Federal Service for Hydrometeorology
and Environmental Monitoring

VOEIKOV MAIN GEOPHYSICAL OBSERVATORY

Since 1849

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Seasonal and sub-seasonal prediction at Voeikov Main Geophysical Observatory

Vladimir Kattsov and Victoria Mirvis

APCC Symposium, Busan, 18-20 September 2007

The Ob catchment:
Snow mass anomaly (kg) evolution
as simulated by the ensemble of IPCC AOGCMs (A2)

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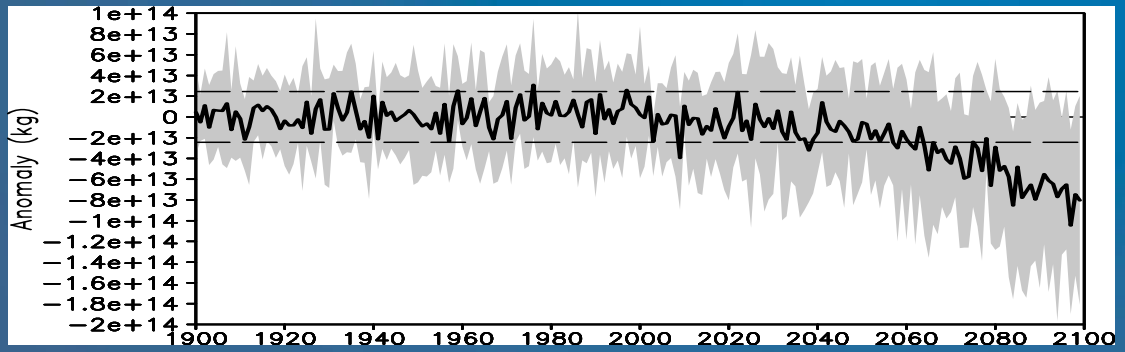
March



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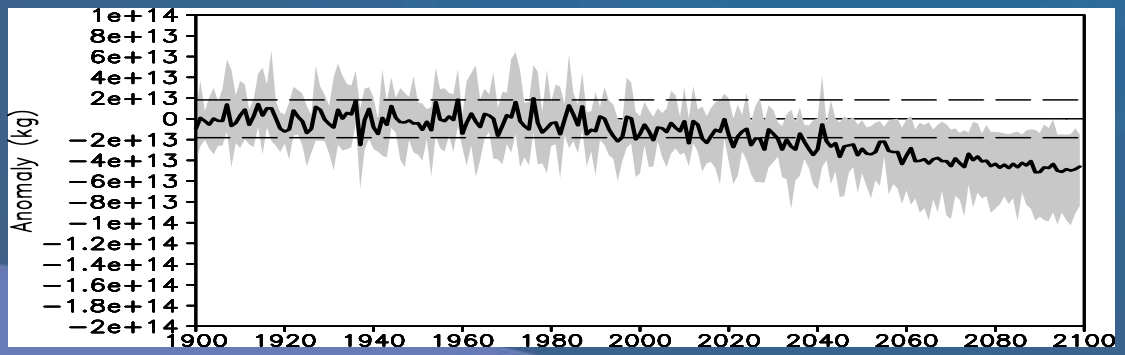

Kattsov et al., 2007

The Lena catchment:
Snow mass anomaly (kg) evolution
as simulated by the ensemble of IPCC AOGCMs (A2)

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Kattsov et al., 2007

MGO_AM2
seasonal forecasting

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- Resolution T42L14
- Parameterizations: solar/terrestrial radiation with diurnal cycle; computed clouds/optical properties; Tiedtke convection; orography-induced gravity wave drag; boundary layer; land surface; slab ocean
- Ensemble size – 10 members (5 and 5 members produced by breeding technique from 2 sequential dates)
- 4 seasons with 1 month lead time (for APCC)
- (+ since 2007 – every month for 3 months, 7 members)
- Initial SST anomalies from NESDIS data set

APCC
T-850 summer hindcasts (1983-2003)
NH extratropics

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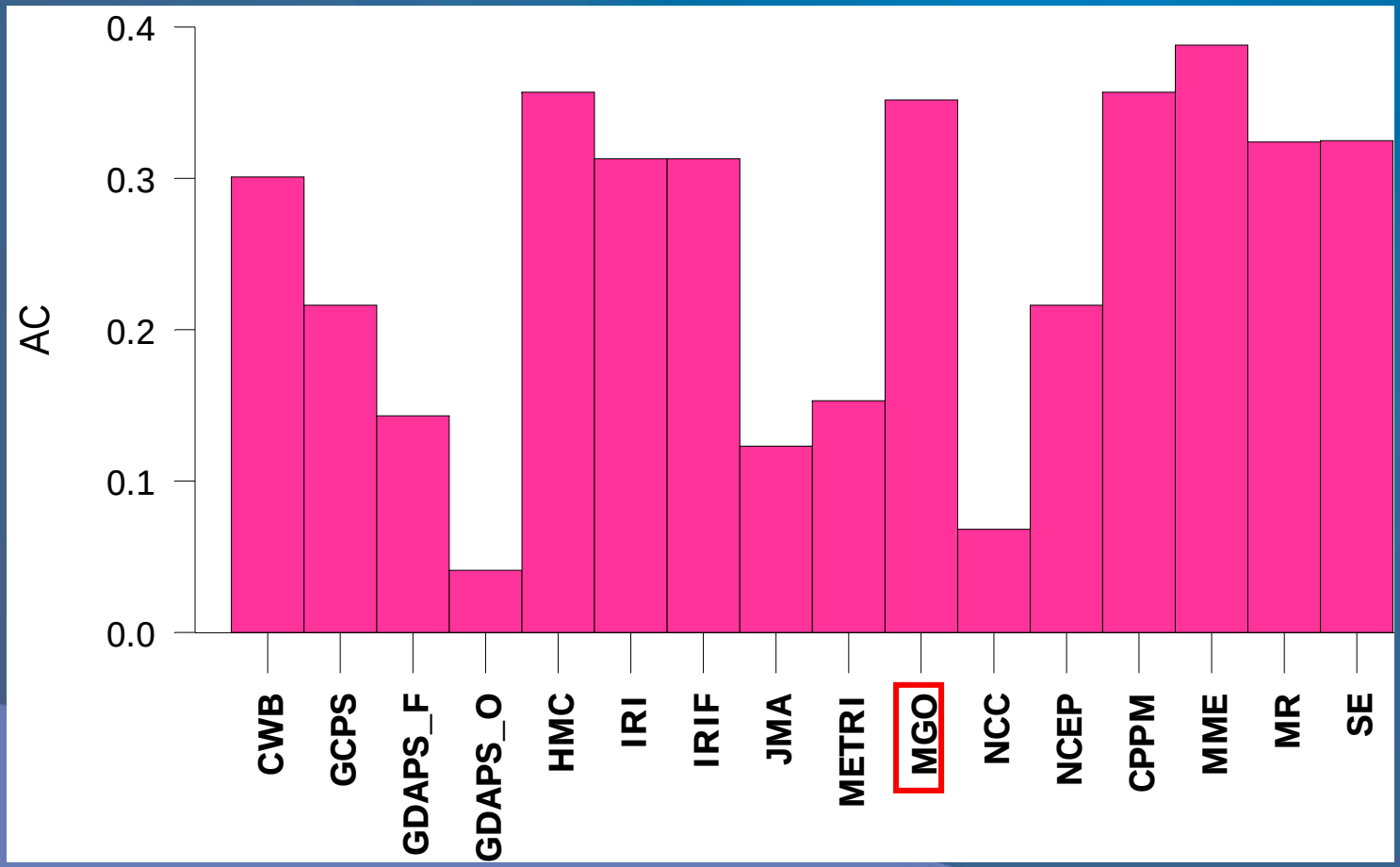

MGO_AM2
T-850 seasonal hindcasts (1978-2001)

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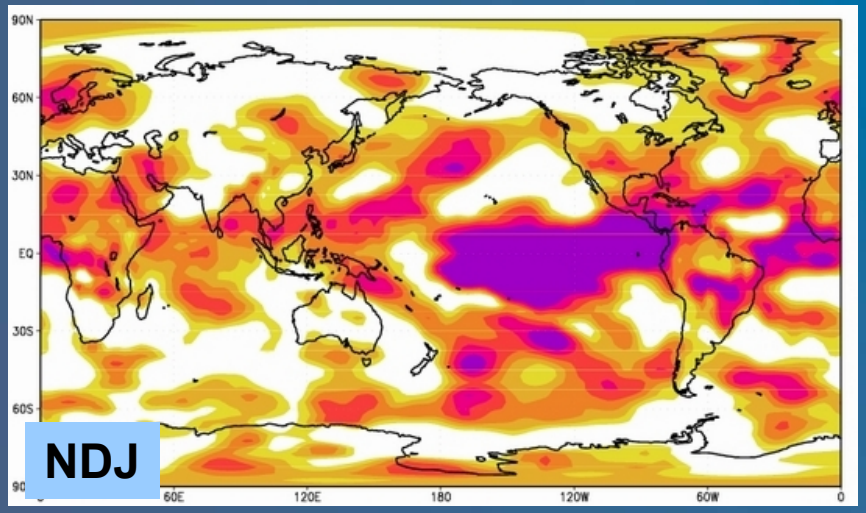

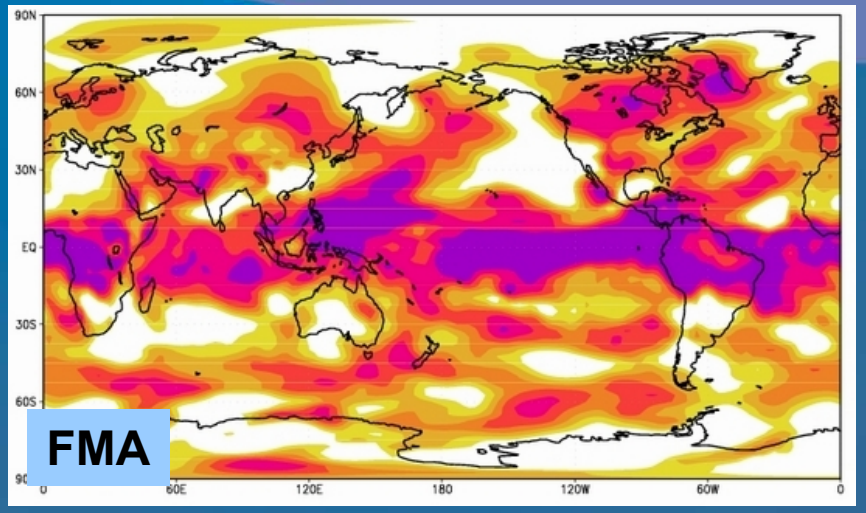

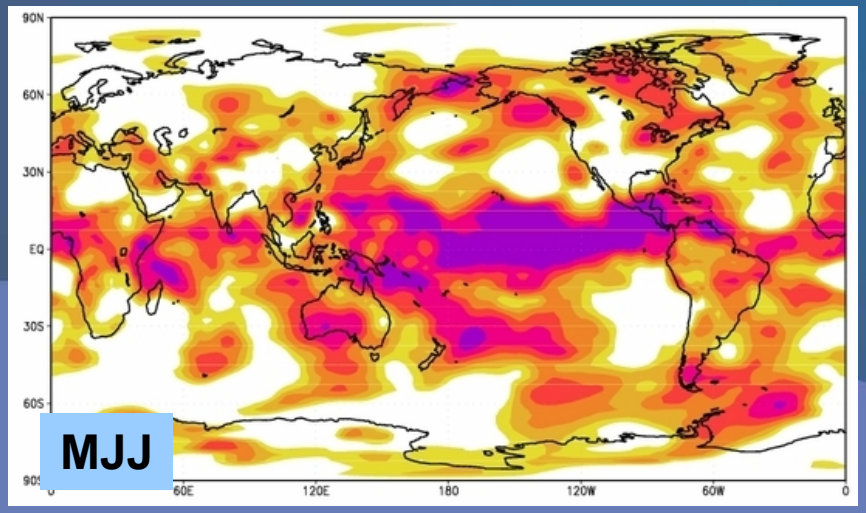

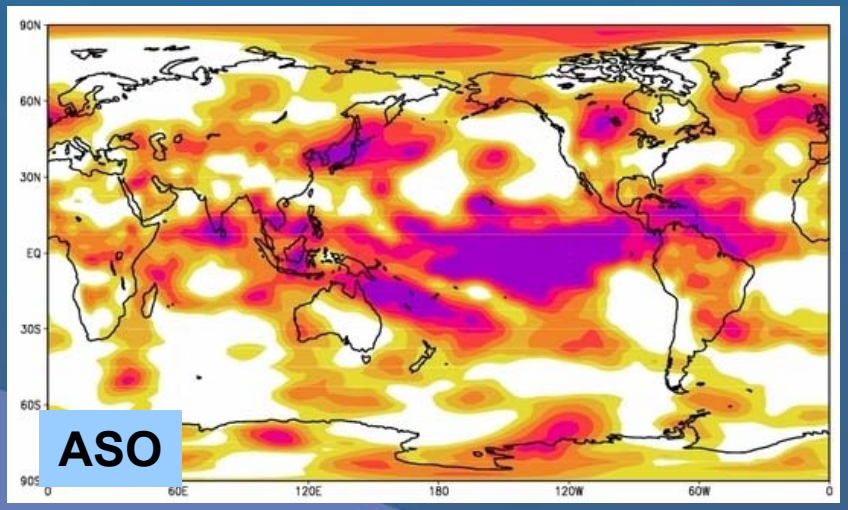

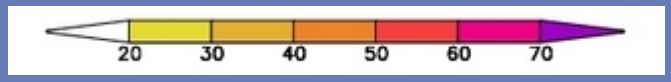

MGO_AM2
potential predictability associated with soil moisture (1979-2000)

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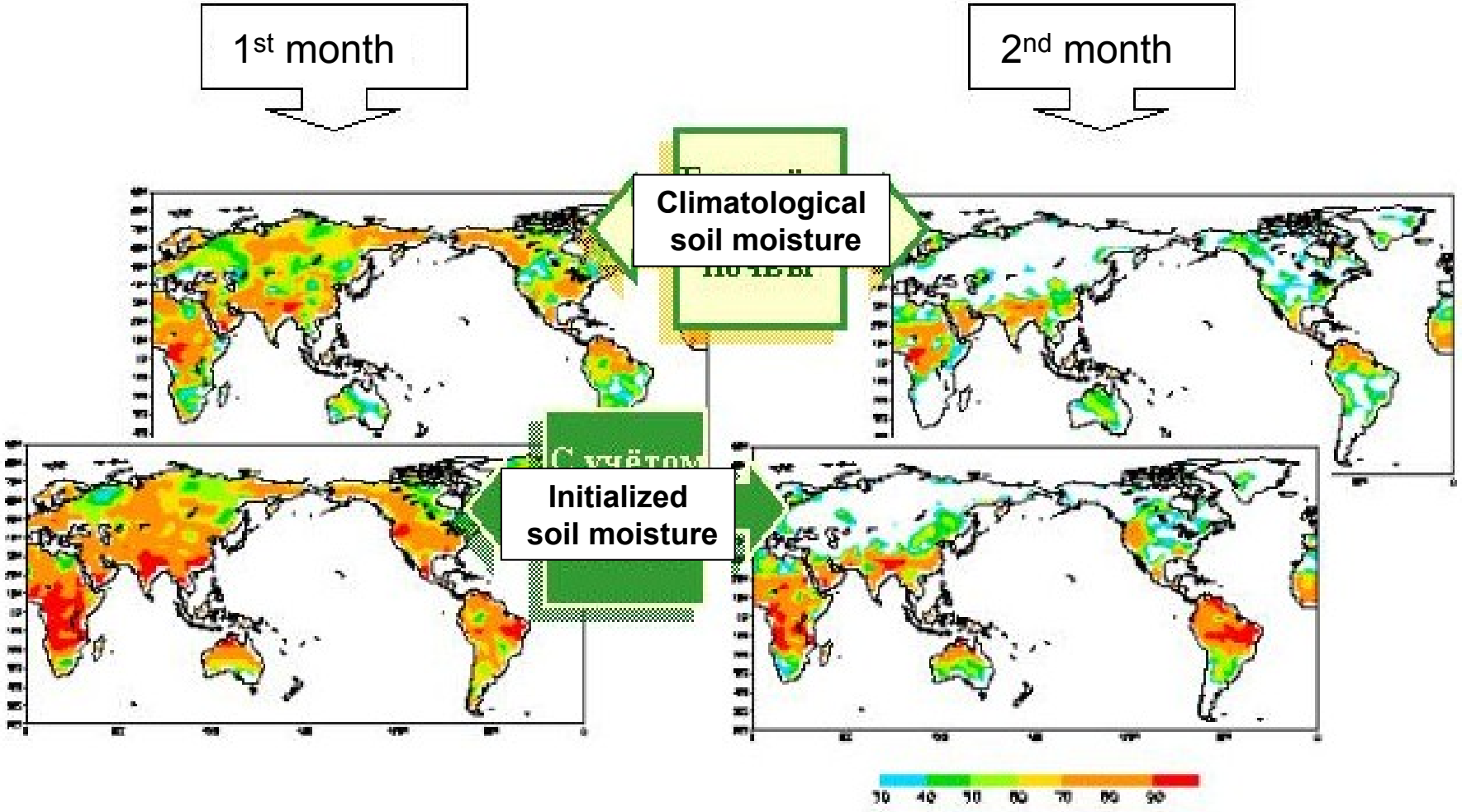

Monthly forecasting

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- Resolution T42L14
- Ensemble size – 9 members (breeding)
- weekly
- 00 UTC from HMC operational atmosphere analyses
- Initial SST anomalies from NESDIS data set

Stations for T_{2m} and P forecasts verification

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AC of monthly T_{2m} forecasts (time series)

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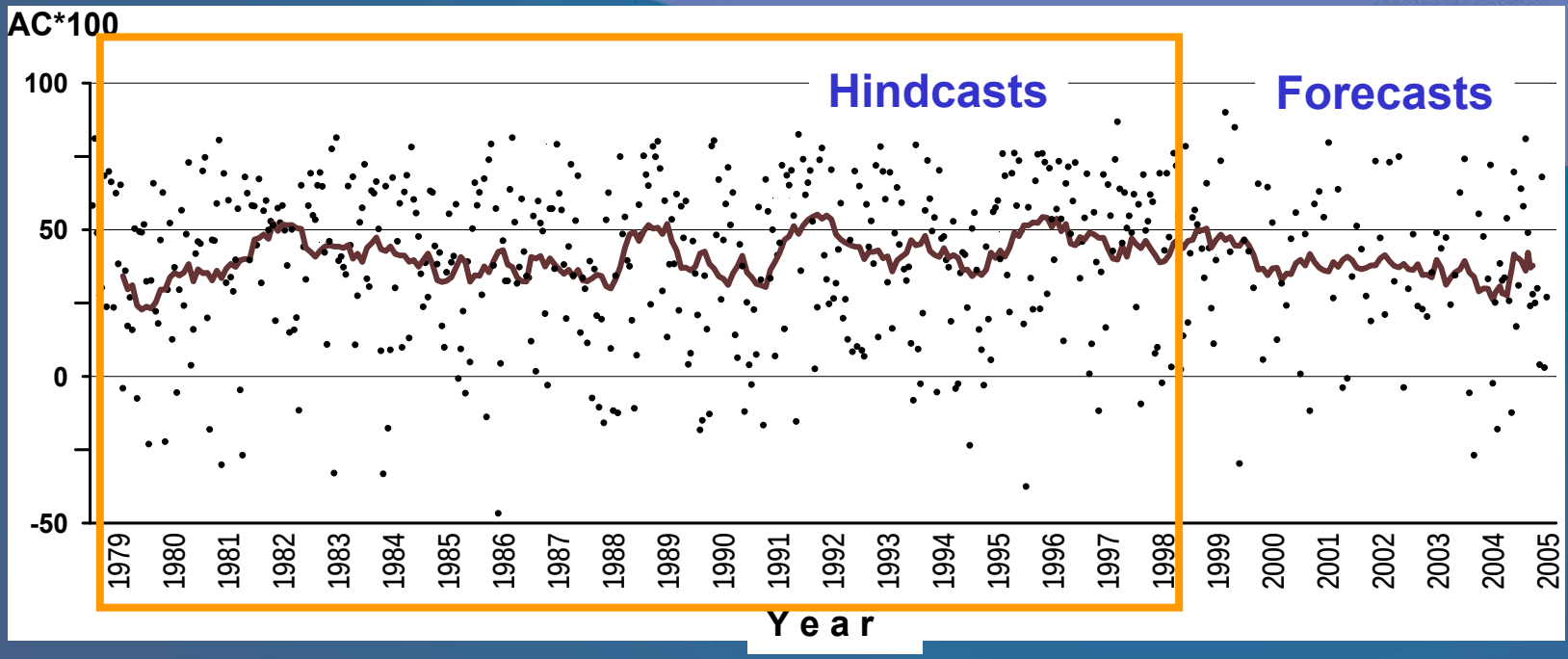

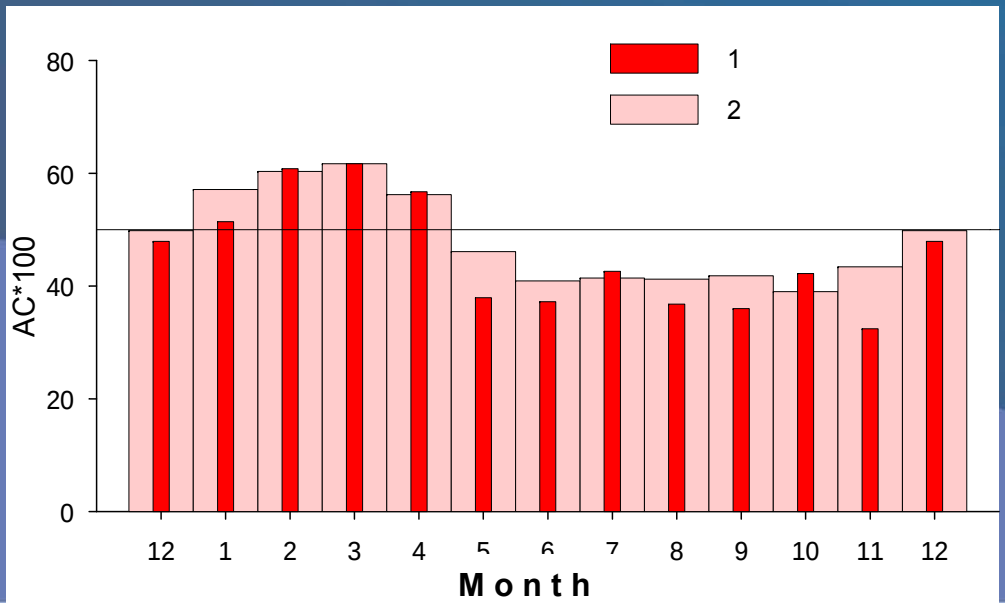

Monthly (1) and seasonal (2) average AC

RMSSS *cl (%)* of monthly T_{2m} forecasts

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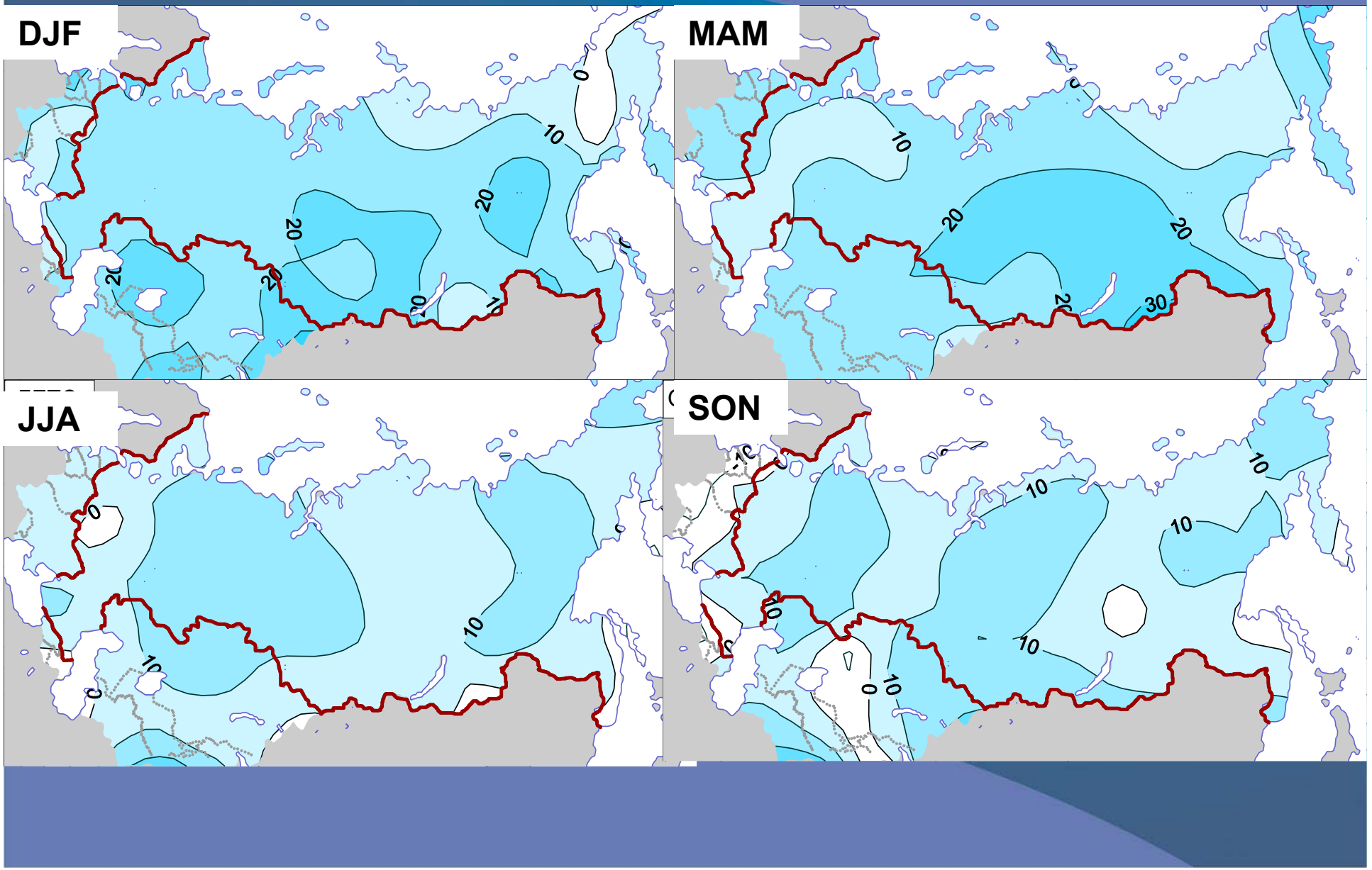

T_{2m} forecasts over Russia

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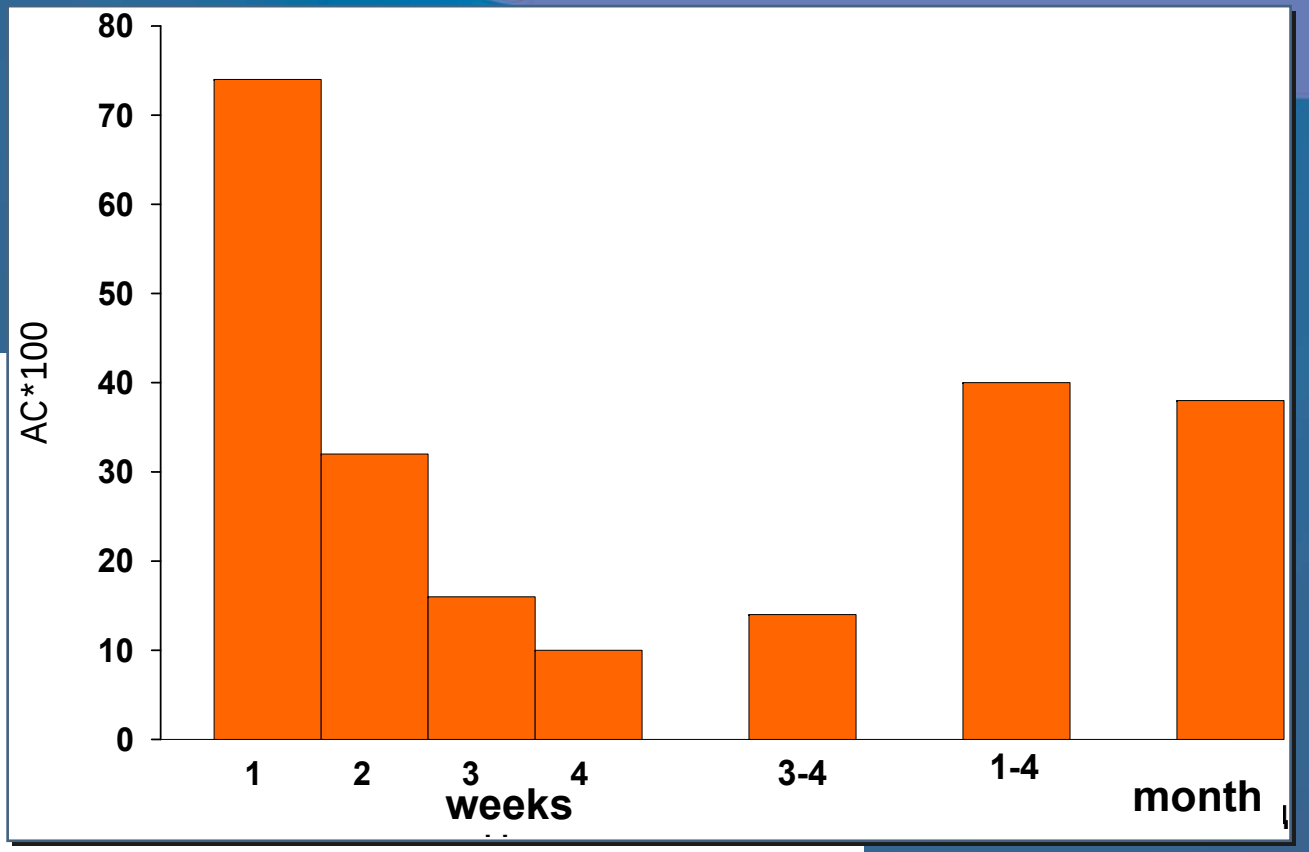

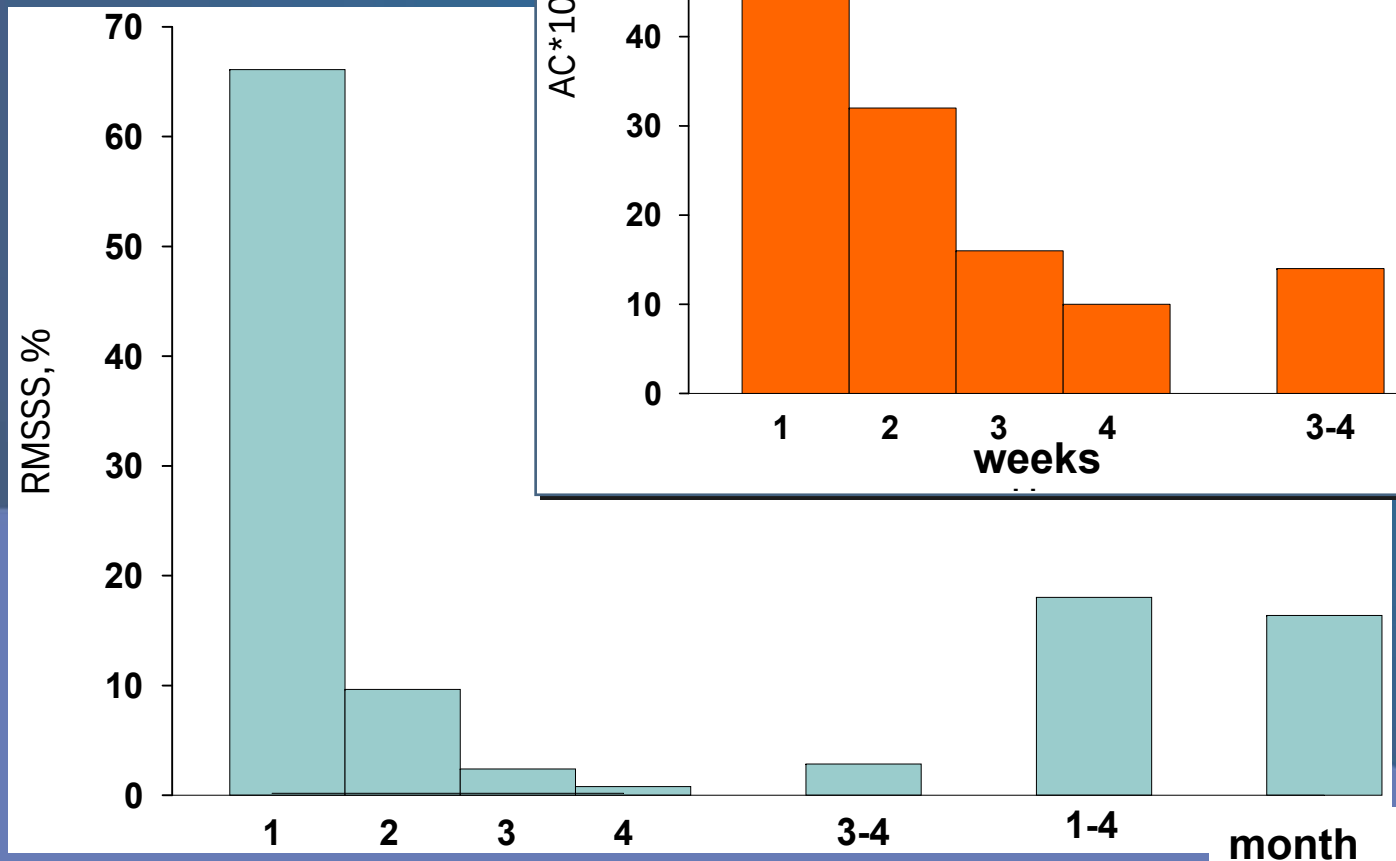

Probabilistic forecast (example)

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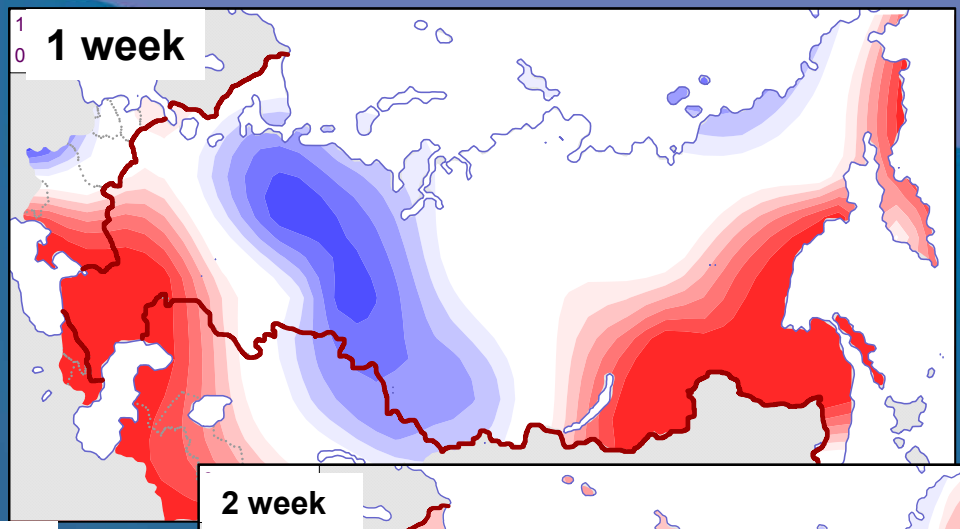
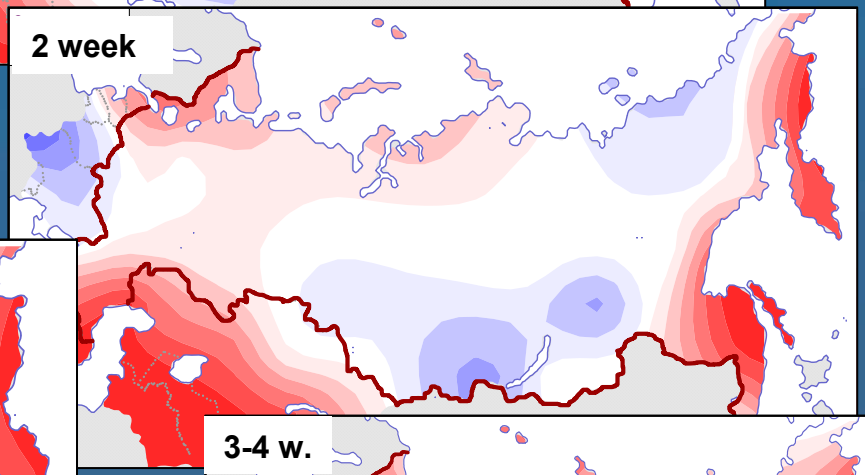
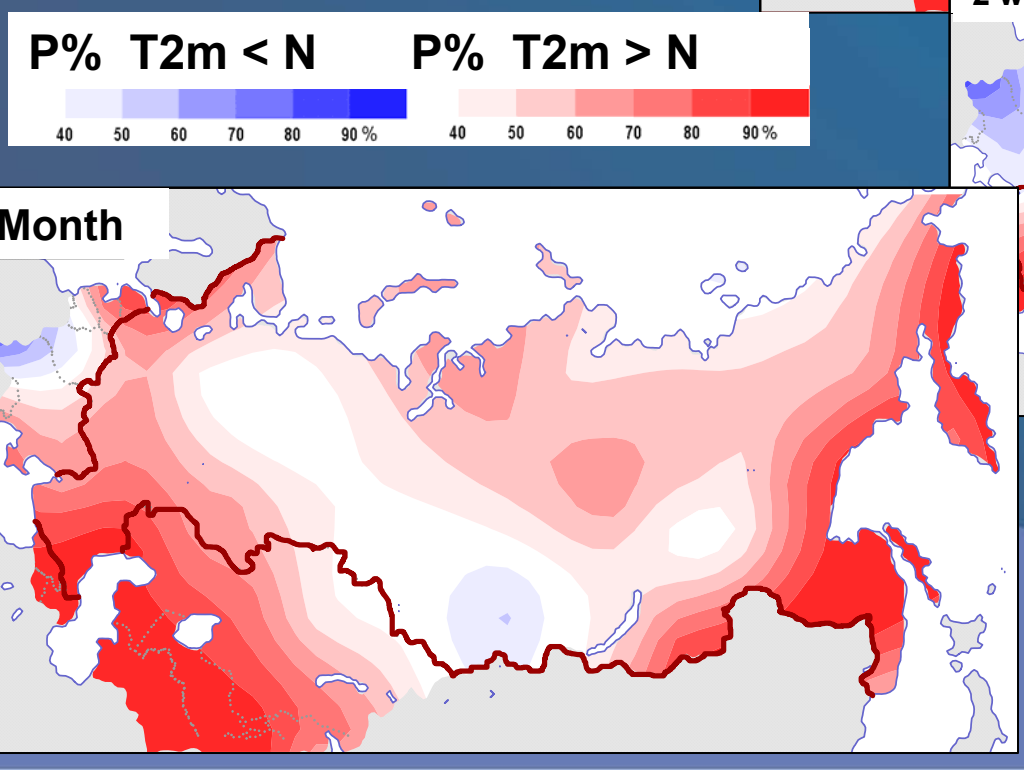
below normal (<N),

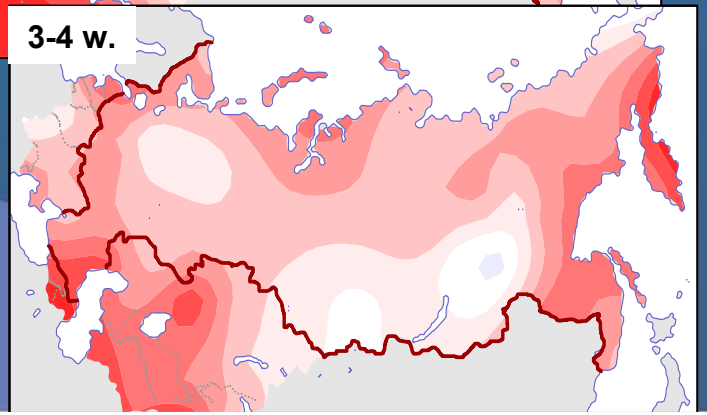
near normal (N),

above normal (>N)









MGO_AM2
recent developments

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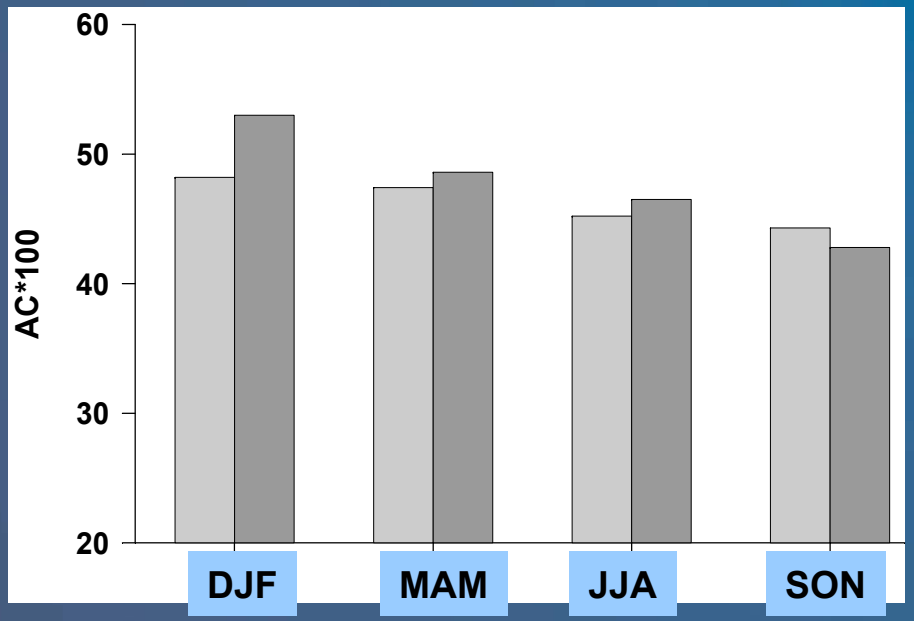
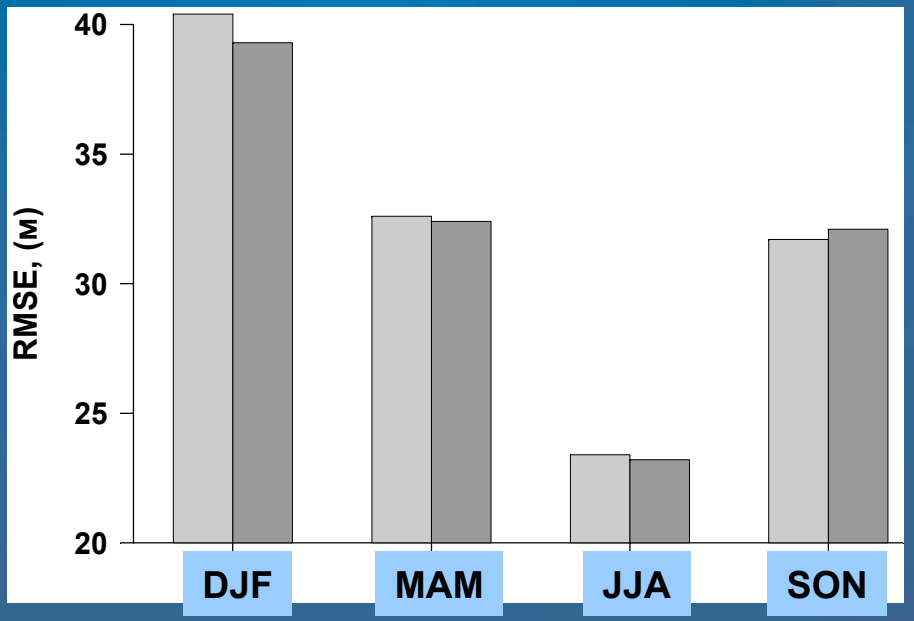
- T42L14 => T63L14

H-500





T42 T63

MGO_AM2
recent developments

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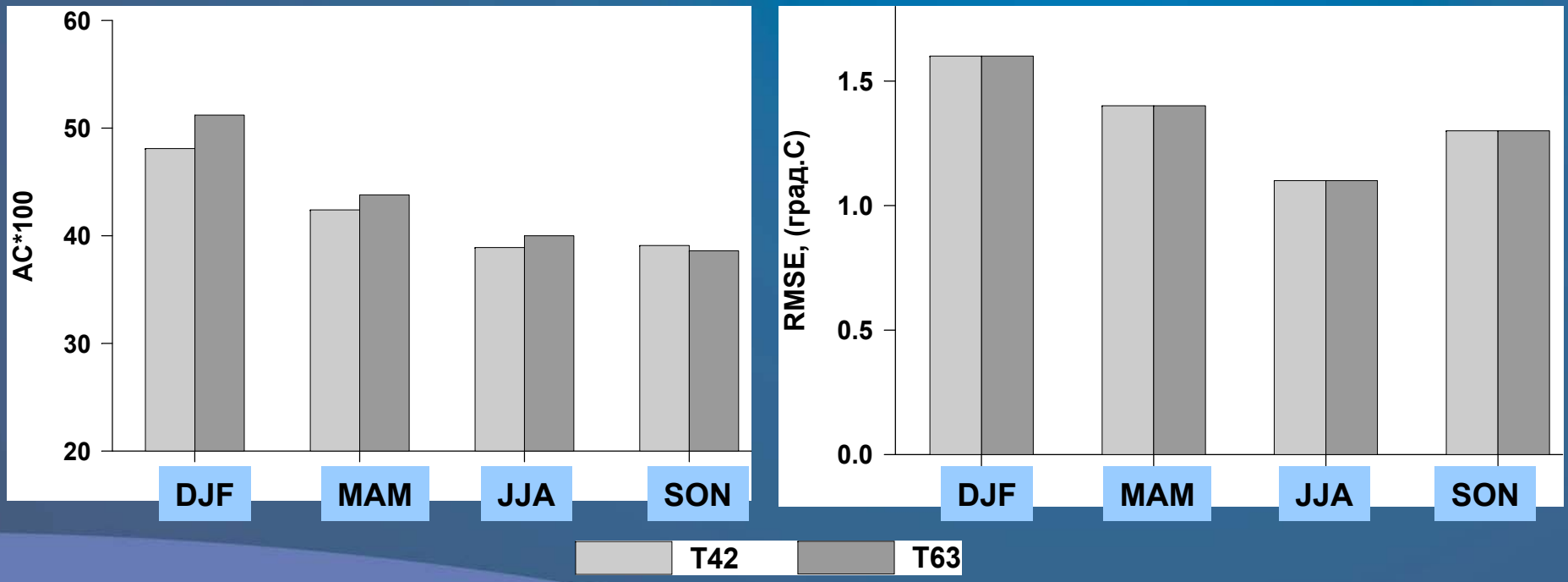
- T42L14 => T63L14



WMO WCC-3

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12 to 16 October 2009 in Geneva

The overarching theme for the WCC-3: "**Climate Prediction for Decision Making: Focusing on Seasonal to Inter-annual Timescales**".

Four scientific sub-themes:

(1) climate prediction science;

(2) maximizing global exchange, sharing and application of climate prediction products;

(3) applications and socio-economic benefits of climate prediction;

(4) using climate predictions in decision-making.

WMO XV Congress suggested a conference title of "**Predicting Weather and Climate for a Changing World**" with the understanding that the final title would be set in the course of the organization of the Conference.

WMO WCC-3

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Scientific segment

- Build more social science into the science sessions – economics etc
- Improve linkages between users and providers of climate information
- Multi/disciplinary, multi/theme RCCs and their role, (role of training)
- Consider not only extreme events but extended conditions, such as droughts that are important economically;
- WCC-3 should not be another UNFCCC discussion on climate change, but focus on near term climate conditions (current state, season to inter-annual predictions) and their impact and responses.
- Long-term climate changes over a 25 to 50 year period as a way to analyze the evolution of seasonal to inter-annual climate phenomena and impacts, e.g., extreme events are affected by the evolution of climate over decades.
- Since WCC3 will be 2 years after the IPCC AR4, the WCC3 will need to consider whether there are scientific advances on ACC that might change the context for the conference.
- Consider observing systems in the context of GEOSS.

WMO WCC-3

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High-level segment

- High/level segment must have important outcomes or a WCC-3 is not worth having;
- WCC-3 should be a conference of delivery with decision makers working in partnership with others to bring proposed projects/actions to the conference;
- Defining, developing and implementing climate-equipped, multihazard Early Warning Systems (EWS) should be a key theme of the Conference;
- The conference should spur the completion of the coordinated climate-related observing systems;
- Advancing climate prediction science should be a major goal of a WCC-3 with a focus on key needs, such as enhanced super computing for climate modeling and interdisciplinary research, incorporating the social and economic sciences;
- There is a need to involve a range of users in a proposed WCC-3 and to work with users to develop climate information products and services to meet their needs;

WMO WCC-3

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High-level segment

- The RCCs should evolve into multi-disciplinary, multi thematic centers of action on climate information for applications, e.g., focal points for climate risk management in their regions;
- Most countries are vulnerable to climate hazards, such as extreme events and need better ways to anticipate and respond to them. Developing pro/active mechanisms to prepare for climate hazards (e.g., EWS) can mitigate the impacts of these hazards. Implementing EWSs should be a major response to mitigating the impacts of extreme events:
- The process of organizing a WCC3 should foster lasting relationships between relevant stakeholders, in particular between NMHSs and end users at various levels of government and in the private sector;
- The Conference should lead to improved coordination and response on climate at the international level.
- Climate activities have grown over 20 years, and the adequacy of current coordination mechanisms would benefit from being accessed.

WMO WCC-3

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WCC-3 Ad Hoc Exploratory Committee (28-29 April 2005)

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Additional figures

Verification of deterministic forecasts

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1. Mean error

$$ME = \frac{\sum_i (F_i - O_i) \cdot \cos\varphi_i}{\sum_i \cos\varphi_i}$$

2.Rout mean square error

$$RMSE = \sqrt{\frac{\sum_i \cos\varphi_i (F_i - O_i)^2}{\sum_i \cos\varphi_i}}$$

3. Rout Mean Squared Skill Score

$$RMSSS_{cl} = (1 - RMSE_m / RMSE_{cl})$$

4. Anomaly correlation

$$AC = \frac{\sum_i \cos\varphi_i (\Delta F_i - \Delta\overline{F}) \cdot (\Delta O_i - \Delta\overline{O})}{\sqrt{\sum_i \cos\varphi_i (\Delta F_i - \Delta\overline{F})^2 \cdot \sum_i \cos\varphi_i (\Delta O_i - \Delta\overline{O})^2}}$$

5. Two categorical statistic (ρ)

$$\rho = \frac{n_+ - n_-}{n_+ + n_-}$$

6. Relative error

$$Q = \frac{1}{n_i} \sum_i \frac{(F - O)^2_i}{\sigma^2_i}$$

F– forecasts , *O* – observations

Verification of probabilistic forecasts

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Probability Score(Brier score)

$$PS = 1 - \frac{1}{2n}\sum_{i=1}^{n}\sum_{j=1}^{k}(P_{ji} - d_{ji})^2$$

Ranked Probability Score

$$RPS = 1 - \frac{1}{2n}\sum_{i=1}^{n}\sum_{r=1}^{k}(SP_{ri} - Sd_{ri})^2$$

$$SP_{ri} = \sum_{j=1}^{r} P_{ji} \qquad Sd_{ri} = \sum_{j=1}^{r} d_{ji}$$

Brier skill score SSPS

$$SSPS_c = \frac{SSPS_m - SSPS_c}{1 - SSPS_c} \cdot 100\%$$

Reliability diagram

ROC (Relative operating characteristic)

Relative (economic) value

$$V = \frac{E_c - E_m}{E_c - E_i}$$

$$r = C/L$$

ROC (Relative Operating Characteristics) diagrams of the probability that the weekly mean T_{2m} are in the upper tercile

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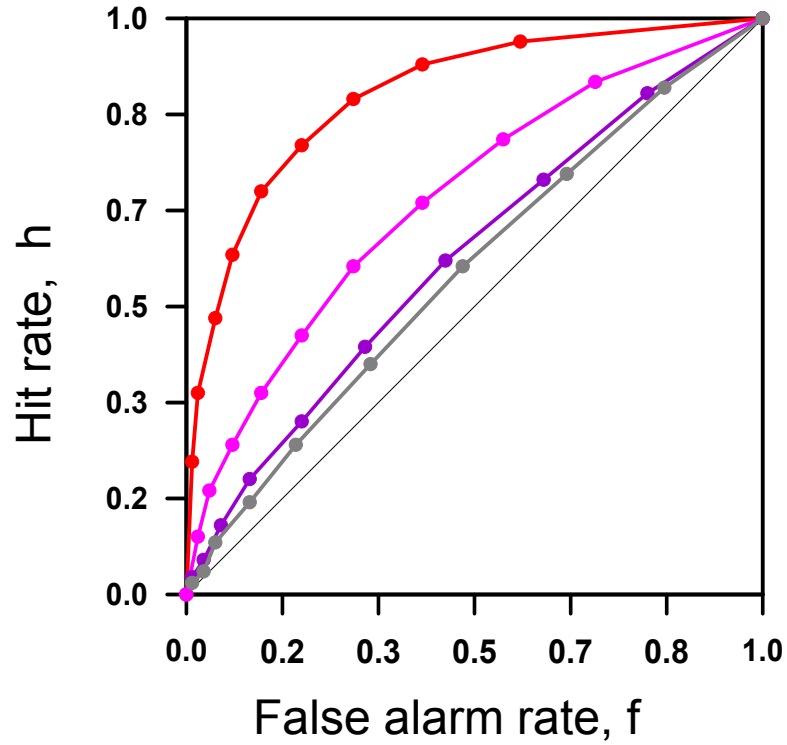

ROC: 0.87, 069, 0.59, 0.56

- 1 week (2- 8 days)
- 2 week (9-15 ")
- 3 week (16-22 ")
- 4 week (23-29 ")

Relative economic value for monthly T2m anomalies 480*70 cases: (1979-1998)

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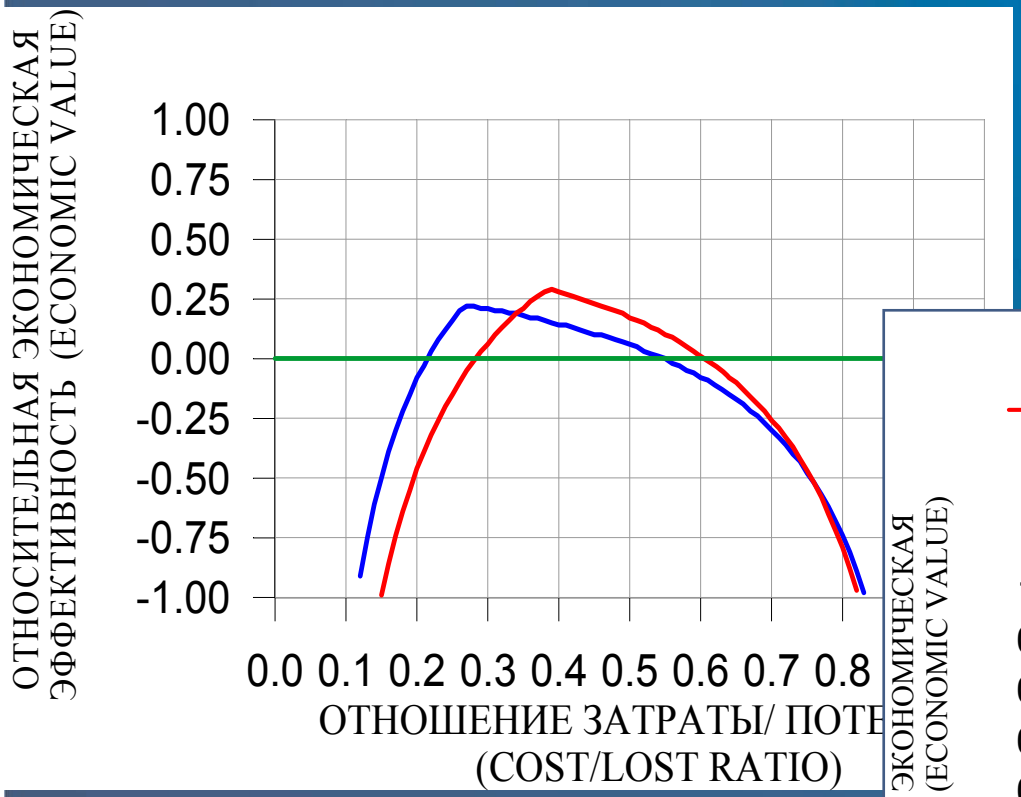

Differents users