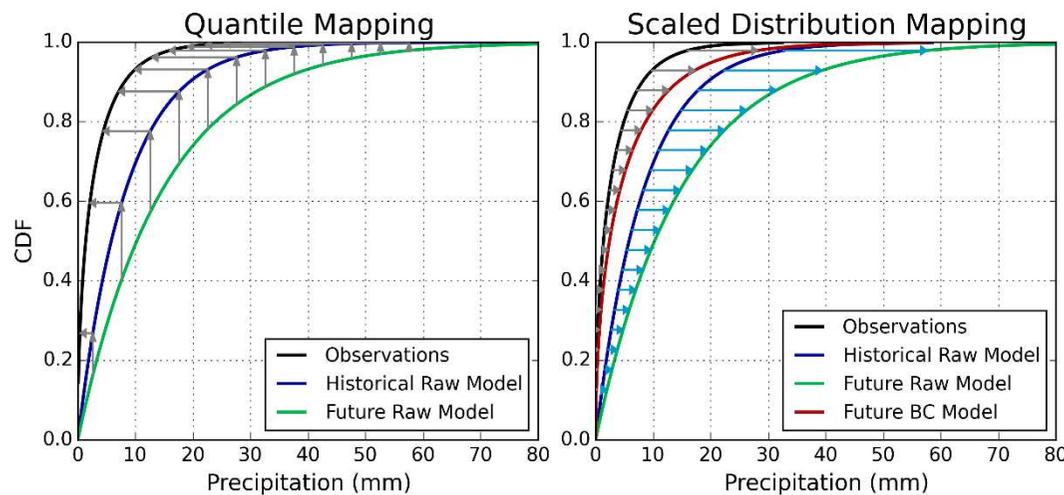

Method performance in preserving the climate change signals across different moments for precipitation (blue minimizes error and has the best performance).

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temperature based	
tm	air temperature
su25	summer days
su30	hot days
tr20	tropical nights
hw_sum_days	heat wave
kys	kysely days
gsl	growing season length
sd_gsl	start of growing season length
cdd	cooling degree days
fd0	frost days
cw_sum_days	cold wave
id0	ice days
id7	extreme ice days
tpd	thaw period days
ftc	freeze thaw changes
hdd	heating degree days

precipitation based	
rr	precipitation amount
rr1	wet days
sdii	simple daily intensity index
rx1day	highest one-day precipitation amount
rx5day	highest five-day precipitation amount
rr_1mm, rr1_30pct, rr1_60pct, rr1_90pct, rr1_95pct, rr1_98pct	precipitation amount on wet days
rr1_dry, rr1_weak, rr1_moderate, rr1_significant, rr1_heavy, rr1_severe, rr1_extreme	precipitation amount days
cwd_sum_days	consecutive wet days
cdd_sum_days	consecutive dry days
radiation based	
ssd	absolute sunshine duration
rsds	surface downwelling shortwave flux in air

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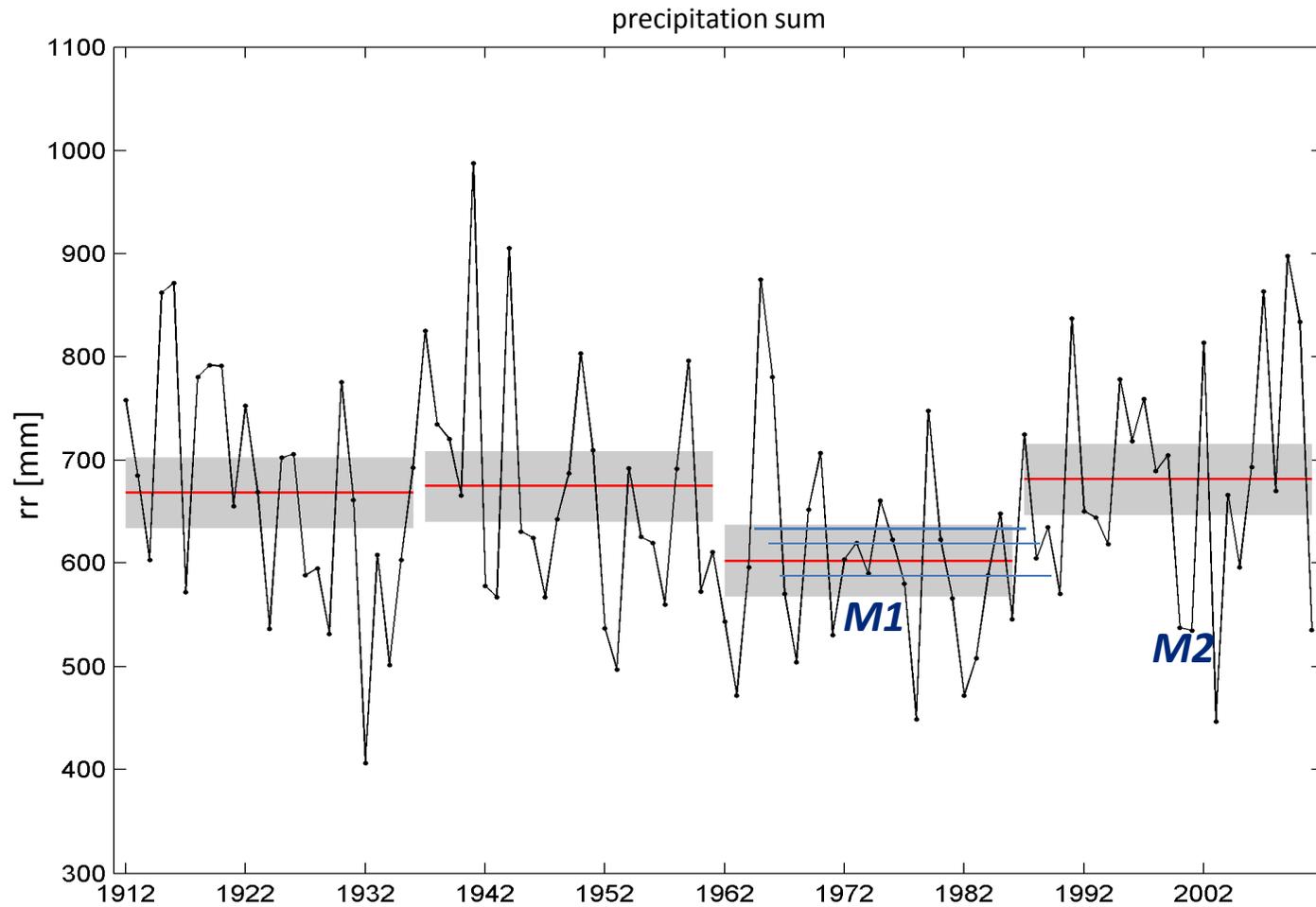
Natural
variability (NV)

M...climate mean
ΔM...M2-M1
NV...~variability of
running Ms

precipitation sum

Days with Tmax>30°C

Mittel wert

Median

Summer precipitation

Wilcoxon-Mann-Whitney-Test

| significance\ consistency	<50 % of models are significant	≥50 % of models are significant
<80 % of significant models are consistent	No significant change	Lacking model consistency
≥80 % of significant models are consistent	No significant change	Significant change

Days with
Tmax>30°C

Median of modells

Information on quality of information

Information on spread of modells
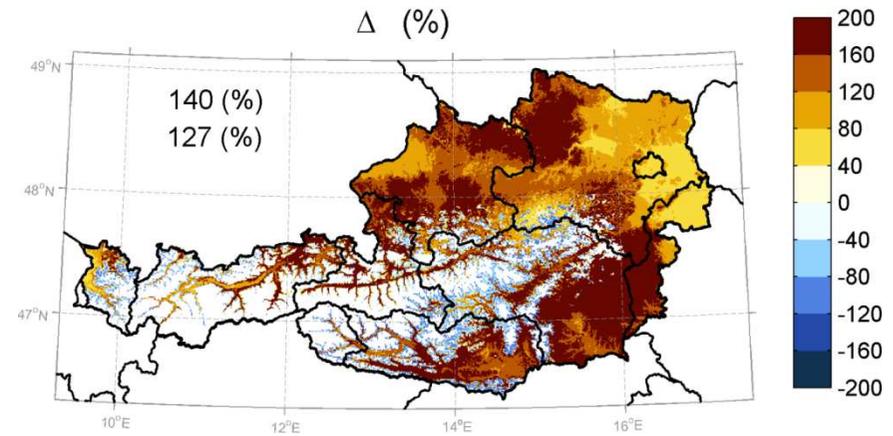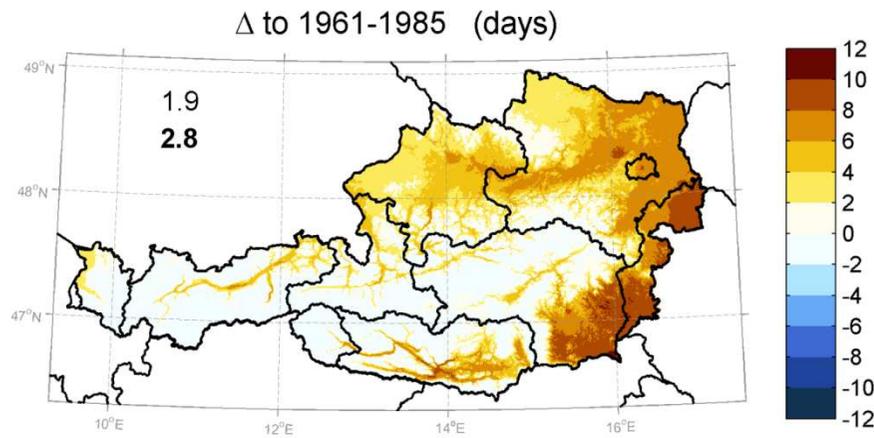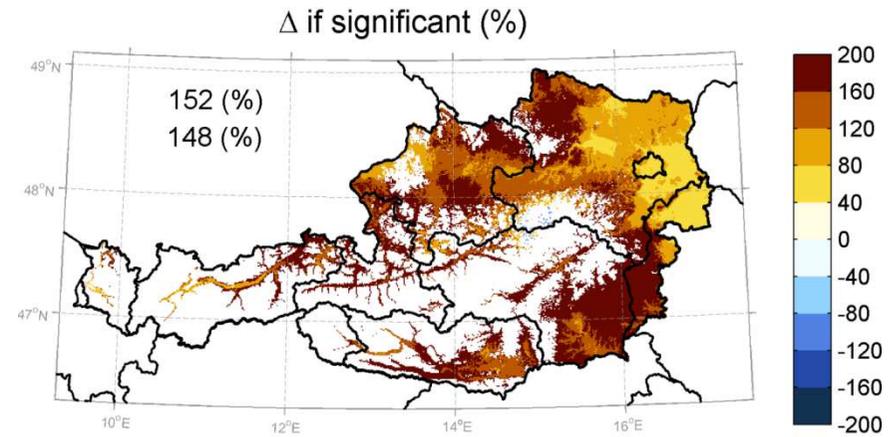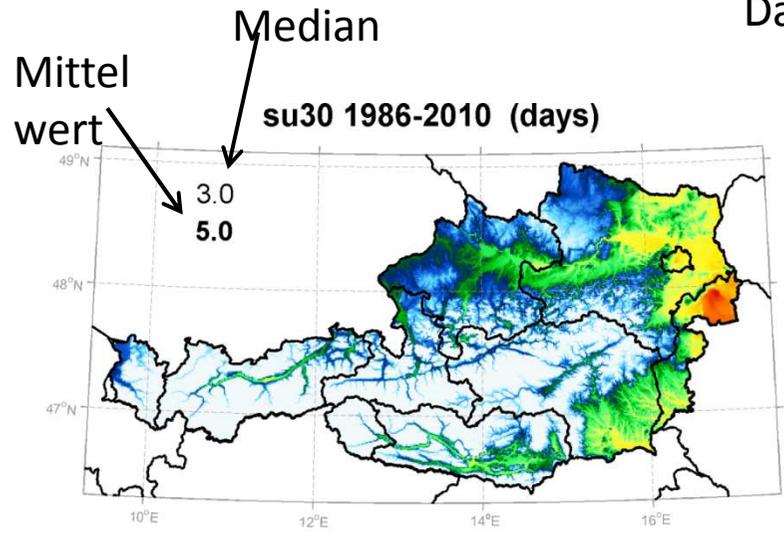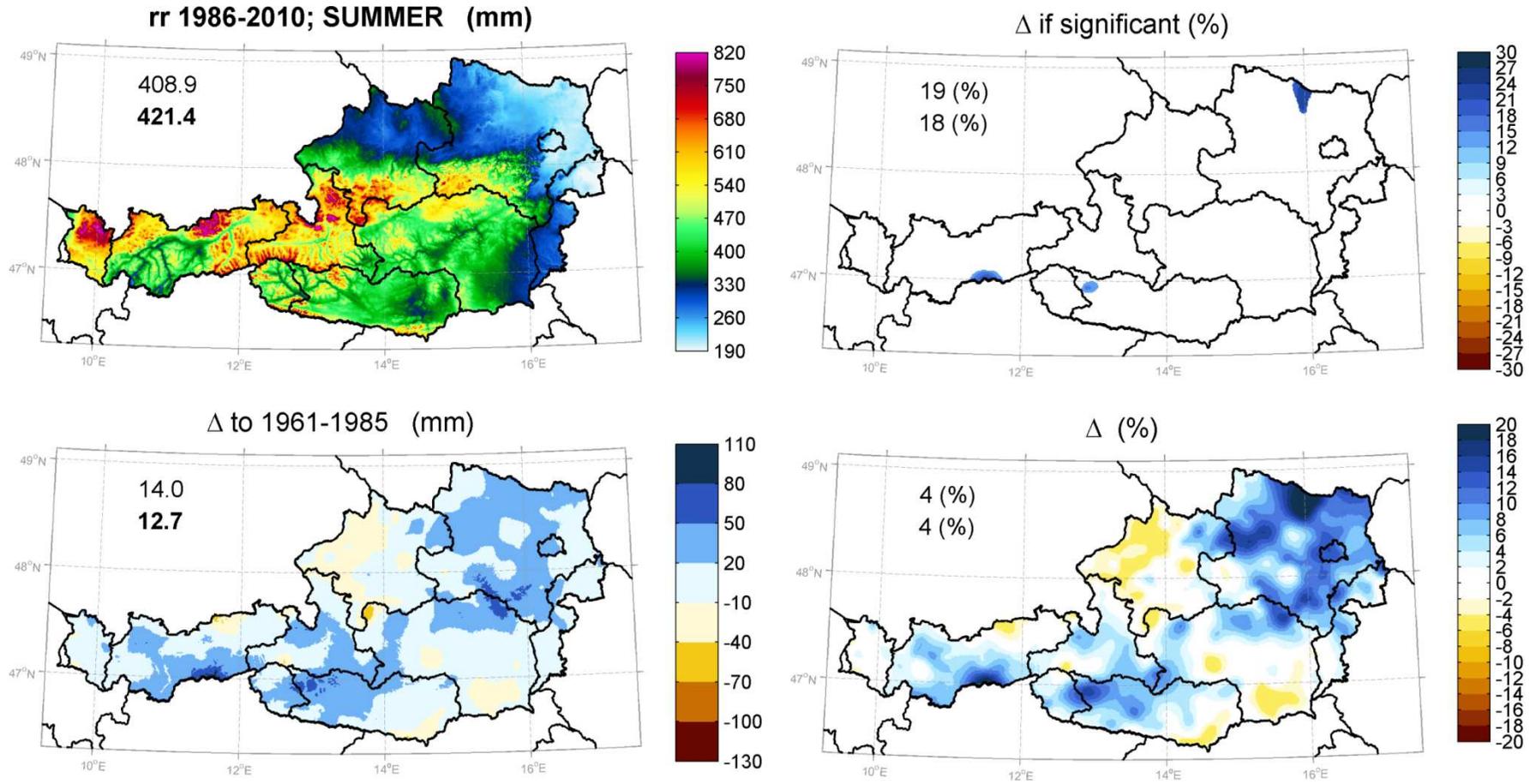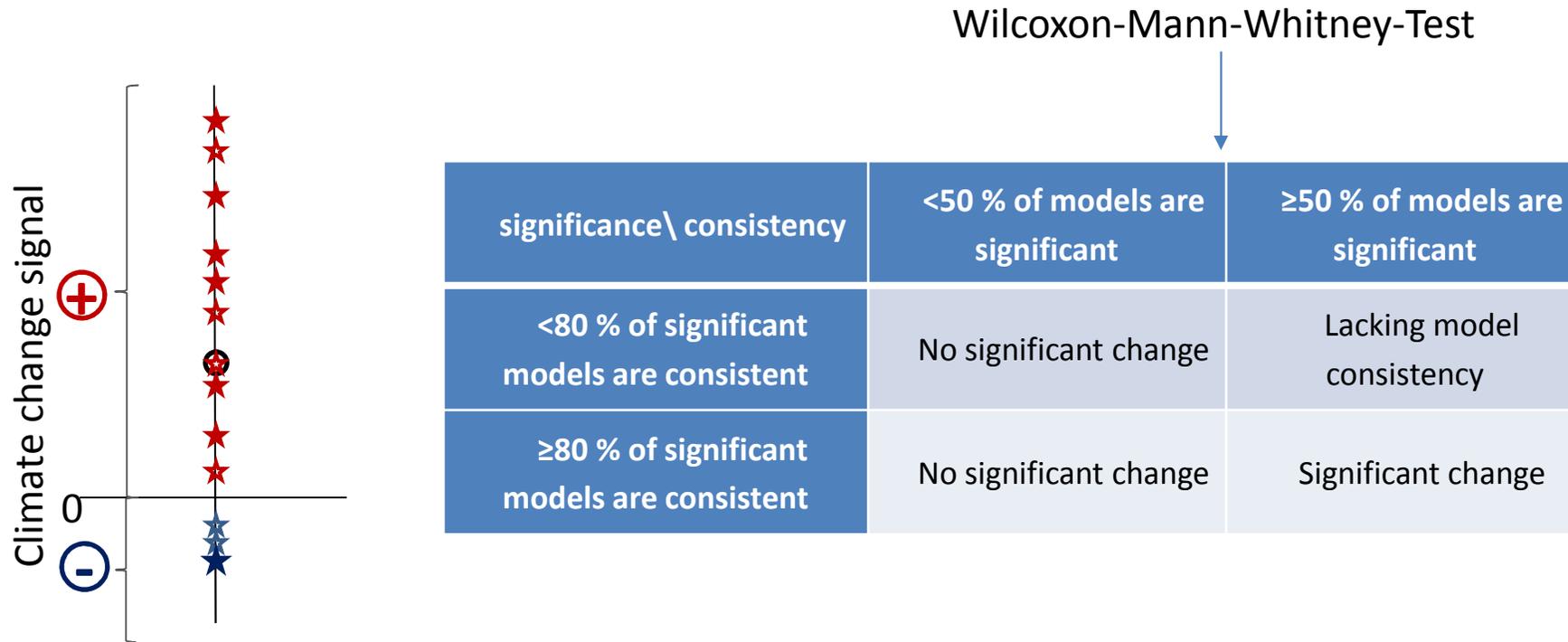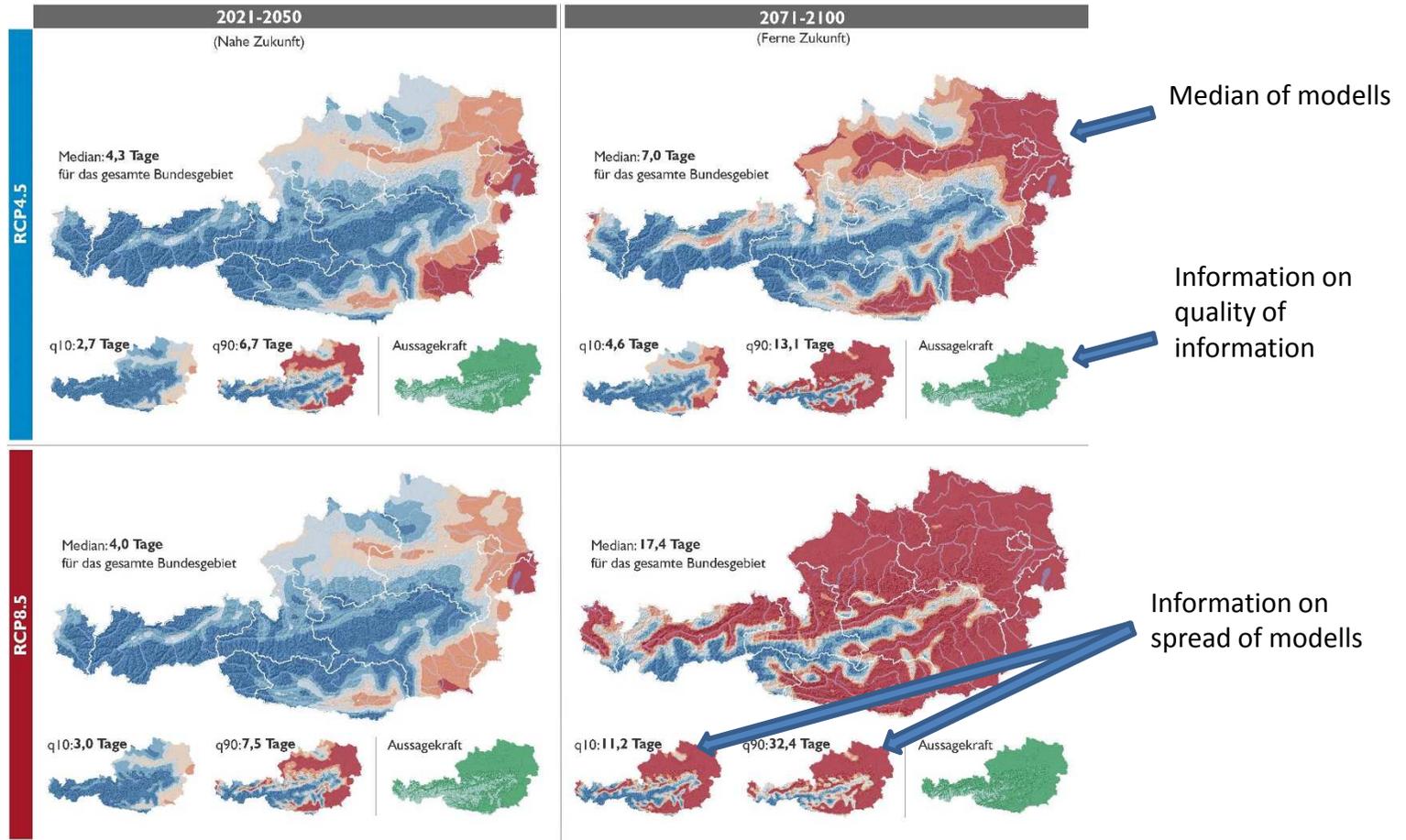
Simulated change in days (ref: 1971-2000)

0   2   4   6   8   10   >10
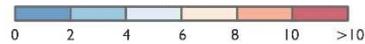
Bandbreite der 13 Modelle:

Median: 50% der Modelle liegen ober- bzw. unterhalb dieses Wertes
q10: 10% der Modelle liegen oberhalb / q90: 90% der Modelle liegen unterhalb
Die reale Klimaänderung kann außerhalb der Bandbreite der Modelle liegen

Little agreement between modells
Not significant (signal smaller natural variability)
Signifikant and high agreement between modells

Summer precipitation
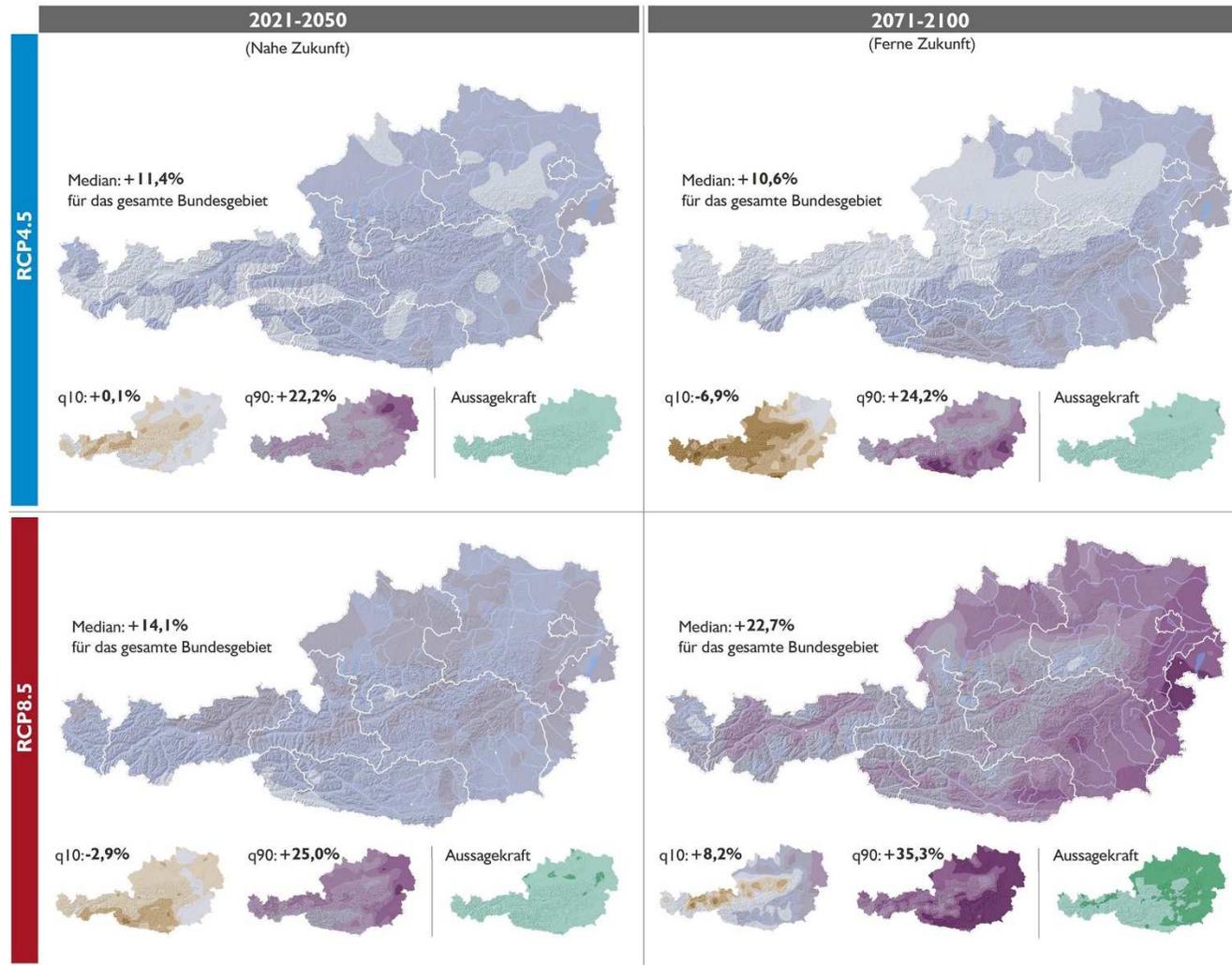

Simulated change in % (ref: 1971-2000)
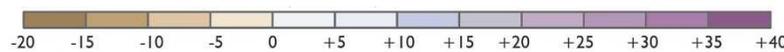
-20 -15 -10 -5 0 +5 +10 +15 +20 +25 +30 +35 +40

Little agreement between modells
Not significant (signal smaller natural variability)
Signifikant and high agreement between modells

Factsheets with main information on climate change including:
- Main statements on temperature an precipitation
- Climate development in the past and the future
- Spatial distribution of climate change signals
- Uncertainty information

Parameters: Temperature, precipitation, chosen climate indices
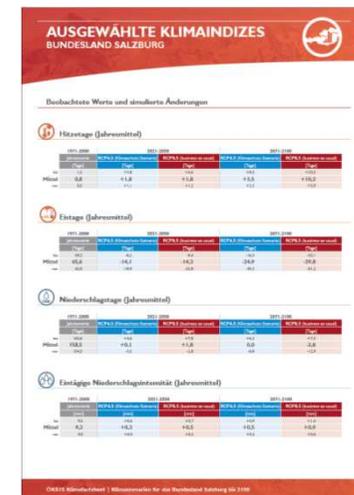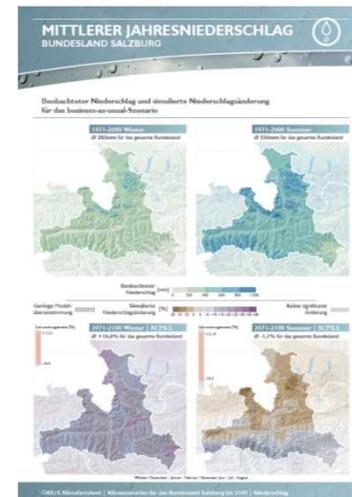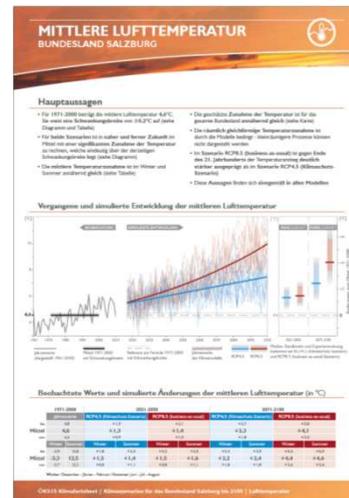
- Reference dataset for climate past, present and future for political decisions and further climate change and climate change impact studies created

- Available parameters: Tmin, Tmax, Tmean, RR, global radiation, ~25 T- and RR-based climate indices

- Resolution: 1km

- Uncertainty information included

- Free access for research by Climate Change Center Austria – Data Center (www.ccca.ac.at)

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STARC-IMPACT

Study on the quality of the dataset (past and future)
       effective resolution
       resolved phenomena
       effect of model generation
       quality of downscaling

       …

Project start: July 2016
Project end : December 2018