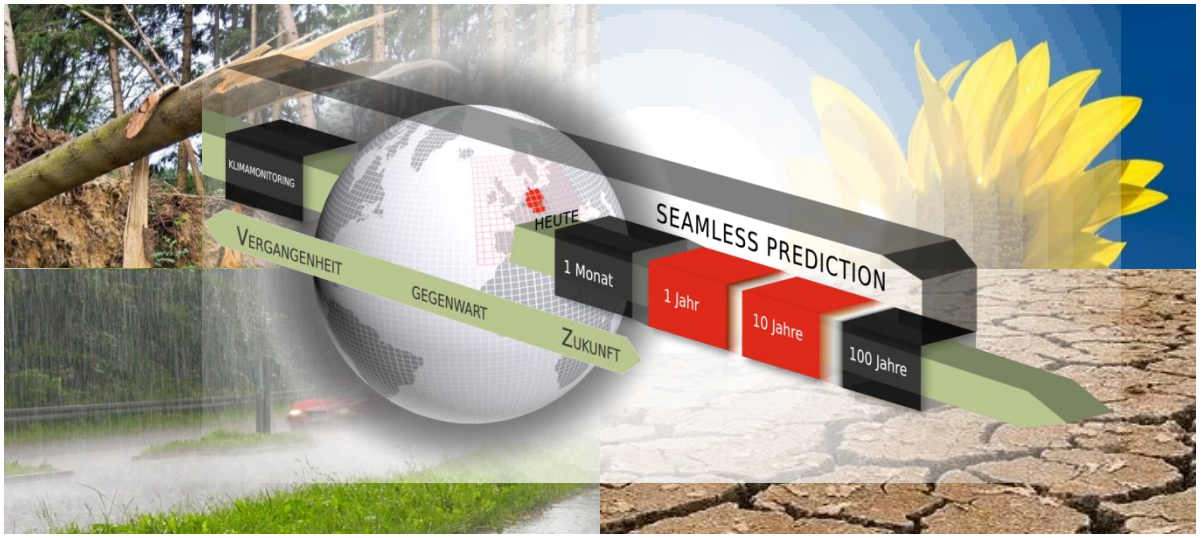


Conditional Evaluation of Regional Hindcasts from the MiKlip Decadal Climate Prediction System

COSMO-CLM Assembly, 19.09.2018

S. Brand[1], B. Früh[1], H. Feldmann[2], H.-J. Panitz[2]

[1] Department Climate and Environment Consulting, German Weather Service (DWD)

[2] Institute of Meteorology & Climate Research – Department Troposphere Research (IMK-TRO), Karlsruhe Institute of Technology (KIT)

Outline

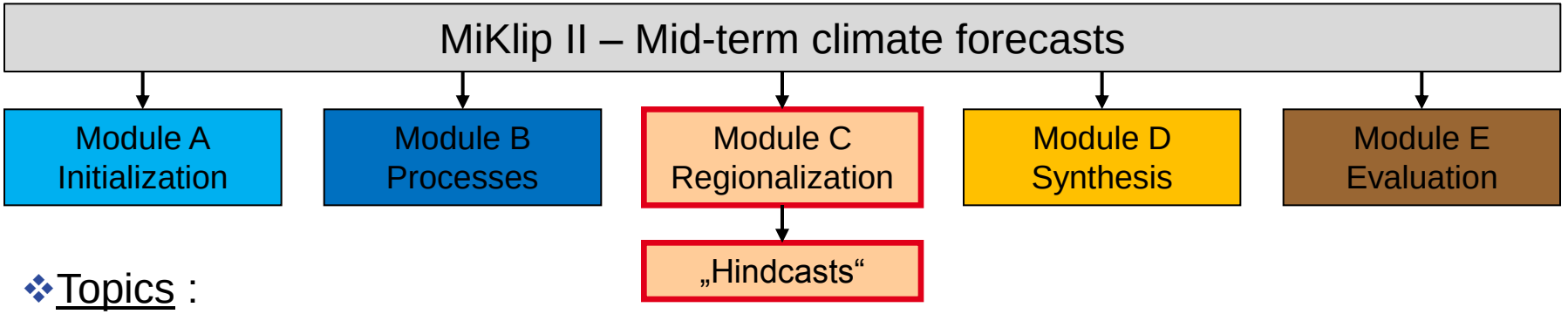
Introduction

- MiKlip II : Regionalization

Conditional Evaluation

- Concept
- Method
- Results

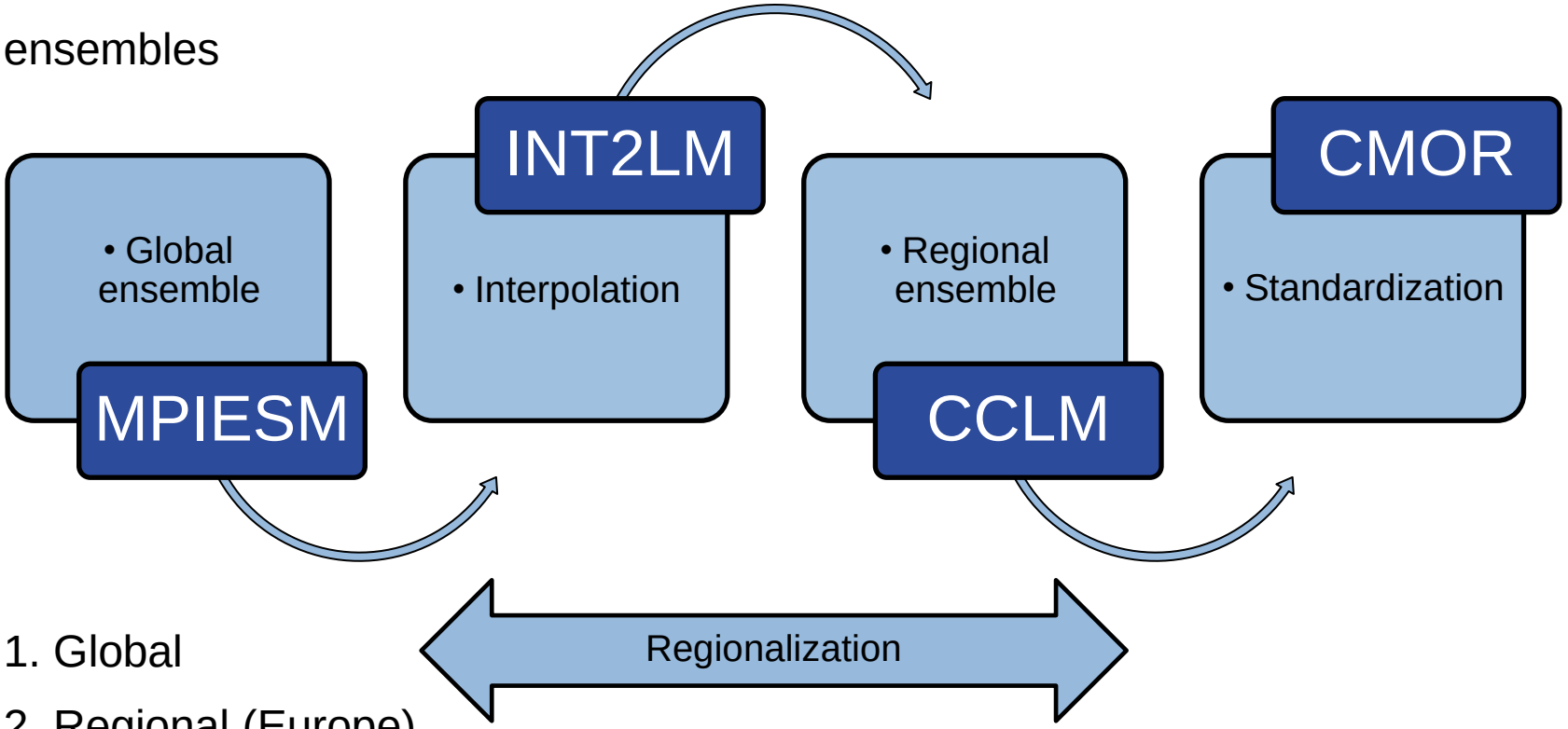
MiKlip II : Regionalization



- Topics :
  - C3-WP3, C2-WP2
- Aims :
  - Dynamical downscaling of global hindcasts for the European domain.
  - Classification of hindcast data with respect to their weather conditions or state of global circulation indices.
  - Detection of potential predictive skill in Europe.

Dynamical downscaling

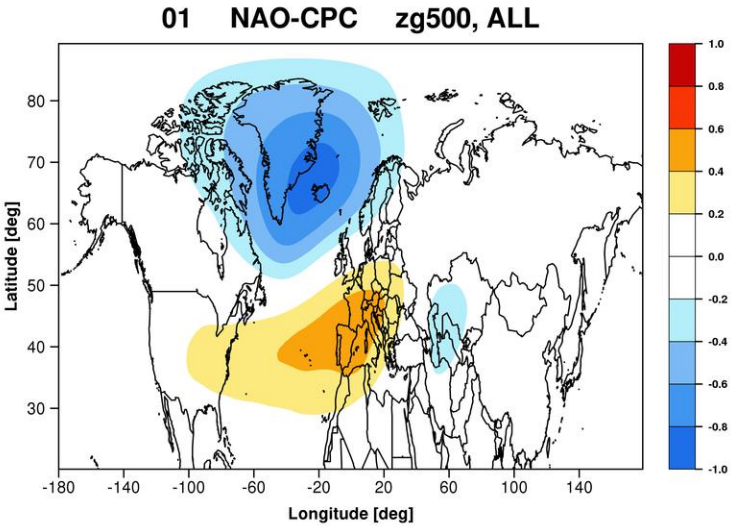
- series of model simulations
- ensembles

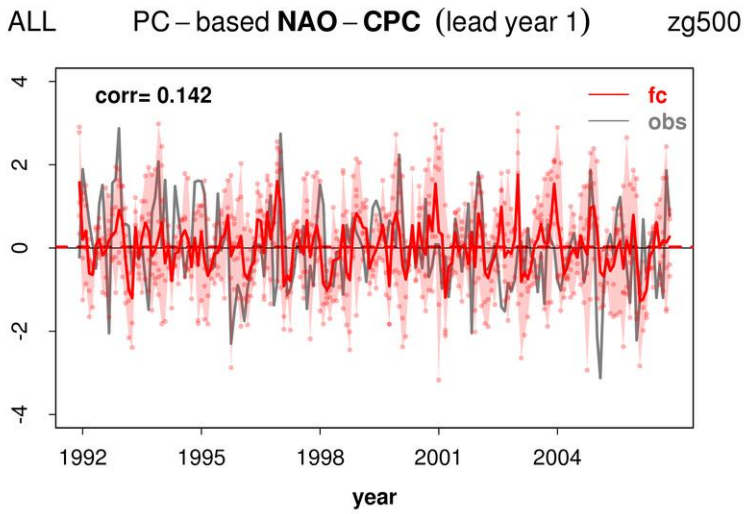


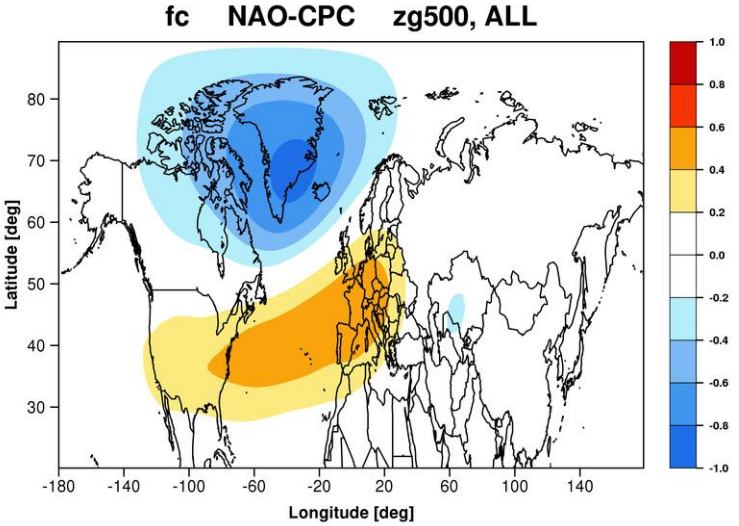
- 1. Global
- 2. Regional (Europe)

Conditional evaluation

- PCA of 500 hPa geopotential height
- Timeseries of weights of PC's = Global circulation indices (e.g., PC1 = NAO)
- 01 / obs : ERAinterim (for comparison)
- fc : forecast / hindcast

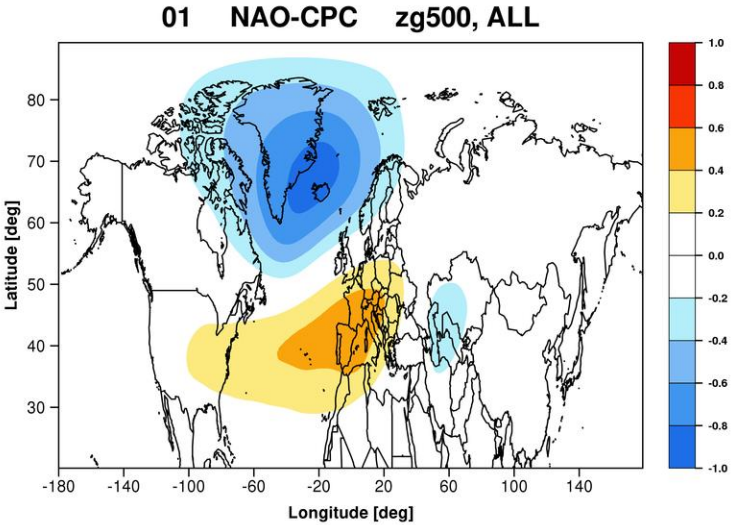


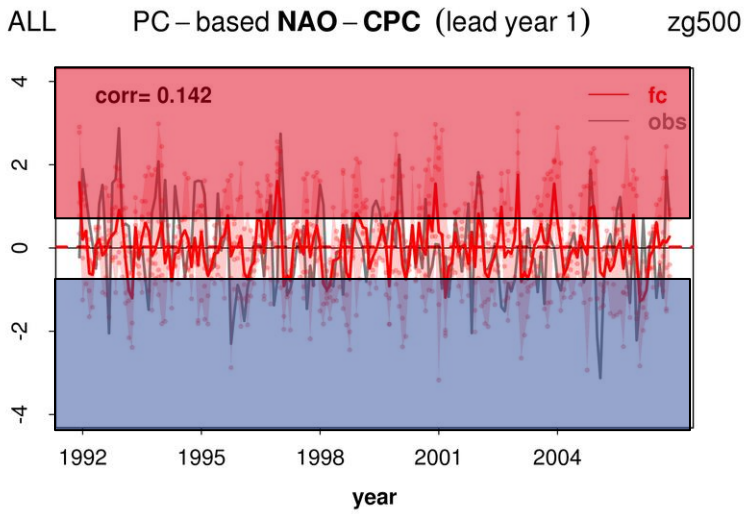


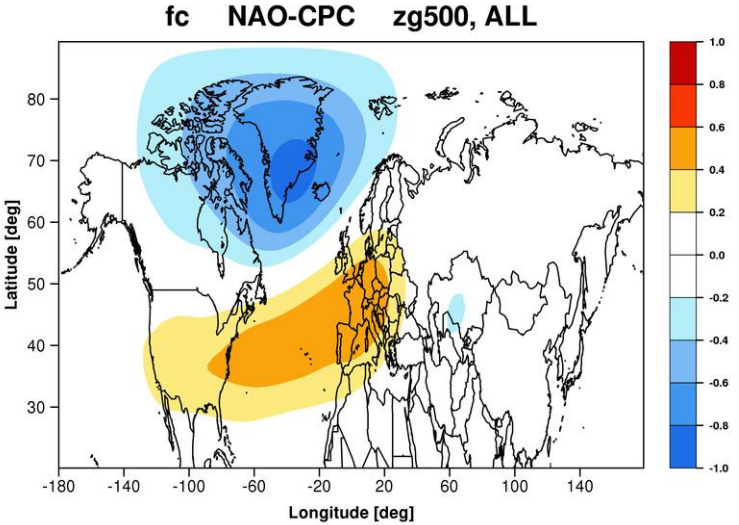


Conditional evaluation

- Classify values of respective index (global)
- Use thresholds (see below) or percentiles (e.g., **terciles**)
- Calculate statistics for each class
- Get conditional forecast skill (regional)

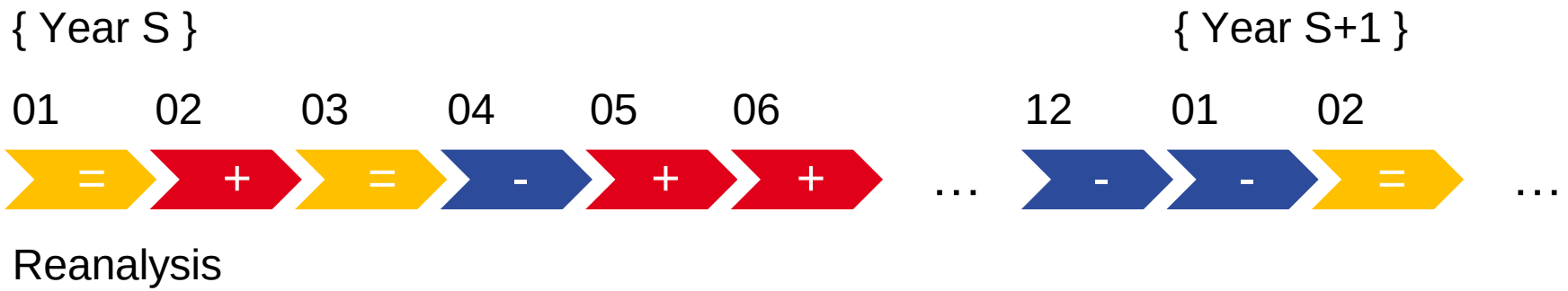






Stratification of data due to global circulation index.

starting year S = (1960-2016)



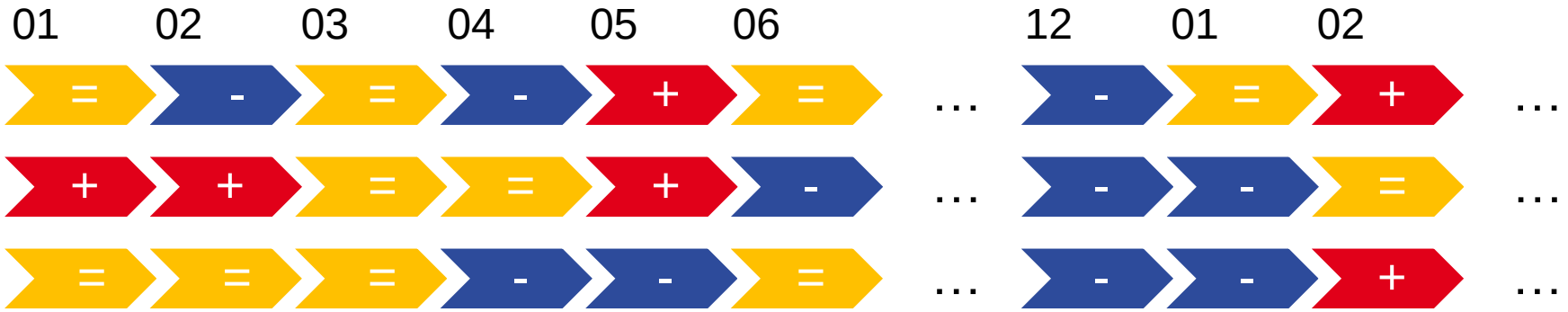
Stratification of data due to global circulation index.

Karlsruhe Institute of Technology

For each [simulation = fc, ref / starting year S = (1960-2016)] :

{ Leadtime LT=0 }

{ Leadtime LT=1 }



Realizations : R(1), R(2), R(3)

{ Year S }

{ Year S+1 }

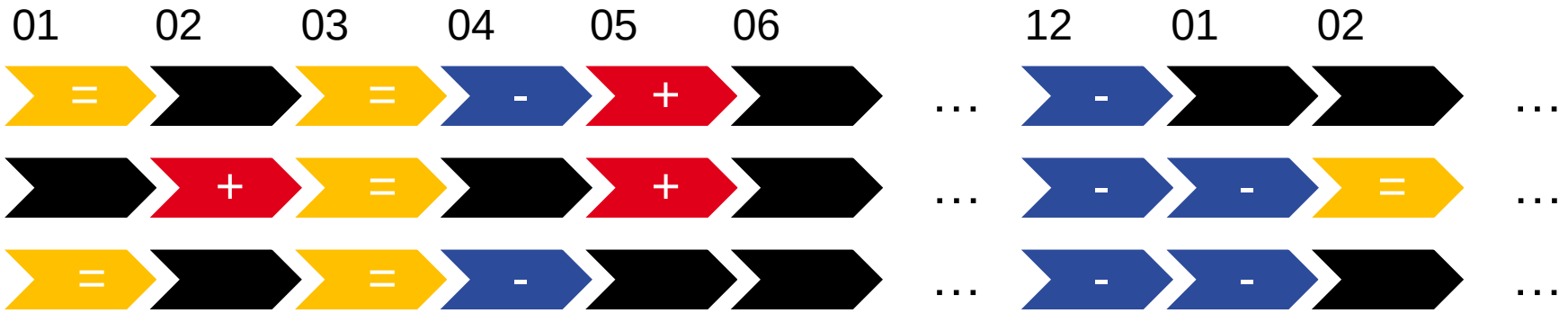
Reanalysis

Stratification of data due to global circulation index.

For each [simulation = fc, ref / starting year S = (1960-2016)] :

{ Leadtime LT=0 }

{ Leadtime LT=1 }



Realizations : R(1), R(2), R(3)

{ Year S }

{ Year S+1 }

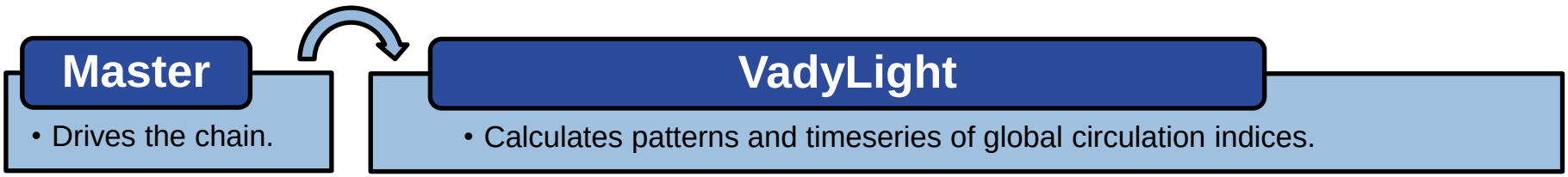
Reanalysis

Analysis chain of conditional evaluation

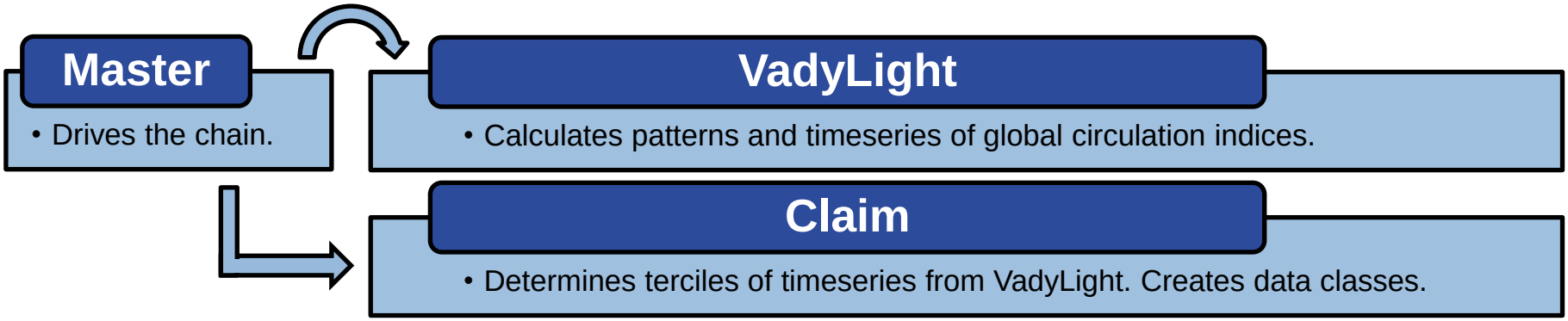
Master

- Drives the chain.

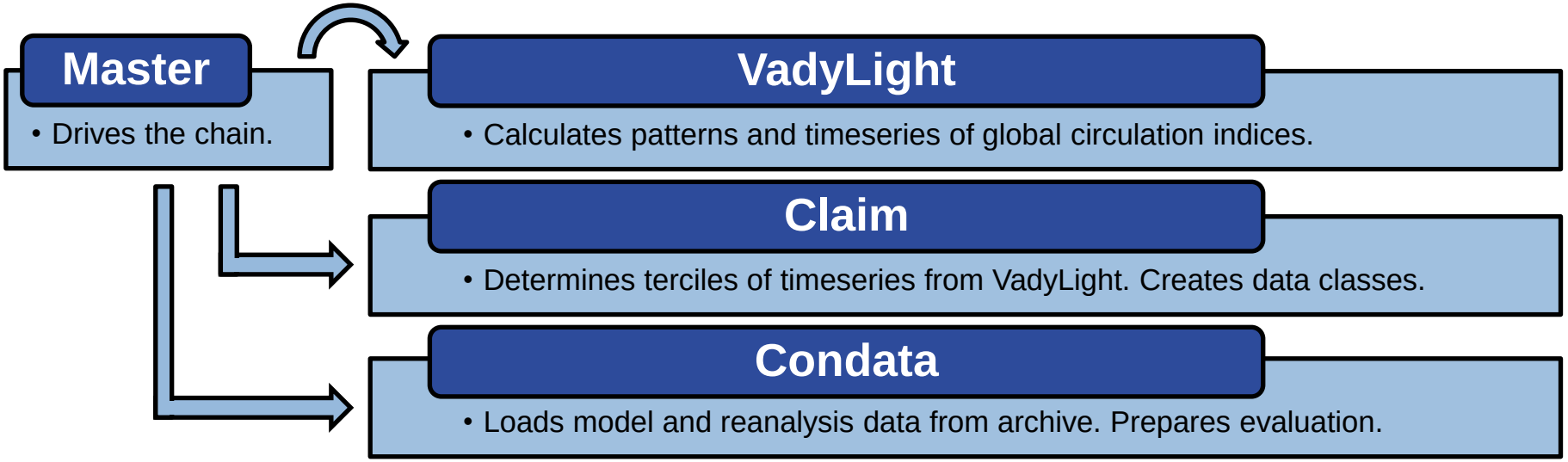
Analysis chain of conditional evaluation



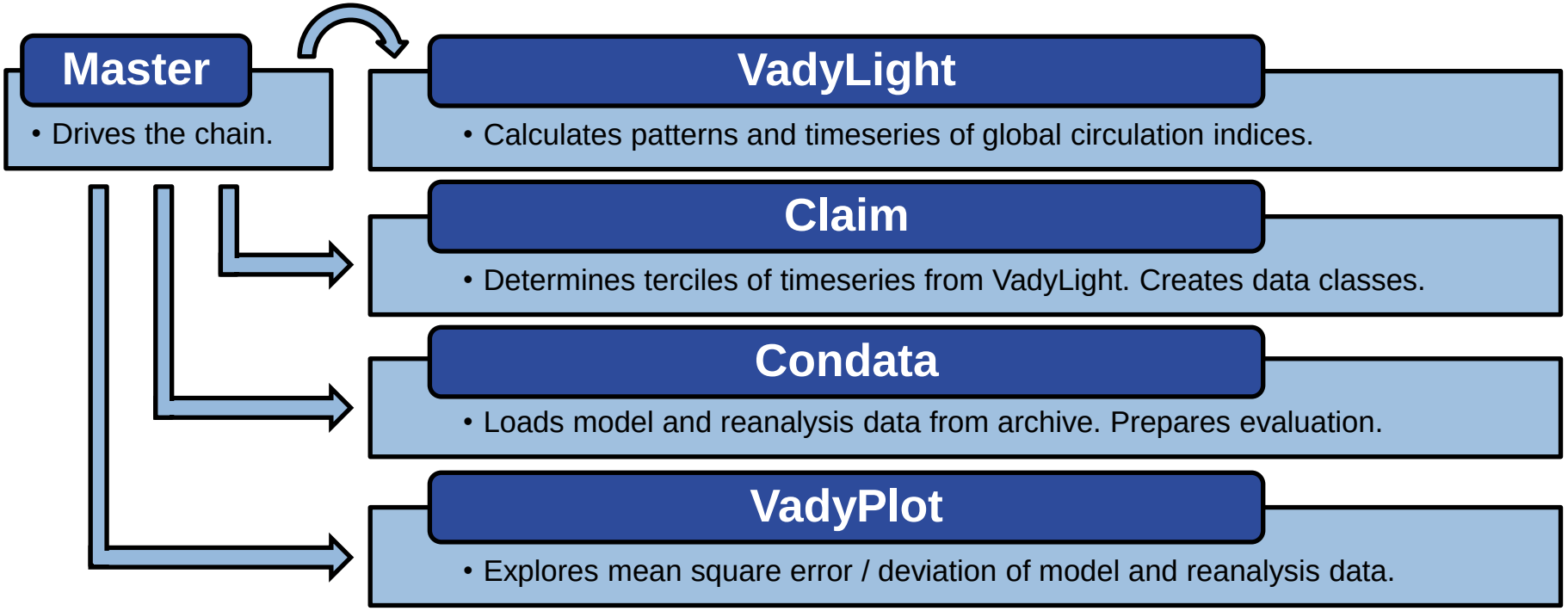
Analysis chain of conditional evaluation



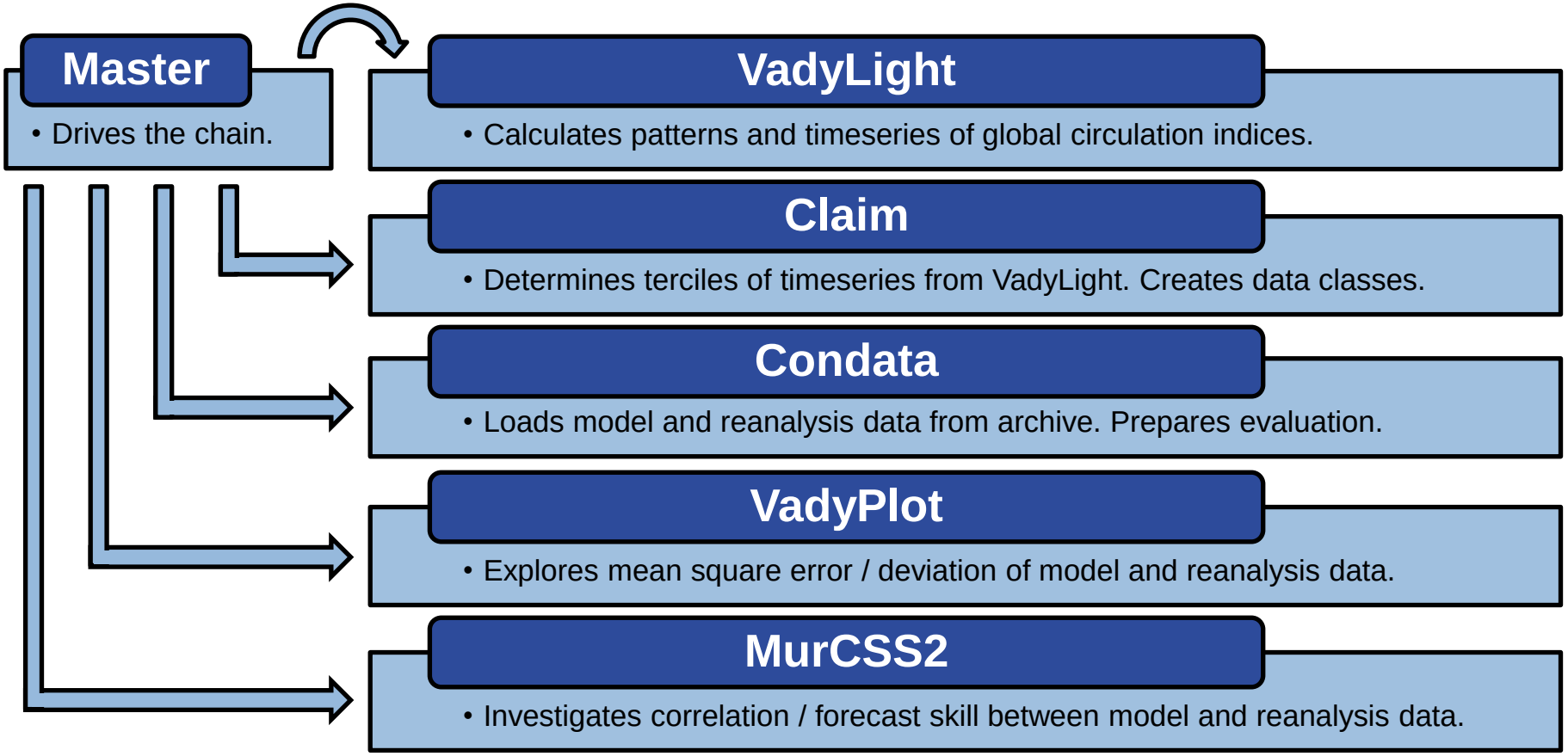
Analysis chain of conditional evaluation



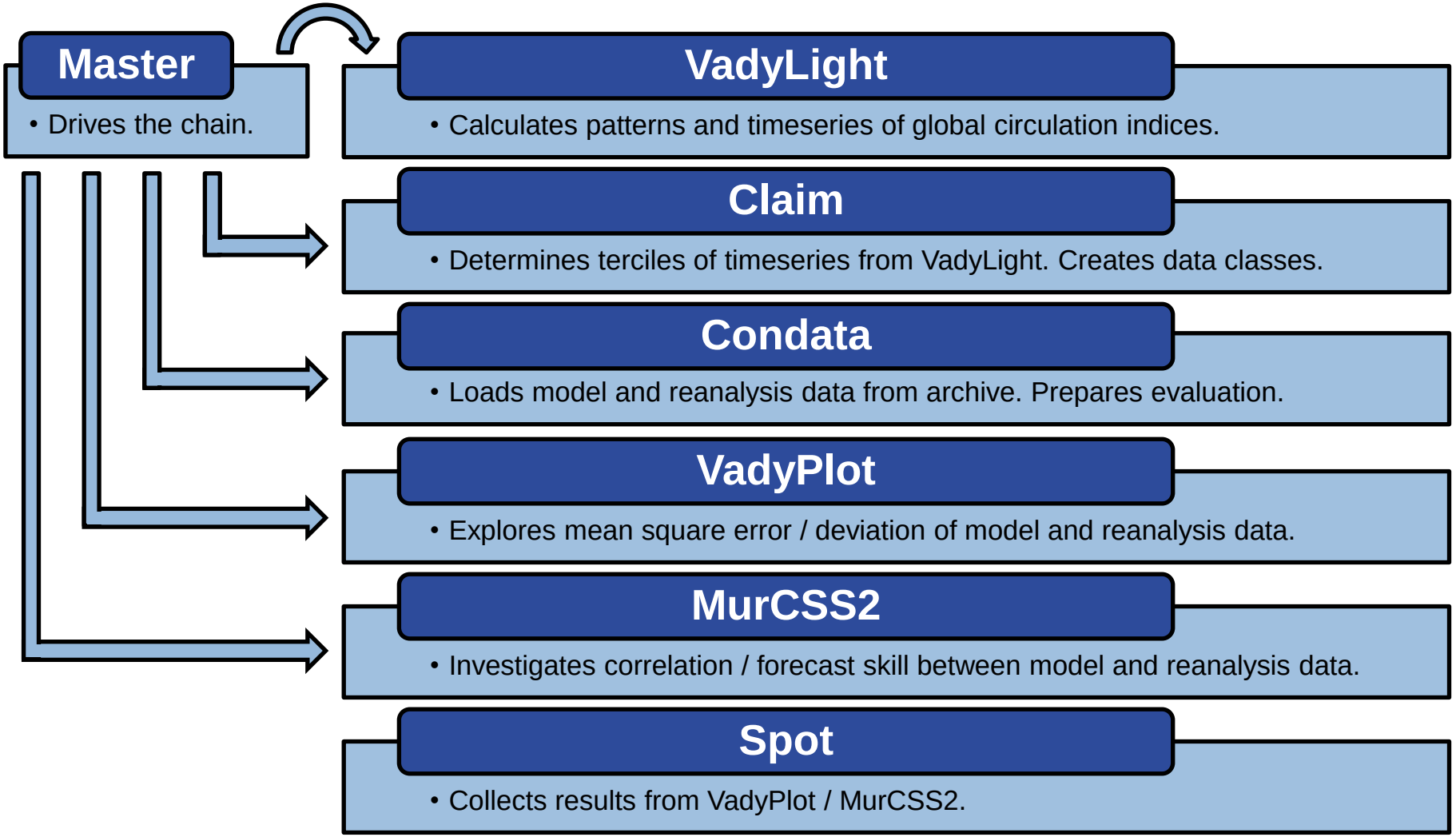
Analysis chain of conditional evaluation



Analysis chain of conditional evaluation



Analysis chain of conditional evaluation



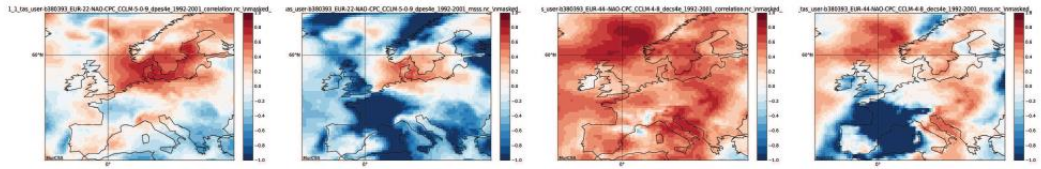
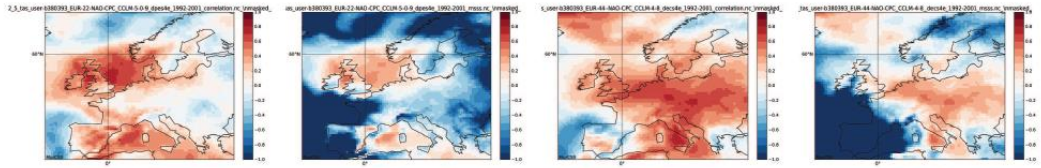
Spot_1992-2001.pdf (Example)

126724.1992-2001.tas.nao.y1.pdf - Adobe Reader

tas
pr
sfcwind

NAO
SCAND
EA
EAWR

126724 / 1992-2001 / tas / NAO / y1

	Preop / regional		Baseline1 / regional	
	Correlation	MSESS	Correlation	MSESS
[LT 1-1]				
[LT 2-5]				

Sascha Brand — MurCSS2 - Overview on results of 1st scan.

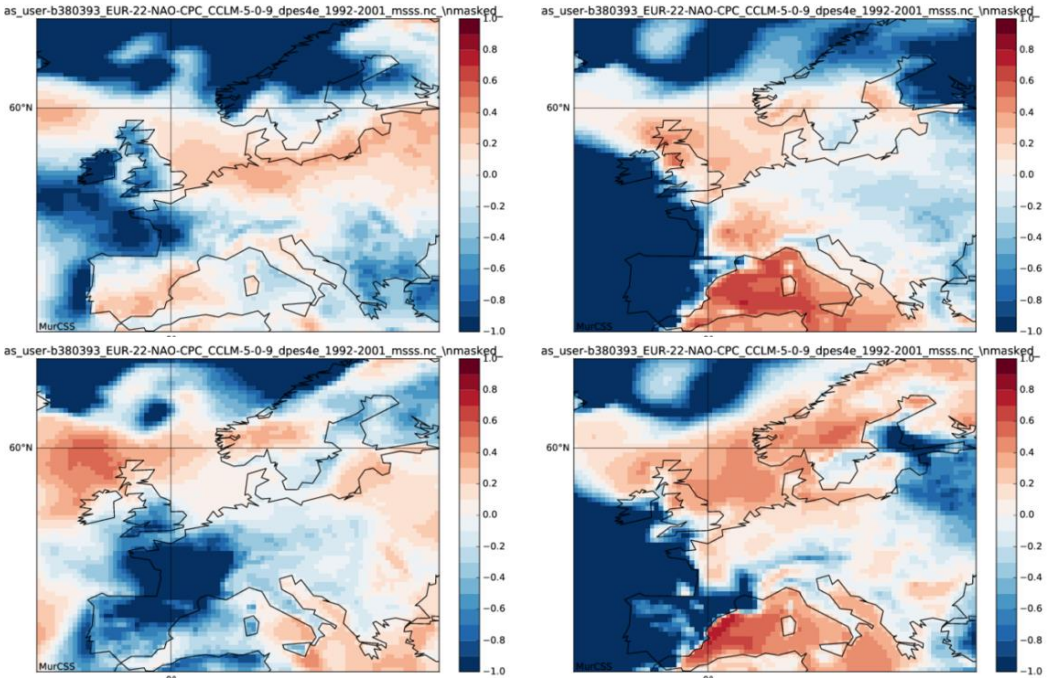
148,2 x 104,8 mm

MSESS (vs. ERA-Interim)
tas, LT1 / LT2-5, 1992-2001

NAO

LT: 1-1

LT: 2-5



[Yes]

[No]

agreement : +/=/-

non-agreement : +/=/-

[Preop-reg]

- One year ago (Graz, 19.09.2017) : 10 decades, full years.
- Similar patterns, regardless of agreement / non-agreement of NAO phase.
- No clear signals except for western Mediterranean Sea, low significances.

MSESS (vs. ERA-Interim)
tas, LT1 / LT2-5, 1965-2007

NAO

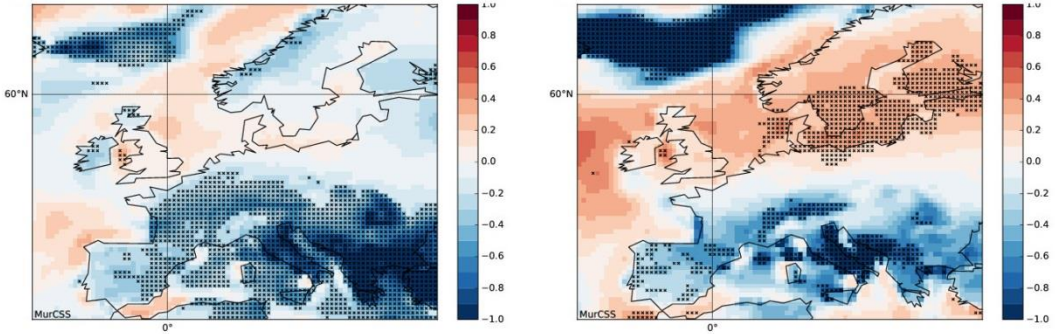
LT: 1-1

LT: 2-5

[JFMOND]

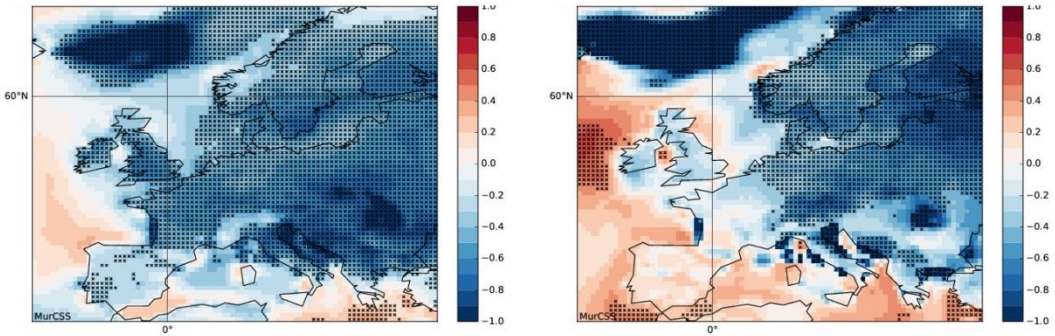
Karlsruhe Institute of Technology

[Yes]



agreement : +/=/-

[No]



non-agreement : +/=/-

[Preop-reg]

- Now (19.09.2018) : 43 decades, winter half years.

MSESS (vs. ERA-Interim)
tas, LT1 / LT2-5, 1965-2007

NAO

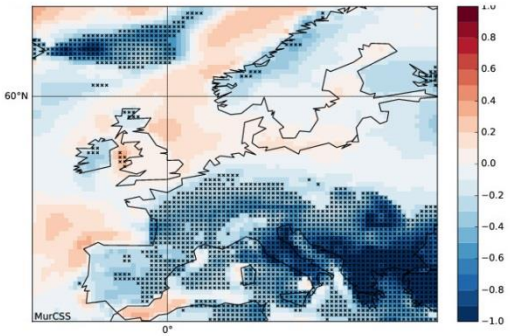
LT: 1-1

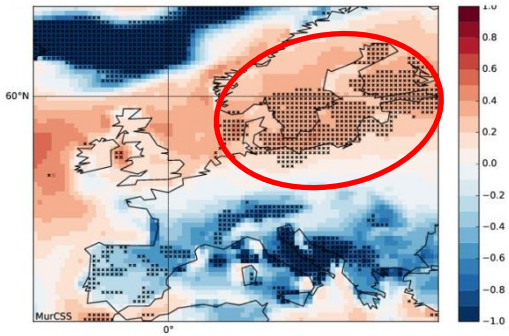
LT: 2-5

[JFMOND]

Karlsruhe Institute of Technology

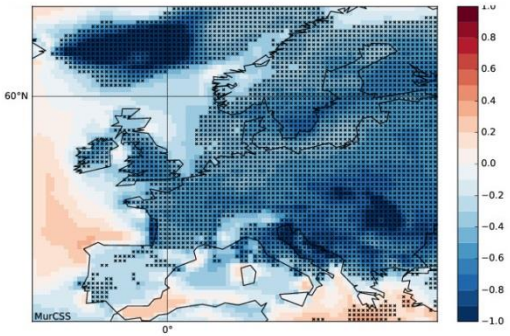
[Yes]

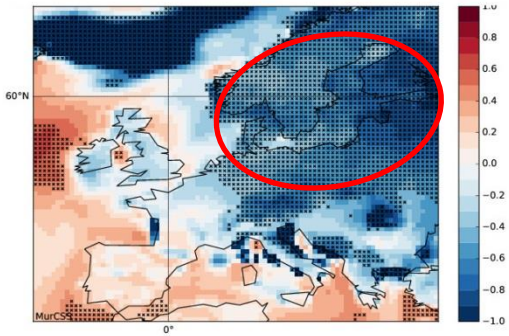




agreement : +/=/-

[No]





non-agreement : +/=/-

[Preop-reg]

- Now (19.09.2018) : 43 decades, winter half years.
- Patterns similar for all cases, but dependency from agreement of NAO phase.
- Significant reversal of signals for Southern Scandinavia & Baltic area.

MSESS (vs. ERA-Interim)
tas, LT1 / LT2-5, 1965-2007

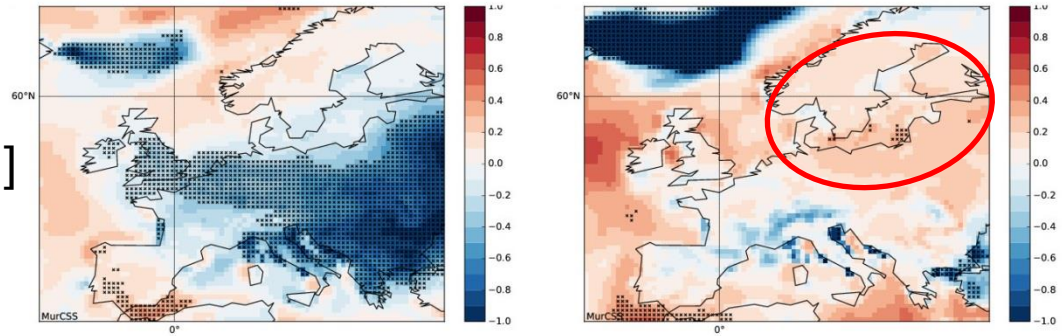
RMSE

LT: 1-1

LT: 2-5

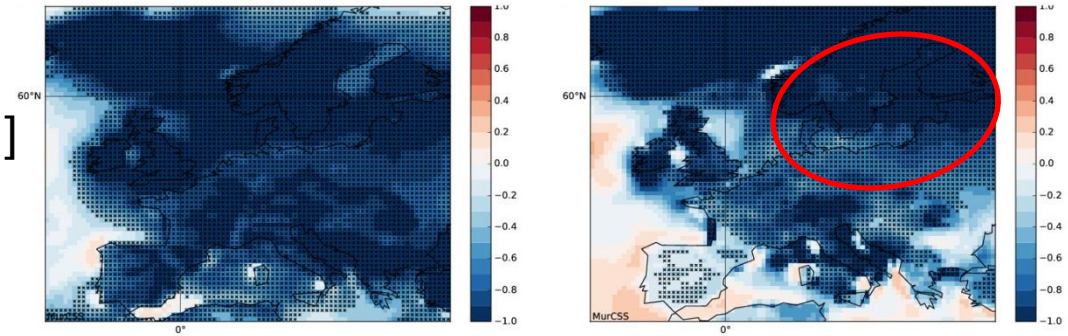
[JFMOND]

[small]



class : -

[large]



class : +

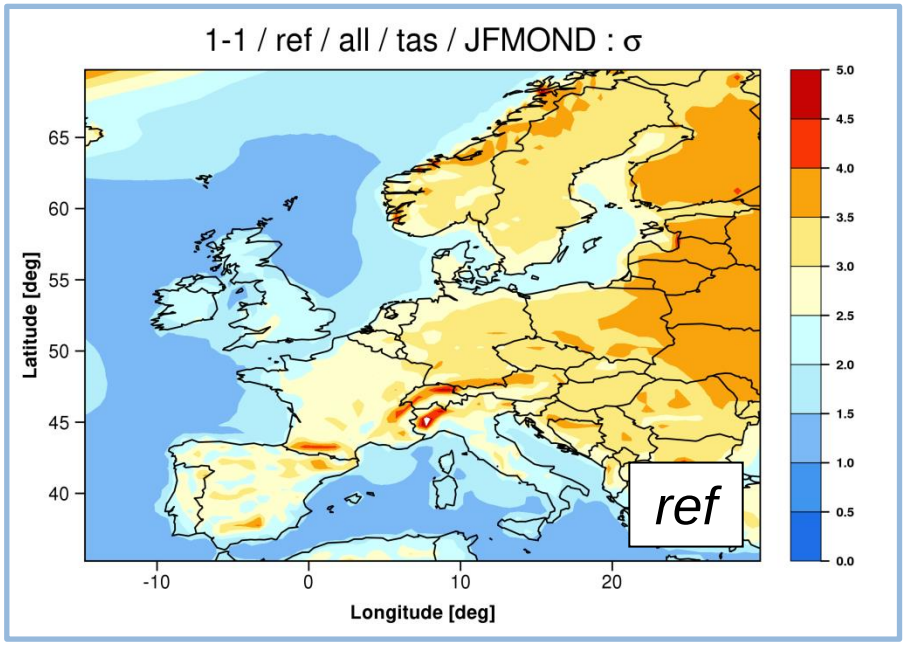
[Preop-reg]

- Structuring with respect to the RMSE as a benchmark.
- Partly resembles results of structuring due to the NAO phase.
- RMSE pattern mainly shaped by NAO as leading mode of atmospheric variability.

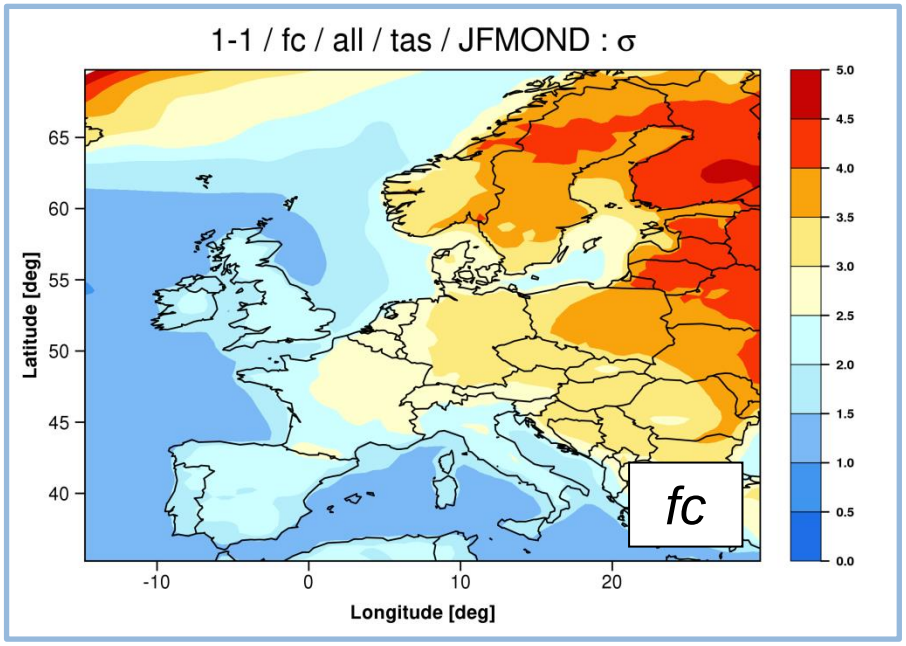
RMSE (vs. ERA-40/Int.), [K]
tas, LT1, 1965-2007, JFMOND

All

baseline1-reg



preop-reg



- Similar patterns for baseline1 and preop.
- Forecast precision best for SW-, worst for NE-Europe (Scandinavia).
- Problems: mountains for baseline1 (resolution), N. Atlantic for preop (ice edge).

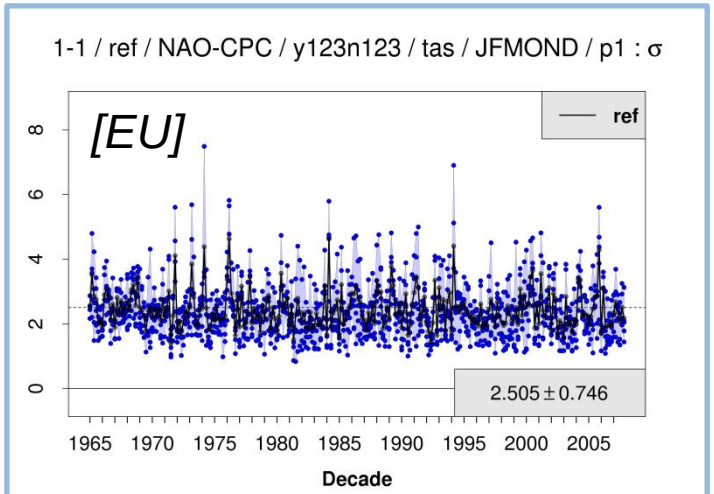
RMSE (vs. ERA-40/Int.), [K]
tas, 1965-2007, JFMOND

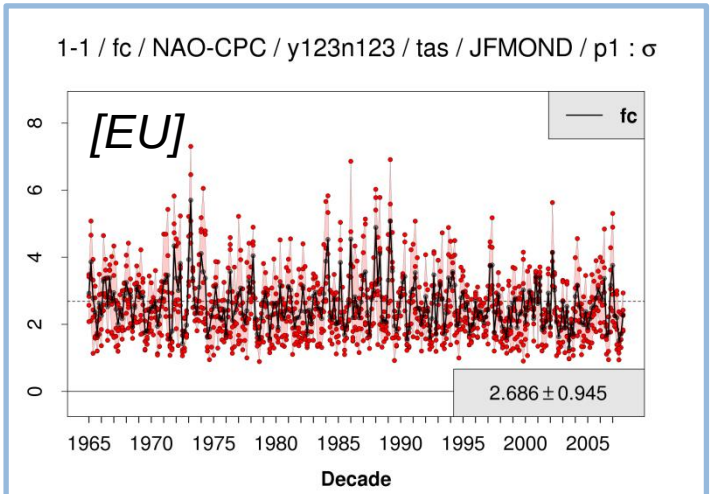
All

baseline1-reg

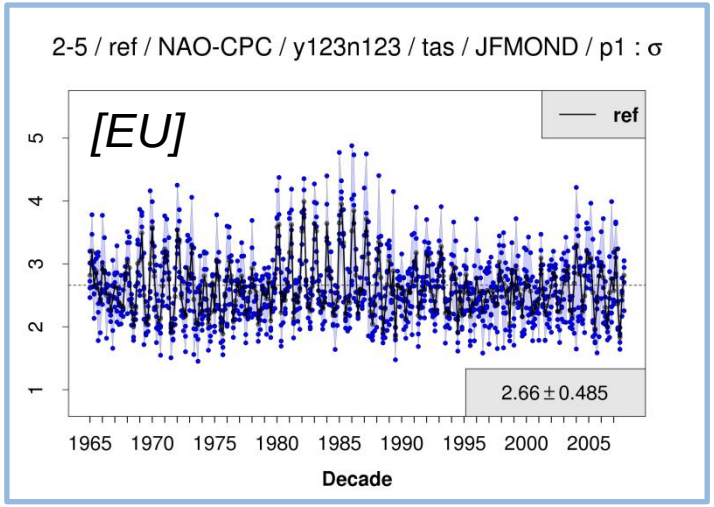
preop-reg

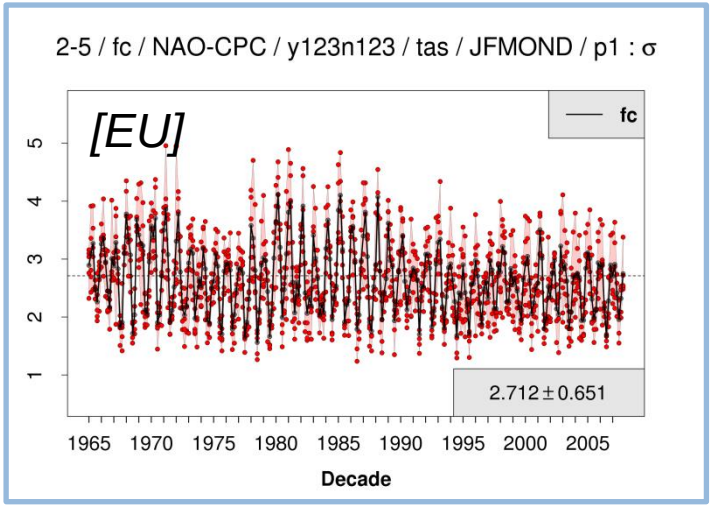
[LT 1]





[LT 2-5]





RMSE (vs. ERA-40/Int.), [K] tas, 1965-2007, JFMOND

Leadtime 1

Table : RMSE for selected NAO classes (LT1-1)

	EU	BI	IP	FR	ME	SC	AL	MD	EA
All	2.69	1.77	1.86	2.25	2.90	3.54	2.60	1.89	3.60
	2.50	1.79	2.39	2.41	2.86	3.05	3.11	2.04	3.42
Yes	2.49	1.64	1.83	2.19	2.68	3.13	2.54	1.86	3.31
	2.47	1.73	2.38	2.38	2.80	2.95	3.05	2.06	3.42
No	2.78	1.83	1.87	2.28	3.00	3.72	2.63	1.90	3.73
	2.53	1.82	2.39	2.43	2.89	3.10	3.14	2.02	3.42
Neg	2.91	1.97	1.93	2.35	3.09	3.96	2.74	1.93	3.81
	2.68	2.09	2.54	2.71	3.19	3.28	3.39	2.07	3.61
Pos	2.54	1.56	1.74	2.17	2.77	3.24	2.49	1.90	3.53
	2.42	1.53	2.22	2.11	2.62	3.02	2.79	1.97	3.39

Leadtime 2-5

Table : RMSE for selected NAO classes (LT2-5)

	EU	BI	IP	FR	ME	SC	AL	MD	EA
All	2.71	1.75	1.85	2.21	2.94	3.54	2.62	1.92	3.71
	2.66	1.91	2.44	2.51	3.05	3.35	3.12	2.05	3.61
Yes	2.52	1.60	1.83	2.10	2.67	3.16	2.54	1.92	3.47
	2.49	1.77	2.44	2.41	2.77	3.00	3.04	2.04	3.38
No	2.81	1.83	1.86	2.27	3.07	3.72	2.67	1.92	3.84
	2.74	1.97	2.44	2.55	3.18	3.52	3.16	2.05	3.73
Neg	2.94	1.96	1.85	2.25	3.11	3.94	2.69	1.93	3.98
	2.82	2.24	2.52	2.75	3.34	3.65	3.36	2.04	3.75
Pos	2.61	1.63	1.84	2.22	2.94	3.34	2.63	1.91	3.63
	2.59	1.67	2.38	2.28	2.87	3.27	2.88	2.02	3.55

(Black : preop-reg ; Grey : baseline1-reg)

- BI : British Isles
- IP : Iberian Peninsula
- FR : France
- ME : Middle Europe
- SC : Scandinavia
- AL : Alps
- MD : Mediterranean Sea
- EA : Eastern Europe

RMSE (vs. ERA-40/Int.), [K] tas, 1965-2007, JFMOND

Leadtime 1

Table : RMSE for selected NAO classes (LT1-1)

	EU	BI	IP	FR	ME	SC	AL	MD	EA
All	2.69	1.77	1.86	2.25	2.90	3.54	2.60	1.89	3.60
	2.50	1.79	2.39	2.41	2.86	3.05	3.11	2.04	3.42
Yes	2.49	1.64	1.83	2.19	2.68	3.13	2.54	1.86	3.31
	2.47	1.73	2.38	2.38	2.80	2.95	3.05	2.06	3.42
No	2.78	1.83	1.87	2.28	3.00	3.72	2.63	1.90	3.73
	2.53	1.82	2.39	2.43	2.89	3.10	3.14	2.02	3.42
Neg	2.91	1.97	1.93	2.35	3.09	3.96	2.74	1.93	3.81
	2.68	2.09	2.54	2.71	3.19	3.28	3.39	2.07	3.61
Pos	2.54	1.56	1.74	2.17	2.77	3.24	2.49	1.90	3.53
	2.42	1.53	2.22	2.11	2.62	3.02	2.79	1.97	3.39

Leadtime 2-5

Table : RMSE for selected NAO classes (LT2-5)

	EU	BI	IP	FR	ME	SC	AL	MD	EA
All	2.71	1.75	1.85	2.21	2.94	3.54	2.62	1.92	3.71
	2.66	1.91	2.44	2.51	3.05	3.35	3.12	2.05	3.61
Yes	2.52	1.60	1.83	2.10	2.67	3.16	2.54	1.92	3.47
	2.49	1.77	2.44	2.41	2.77	3.00	3.04	2.04	3.38
No	2.81	1.83	1.86	2.27	3.07	3.72	2.67	1.92	3.84
	2.74	1.97	2.44	2.55	3.18	3.52	3.16	2.05	3.73
Neg	2.94	1.96	1.85	2.25	3.11	3.94	2.69	1.93	3.98
	2.82	2.24	2.52	2.75	3.34	3.65	3.36	2.04	3.75
Pos	2.61	1.63	1.84	2.22	2.94	3.34	2.63	1.91	3.63
	2.59	1.67	2.38	2.28	2.87	3.27	2.88	2.02	3.55

(Black : preop-reg ; Grey : baseline1-reg)

- Preop vs. baseline1: RMSE smaller towards SW-, larger towards NE-Europe.
- Yes vs. no: RMSE smaller, if NAO phase agrees with reanalysis.
- NAO- vs. NAO+: RMSE smaller for positive phase of NAO.

Summary & Outlook

- MiKlip II – regional : Potential of interannual to decadal forecasts ?
- Conditional evaluation (surface temperature) :
  - Winter half years of available decades (43) analyzed.
  - Predictability (MSESS) enhanced for NAO agreement.
  - Areas of enhanced skill for NAO agreement (Scandinavia, Baltic S.).
  - Similar results for stratification by RMSE, especially year 2-5.
  - RMSE w.r.t. reanalysis with SW-NE gradient for preop & baseline1.
  - Preop better for SW- Europe, baseline1 better for NE-Europe.
  - Smaller RMSE for NAO agreement and for NAO+.
  - „Brand et al. (2018)“ in preparation.

Thanks for Your attention!