

Развитие модели общей циркуляции атмосферы ПЛАВ и ее участие в проекте WP-MIP

Development of SL-AV atmosphere general circulation model and it participation in WP-MIP project

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Content

- SL-AV model description
- Version of SL-AV for subseasonal prediction: results and development
- WP-MIP project and some results for SL-AV

SL-AV global atmosphere model



- Joint development of INM RAS and Hydrometcentre.
- One of 10 original global NWP models
- Hydrometcentre is one of five designated WMO Global Producing centers for SubSeasonal Prediction
- Поддержка грантов РФФ 25-17-00314, 21-17-00254, 21-71-30023

WMO Lead Centre for Sub-seasonal Prediction Multi-Model Ensemble

The Lead Centre for Sub-seasonal Predictions Multi-Model Ensemble (LC-SSPMME) coordinates multi-model ensembles of sub-seasonal forecasts by maintaining an archive containing a set of model fields, by creating graphical products from individual and multi-model ensembles under an agreed format and by creating verification statistics. To provide WMO Members with reliable multi-model ensembles in real time, the LC-SSPMME uses forecast data from several sub-seasonal prediction systems. Forecast data is provided by WMO Global Producing Centres for Sub-seasonal Predictions and by Contributing Centres.

[FORECAST CHARTS](#) [VERIFICATION STATISTICS](#)

Further information on forecast products and forecast digital data is [here](#).

Global producing centre for Sub-Seasonal Predictions (GPC-SSP)

Beijing
Moscow
Tokyo

ECMWF
ECMWF

The GPC-SSP are committed to fulfilling a set of mandatory functions aiming to enhance consistency and usability of forecast information and to facilitate the exchange of data. The timely provision of forecast data to the LC-SSPMME is one of the mandatory functions ([WIPPS](#)).

Contributing centres

Met Office
Exeter
Toulouse

Government of Canada
Montreal
Washington

KMA
Seoul

Глобальная полулагранжева модель атмосферы ПЛАВ

(ПолуЛагранжева, на основе уравнения
Абсолютной Завихренности)



- **Конечно-разностный полунявный полулагранжев блок решения уравнений динамики атмосферы:** несмещенная сетка (Z grid), конечные разности 4го порядка (Tolstykh, Shashkin, Fadeev, Goyman, Geosci. Mod Devel. 2017).
- **Параметризации процессов подсеточного масштаба ALADIN/ALARO,**
- **Блоки расчета коротко- и длинноволновой радиации CLIRAD SW + RRTMG LW,**
- **Модель деятельного слоя суши ИВМ РАН –НИВЦ МГУ, параметризация неорографического ГВС: из модели климата ИВМ РАН, доработаны**
- **Параметризации и усовершенствования собственной разработки**
- **Пока простая модель эволюции ТПО**

SL-AV applications at Hydrometcentre of Russia



Medium-range deterministic forecast
0.1° in longitude , 0.08-0.13° in latitude,
104 levels



Medium-range ensemble prediction system
0.225° in longitude, 0.16°-0.24° in latitude , 51 levels

Subseasonal and seasonal ensemble
forecast
0.9°x0.72°L96



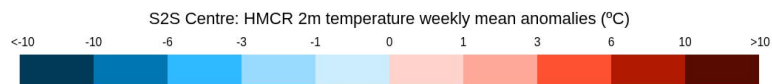
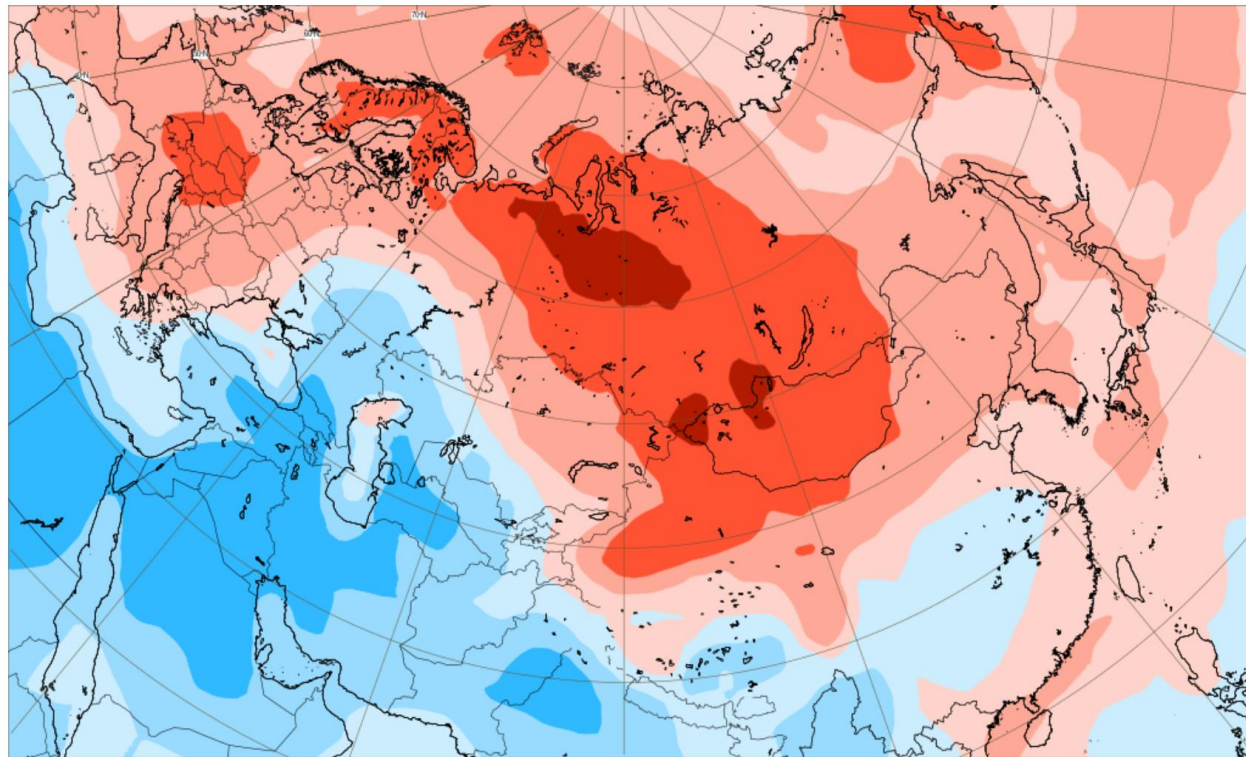
Subseasonal forecast

- The impact of atmospheric initial conditions is less important than for medium range forecast
- Usually presented as weekly anomalies and probabilities
- Many practical applications for 2-3 weeks forecasts (power generation, agriculture, etc)
- WMO S2S project (2014-2023)

Прогноз аномалий приземной температуры на неделю 6-13.04.2026 г от 26.03 (<https://charts.ecmwf.int/wmo/charts>)

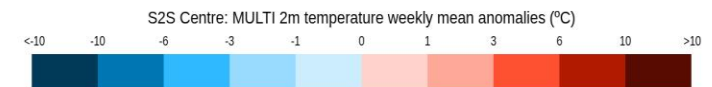
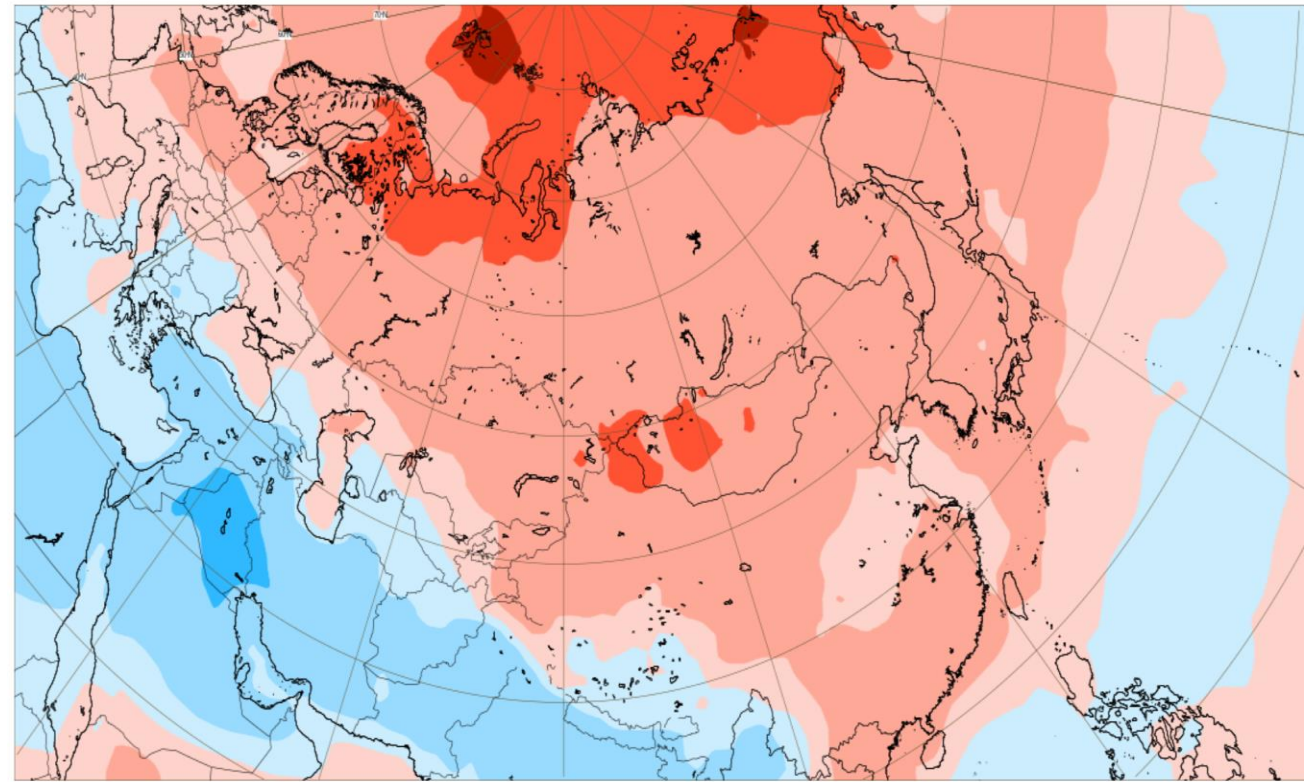
Moscow: 2m temperature weekly mean anomalies

Base time: Thu 26 Mar 2026 Valid time: Mon 06 Apr 2026 - Mon 13 Apr 2026 (+432h) Area : Eurasia



Customized Multi-Model: 2m temperature weekly mean anomalies

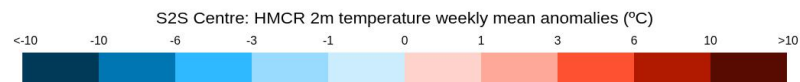
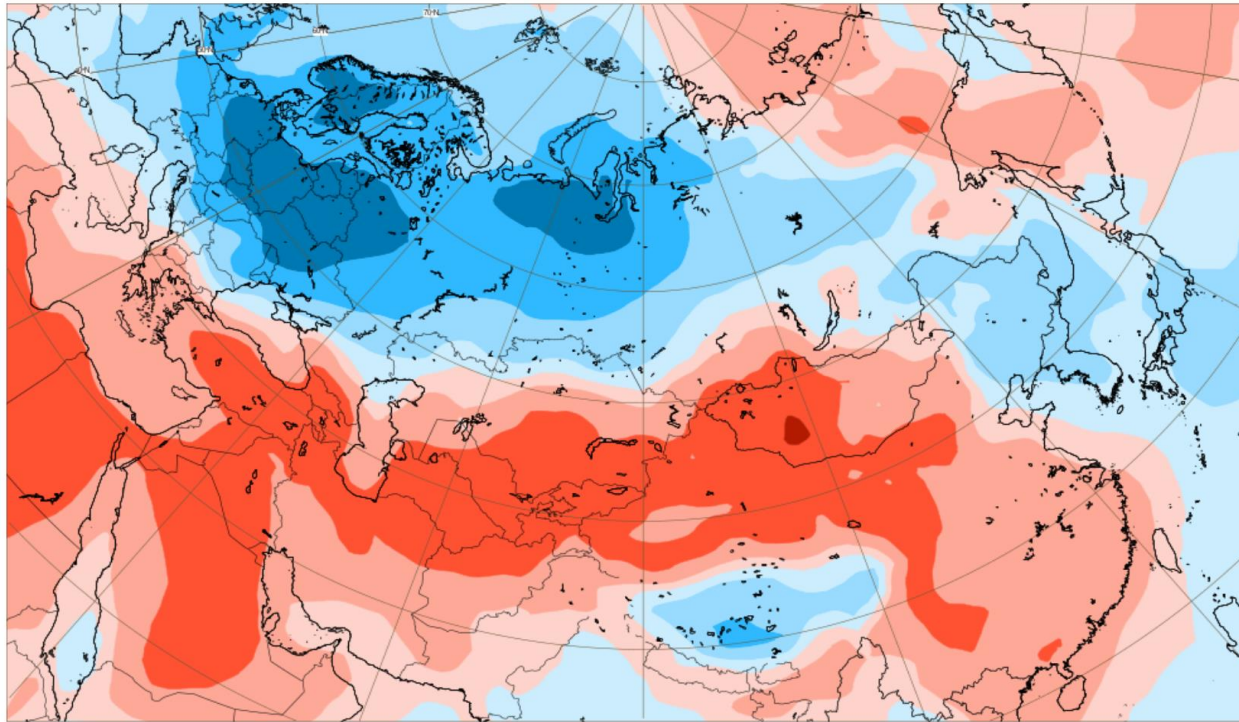
Base time: Thu 26 Mar 2026 Valid time: Mon 06 Apr 2026 - Mon 13 Apr 2026 (+432h) Models combination : cptec, eccc, ecmwf, hmcr, jma, kma, ncep, ukmo Area : Eurasia



Прогноз аномалий приземной температуры на неделю 9-16.02.2026 г от 29.01.2026

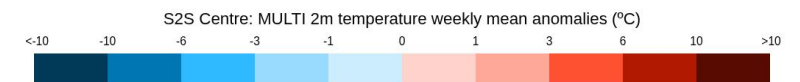
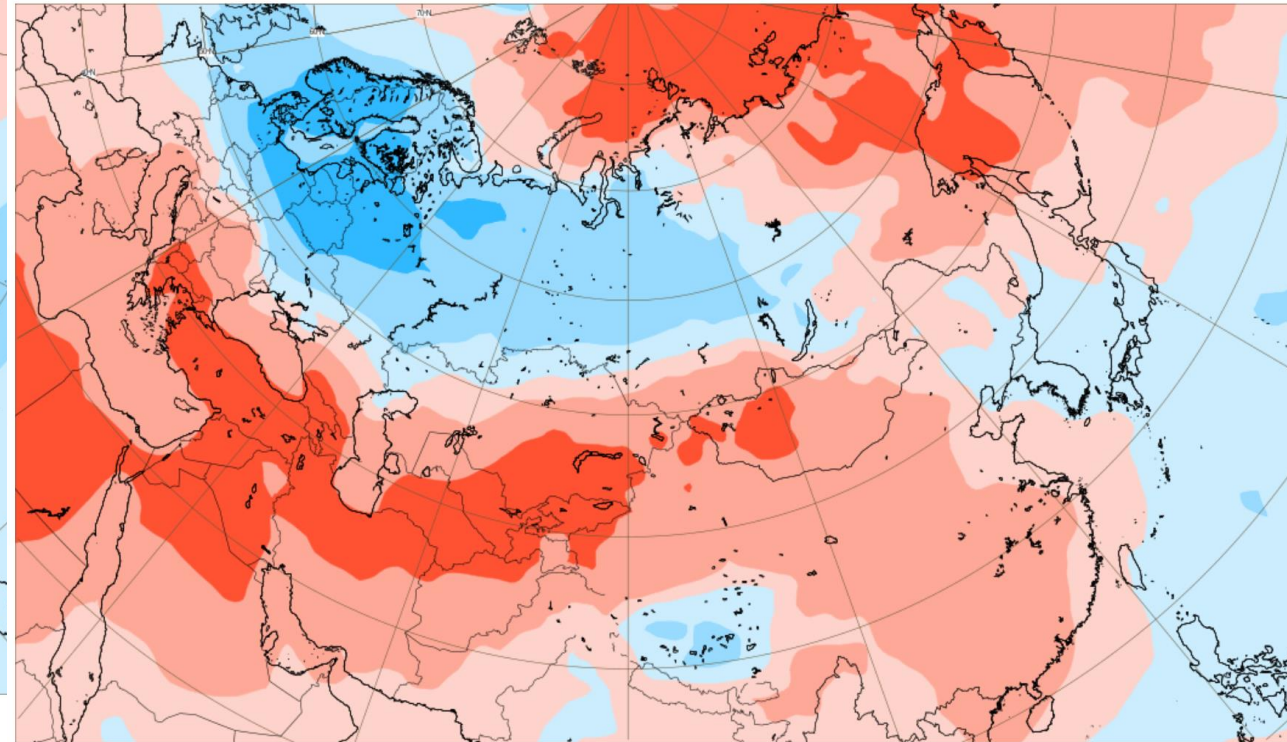
Moscow: 2m temperature weekly mean anomalies

Base time: Thu 29 Jan 2026 Valid time: Mon 09 Feb 2026 - Mon 16 Feb 2026 (+432h) Area : Eurasia



Customized Multi-Model: 2m temperature weekly mean anomalies

Base time: Thu 29 Jan 2026 Valid time: Mon 09 Feb 2026 - Mon 16 Feb 2026 (+432h) Models combination : cptec, eccc, ecmwf, hmcr, jma, kma, ncep, ukmo A Eurasia



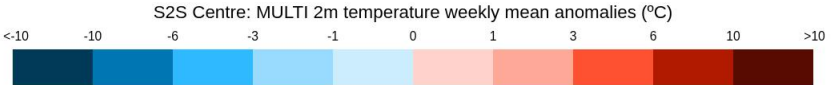
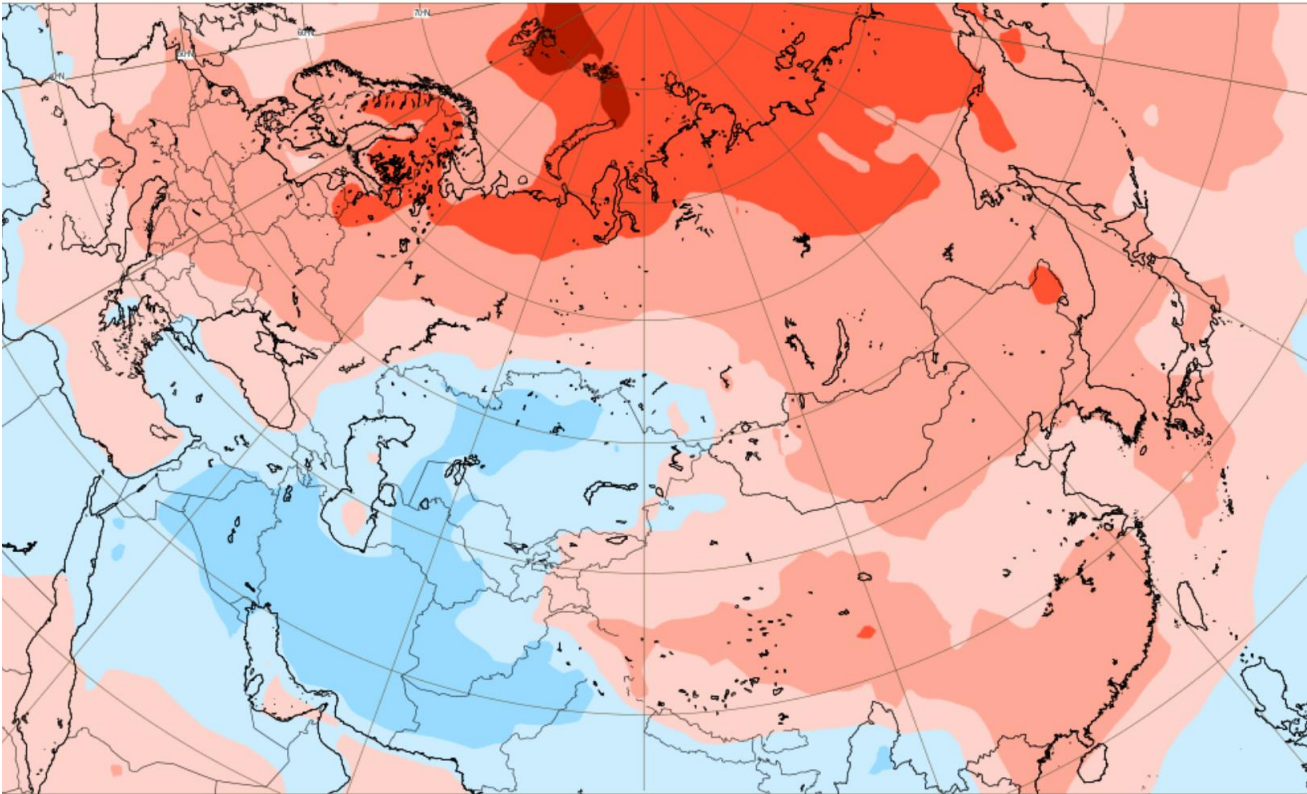
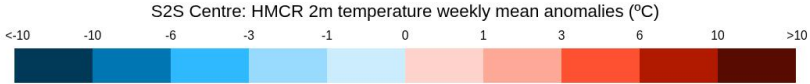
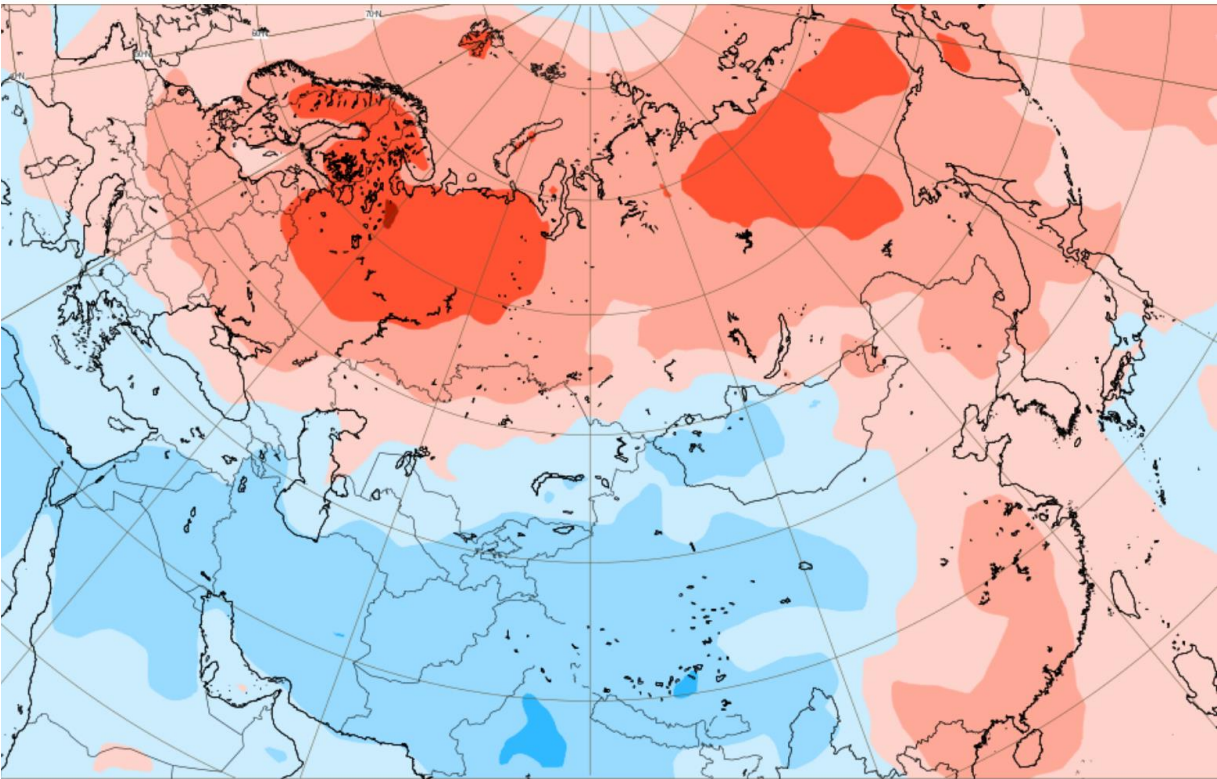
Прогноз аномалий приземной температуры на неделю 23-30.03.2026 г от 5.03

Moscow: 2m temperature weekly mean anomalies

Base time: Thu 05 Mar 2026 Valid time: Mon 23 Mar 2026 - Mon 30 Mar 2026 (+600h) Area : Eurasia

Customized Multi-Model: 2m temperature weekly mean anomalies

Base time: Thu 05 Mar 2026 Valid time: Mon 23 Mar 2026 - Mon 30 Mar 2026 (+600h) Models combination : cptec,eccc,ecmwf,hmcr,jma,kma,ncep,i Eurasia

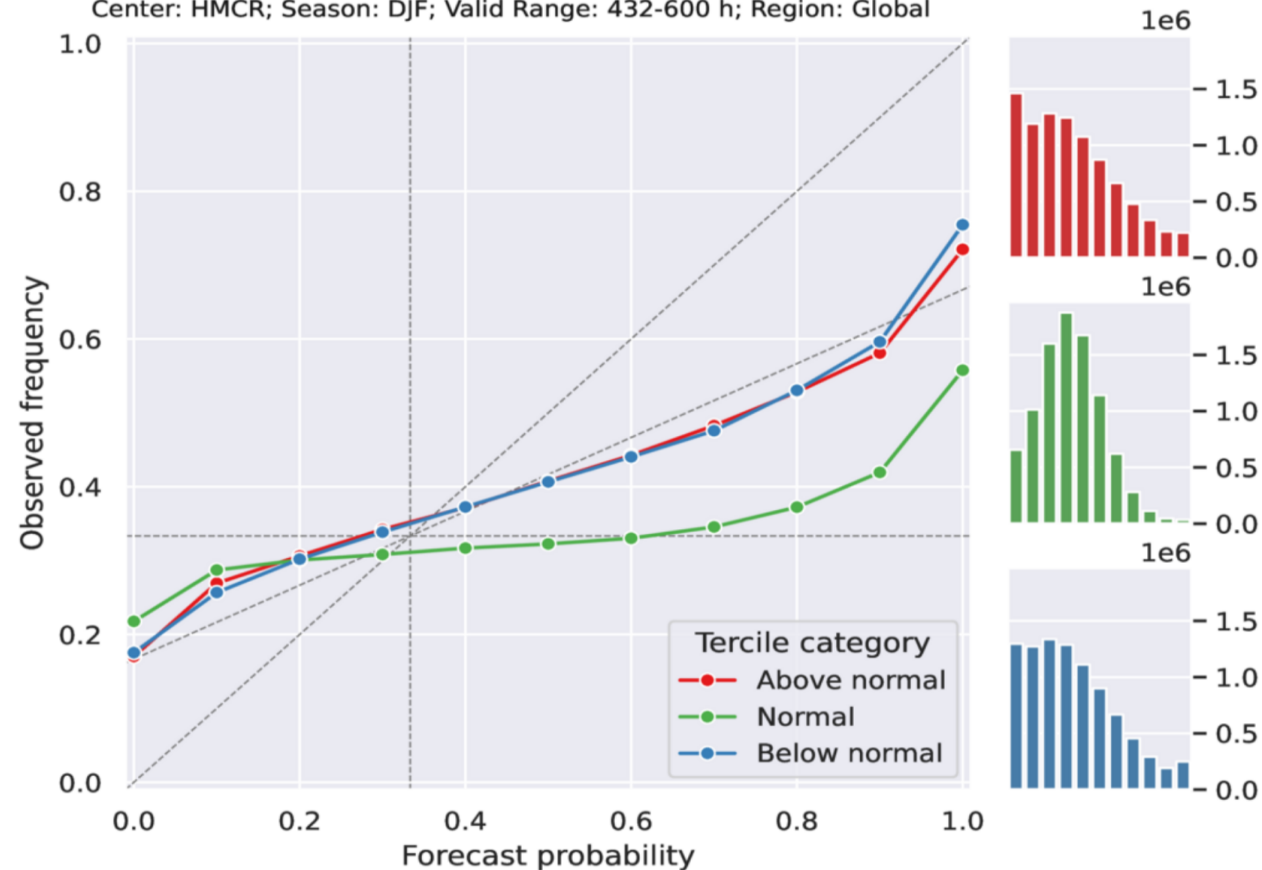


Надежность прогноза терцилей приземной температуры в модели ПЛАВ (слева) и в модели МетОфиса (справа)

Moscow - Reliability of tercile category forecasts

Reliability Diagram for 2-metre temperature

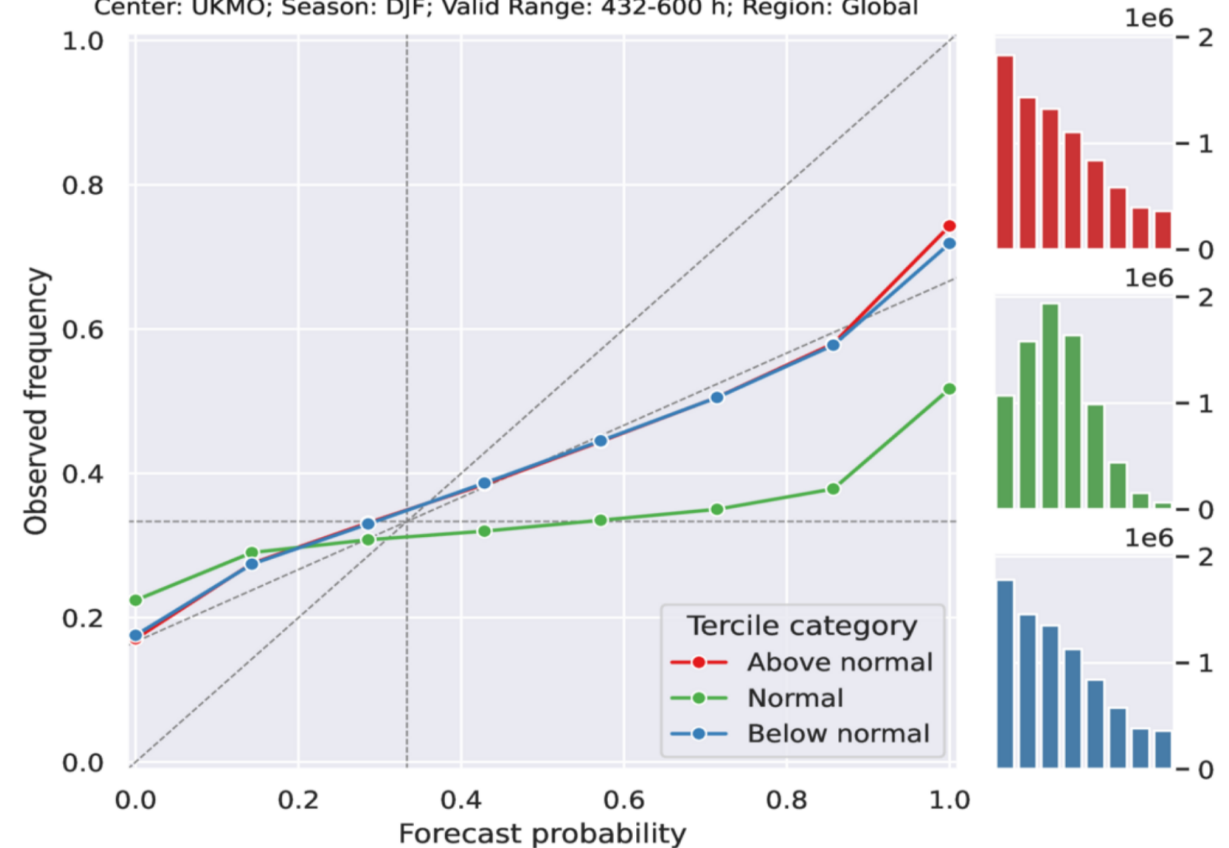
Center: HMCR; Season: DJF; Valid Range: 432-600 h; Region: Global



Exeter - Reliability of tercile category forecasts

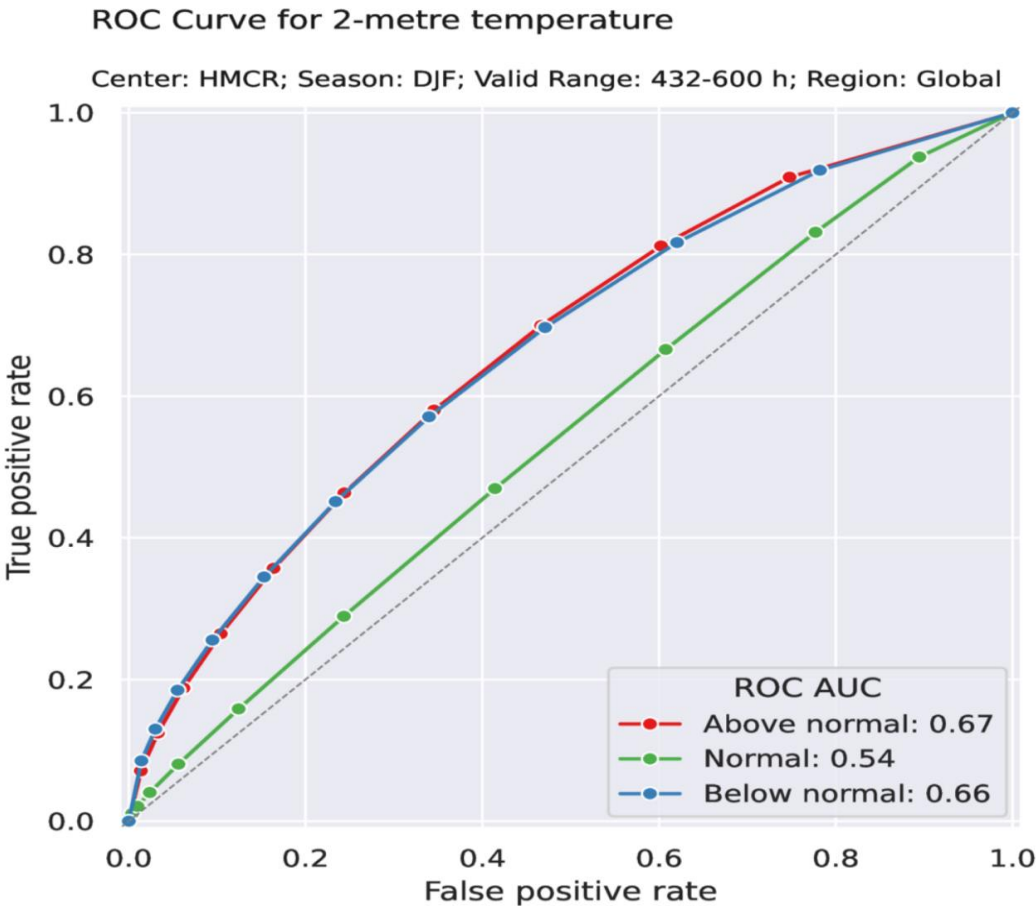
Reliability Diagram for 2-metre temperature

Center: UKMO; Season: DJF; Valid Range: 432-600 h; Region: Global

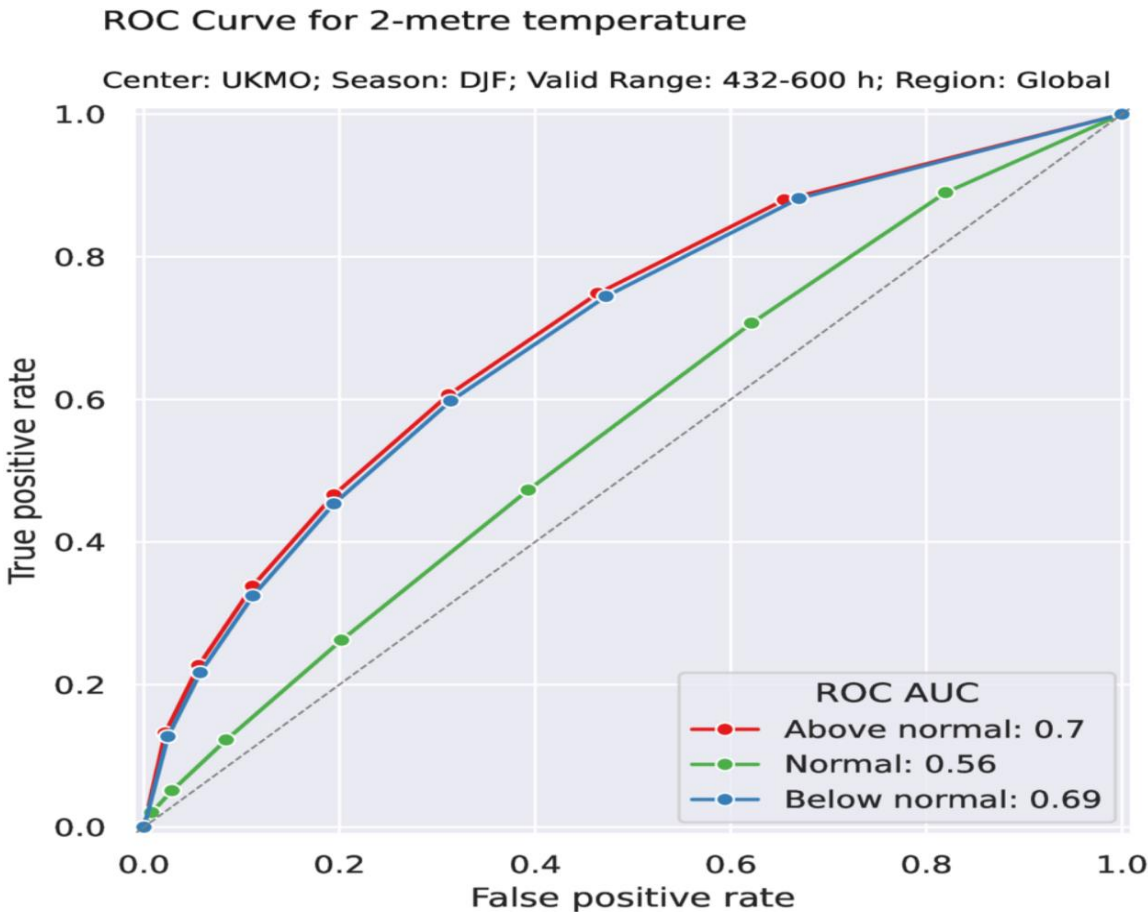


ROC кривые прогноза приземной температуры в модели ПЛАВ (слева) и в модели МетОфиса (справа)

Moscow - Discrimination of tercile category forecasts



Exeter - Discrimination of tercile category forecasts

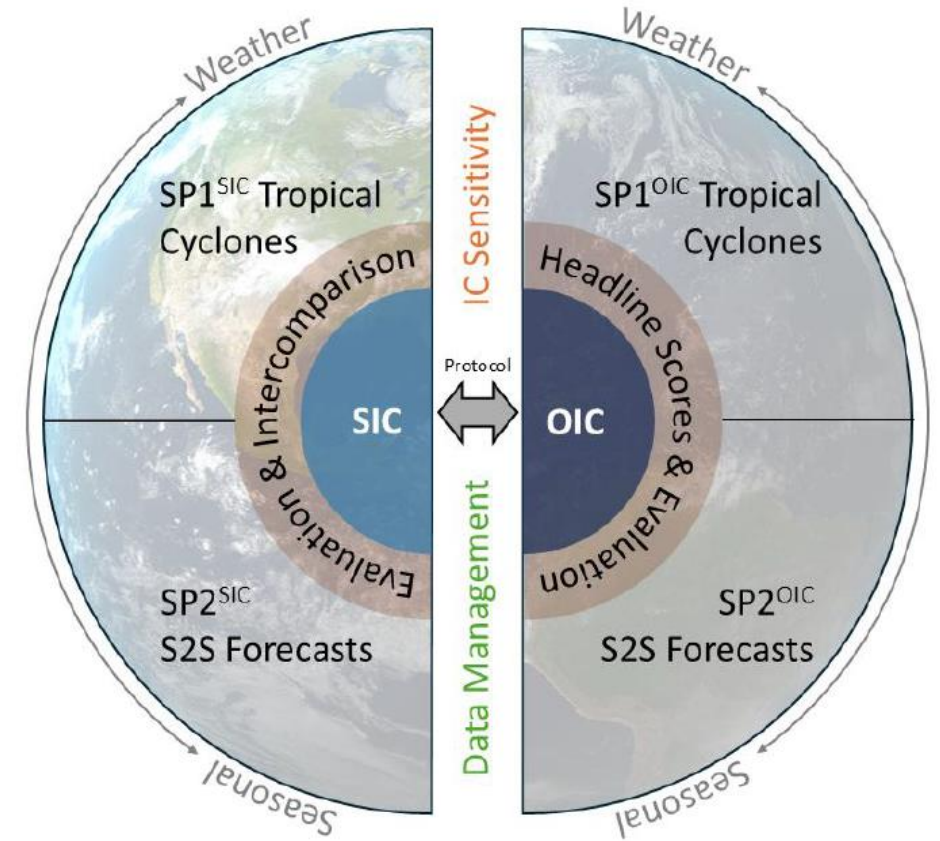


Развитие версии модели ПЛАВ для субсезонного прогноза (проект РНФ 25-17-00314)

- Усовершенствование описания радиации и аэрозолей (устный доклад Р.Ю.Фадеева 8 апреля)
- Разработка методики вероятностного прогноза засух (стендовый доклад П.С.Кланг 7 апреля по анализу воспроизведения влагозапаса почвы)
- Диагностика стратосферно-тропосферного взаимодействия в модели
- Разработка ИИ модели прогноза ТПО на 6 недель и ее апробация в субсезонном прогнозе погоды
- Разработка методики прогноза аномалий УФ индекса

Weather prediction model intercomparison project (WPMIP)

- Physical, AI and hybrid medium-range forecast models
- 122 10-day forecasts for 2024 initial data (every 3d day)
- - own initial conditions (OIC)
- - same initial conditions of ECMWF (SIC)
- Additionally: everyday 10-day forecasts for tropical cyclones fcst evaluation (SP1) ; weekly 2-4 weeks forecasts (SP2)



UPDATES ON PROJECT OBJECTIVES

WP-MIP Overarching Project Goals

Identify the strengths and weaknesses of AI, hybrid and physical models for medium-range deterministic global NWP

- Create a centralized forecast dataset for distributed diagnostics and evaluation
- Develop a community of modelers and evaluation experts to accelerate development
- Inform decision-making around the deployment of AIWP and hybrid systems for operational predictions

- WP-MIP is now a **Pilot Project** of the WMO Integrated Processing and Prediction System (WIPPS):
 - WIPPS Kick-Off for AI Technology Guidelines was held on 12 November
- WP-MIP will lead the drafting of AI technical guidance for medium-range predictions
 - This gives WP-MIP a “direct line” to inform decision-making at national meteorological centres

WIPPS AI Guideline Objectives

Provide guidance on potential and limitations of AI in NMHSs and to provide best-practices for integration into operational systems

Группы модельеров, участвующих в WP-MIP

Center Acronym	Center Name	Country/Region
CPTEC/INPE	Centro de Previsão do Tempo e Estudos Climáticos / National Institute for Space Research	Federative Republic of Brazil
CMA	China Meteorological Administration	People's Republic of China
ECCC	Environment and Climate Change Canada	Canada
ECMWF	European Centre for Medium-Range Weather Forecasts	Europe
GFDL	Geophysical Fluid Dynamics Laboratory	United States of America
DWD	Deutscher Wetterdienst	Federal Republic of Germany
JMA	Japan Meteorological Agency	Japan
KMA/KIAPS	Korean Meteorological Agency / Korean Institute of Atmospheric Prediction Systems	Republic of Korea
UKMO	Met Office	United Kingdom of Great Britain and Northern Ireland
NOAA	National Oceanographic and Atmospheric Administration	United States of America
RAS	Russian Academy of Sciences	Russian Federation

FORECAST DATA ARCHIVE

Original Plan

- Forecasts delivered by contributing centres to ECMWF in grib2 format via ftp
- Data restructured for internal MARS requirements
- Users access data through MARS interface as for ERA5, TIGGE, S2S, etc
- Benefits of MARS: a very well-defined, flexible and familiar user interface

The Bad News

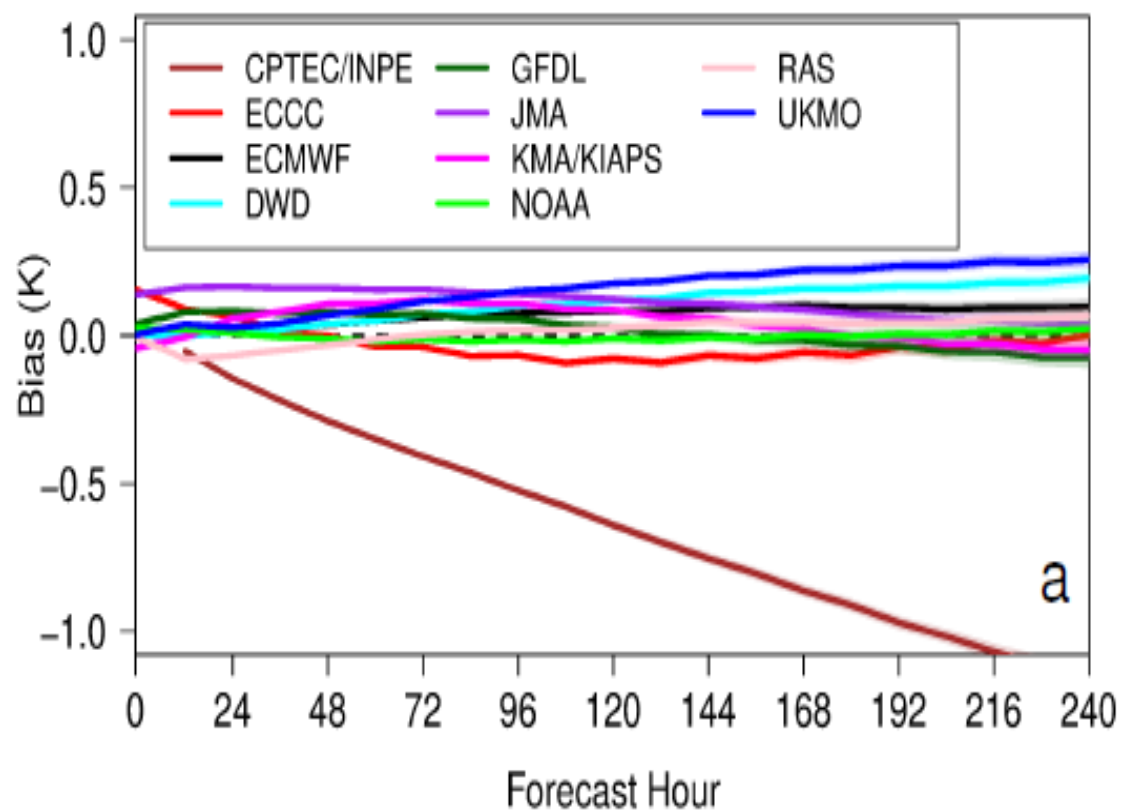
- The ECMWF Council voted to not host WP-MIP data in early July
- Decision appears to be based on politics rather than scientific value
- Efforts to negotiate for MARS space have failed



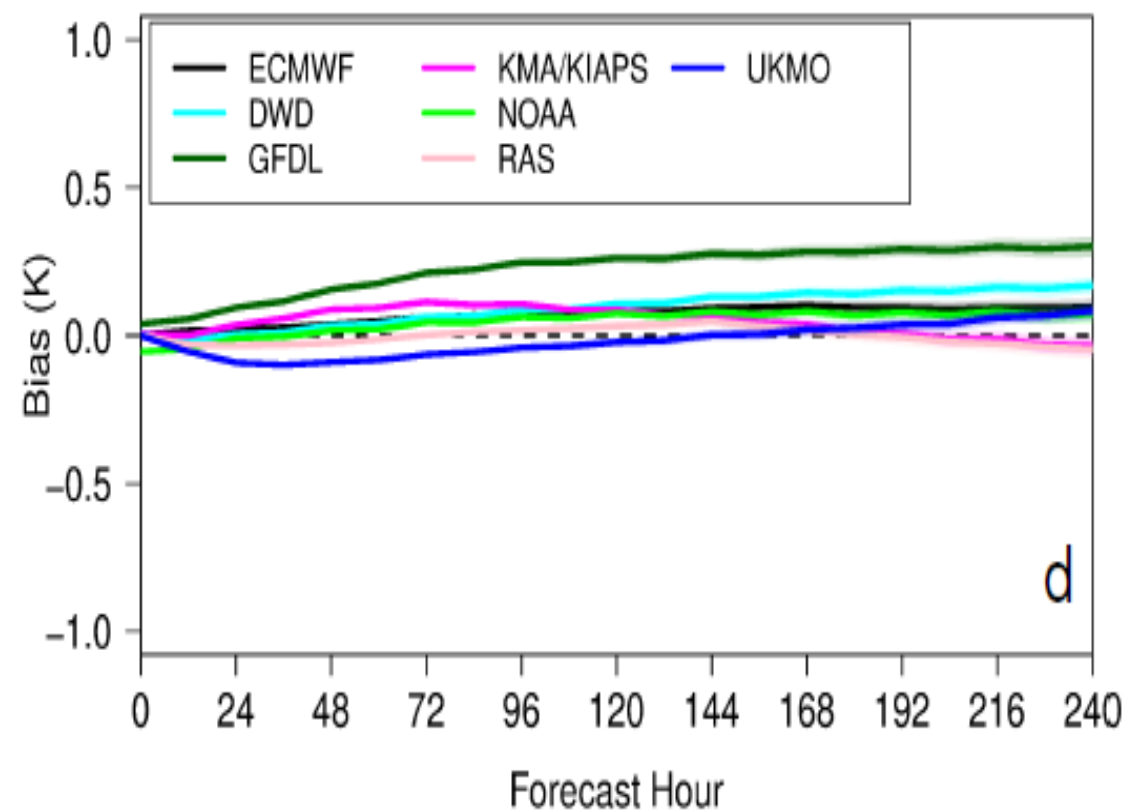
Mean T500 error

Own Initial Conditions (OIC)

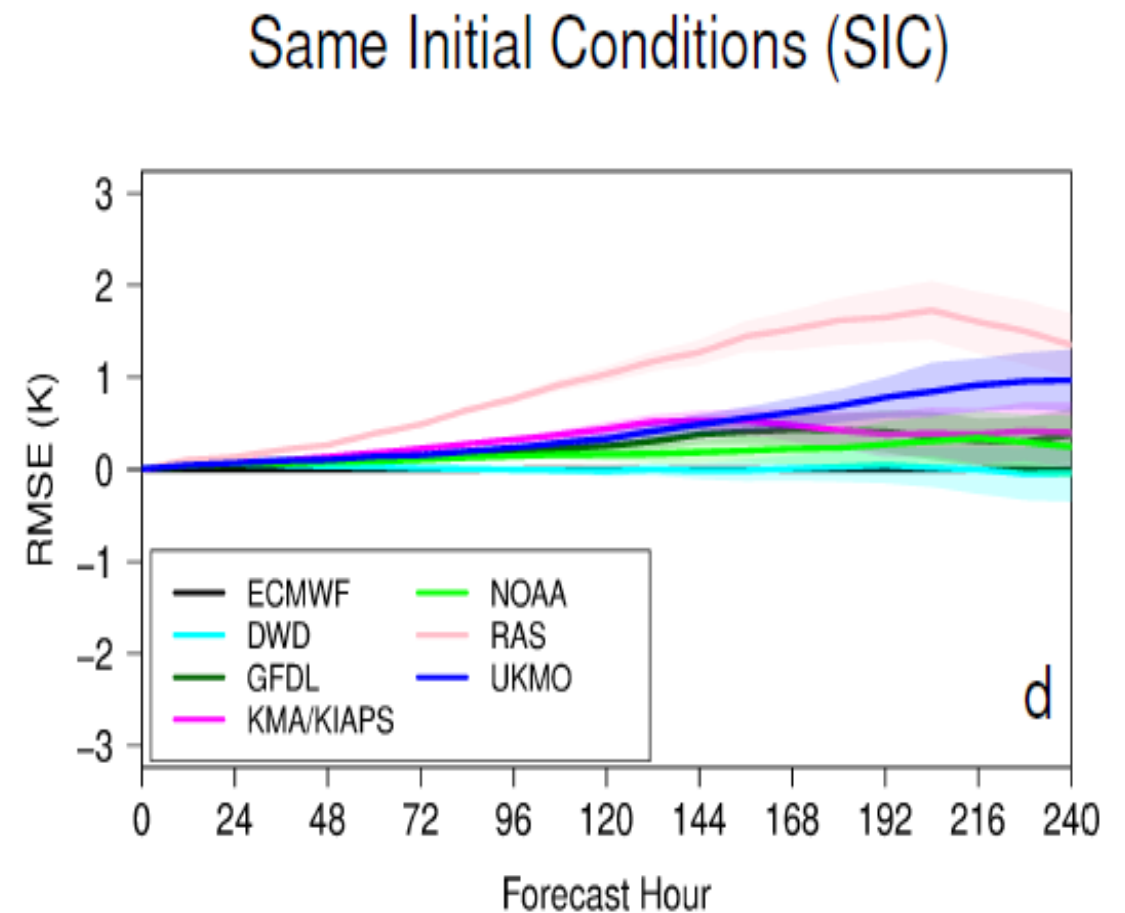
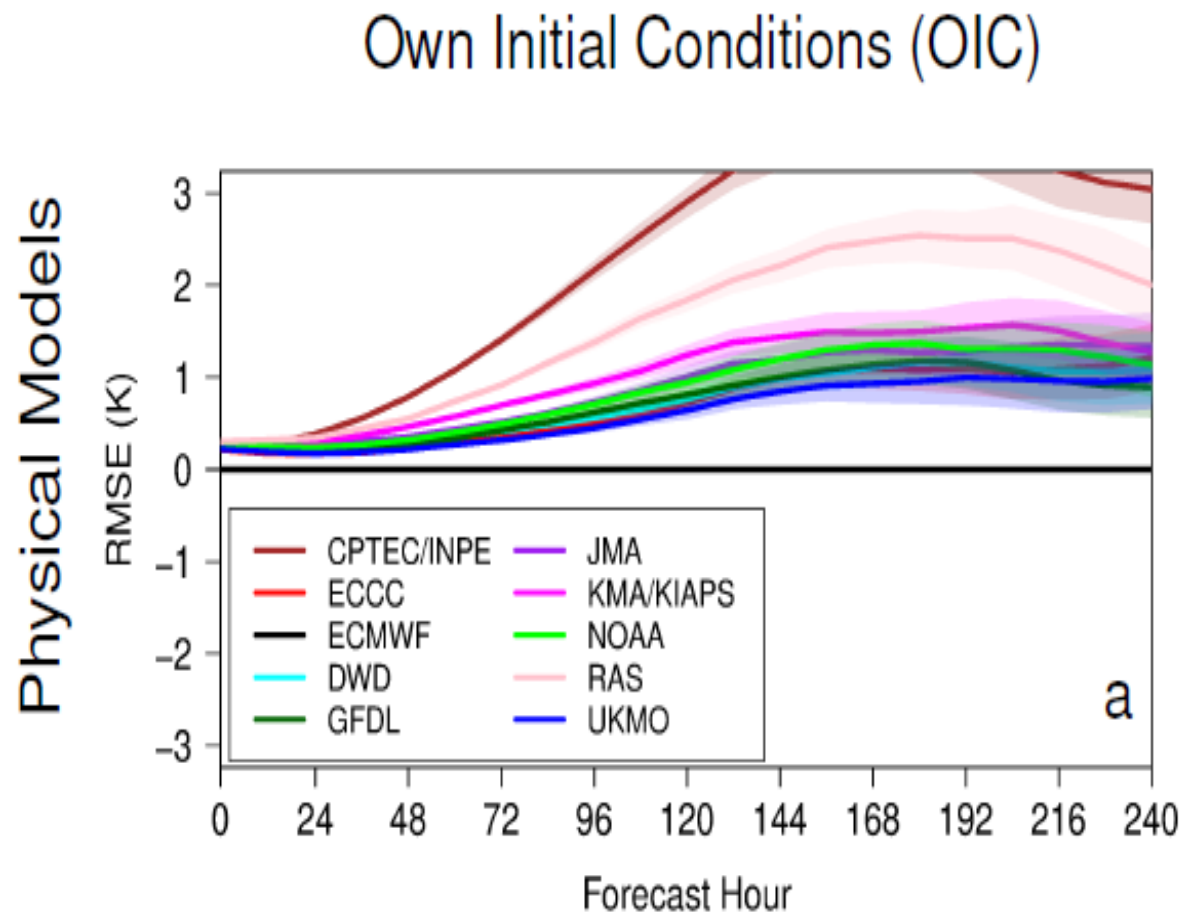
Physical Models



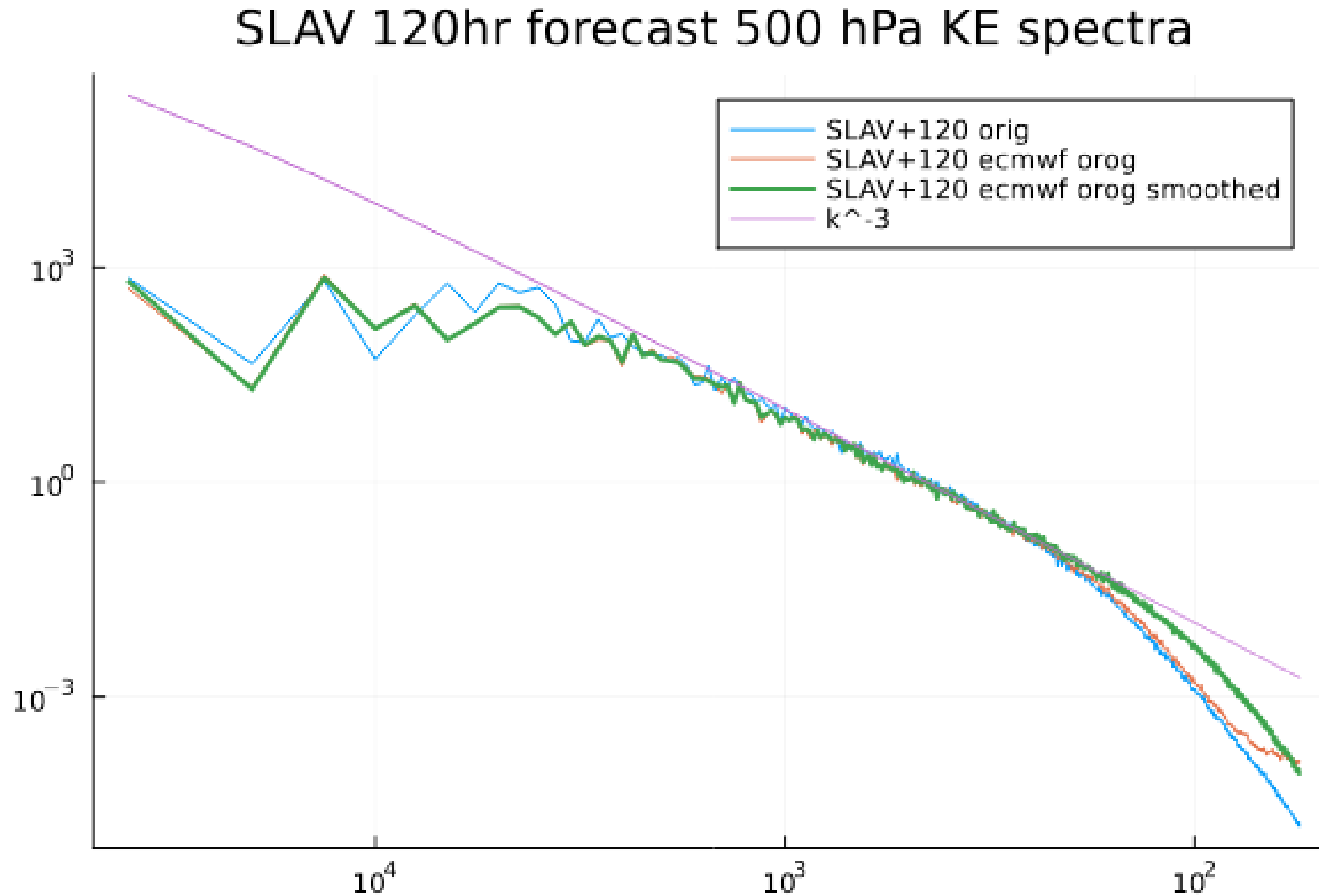
Same Initial Conditions (SIC)



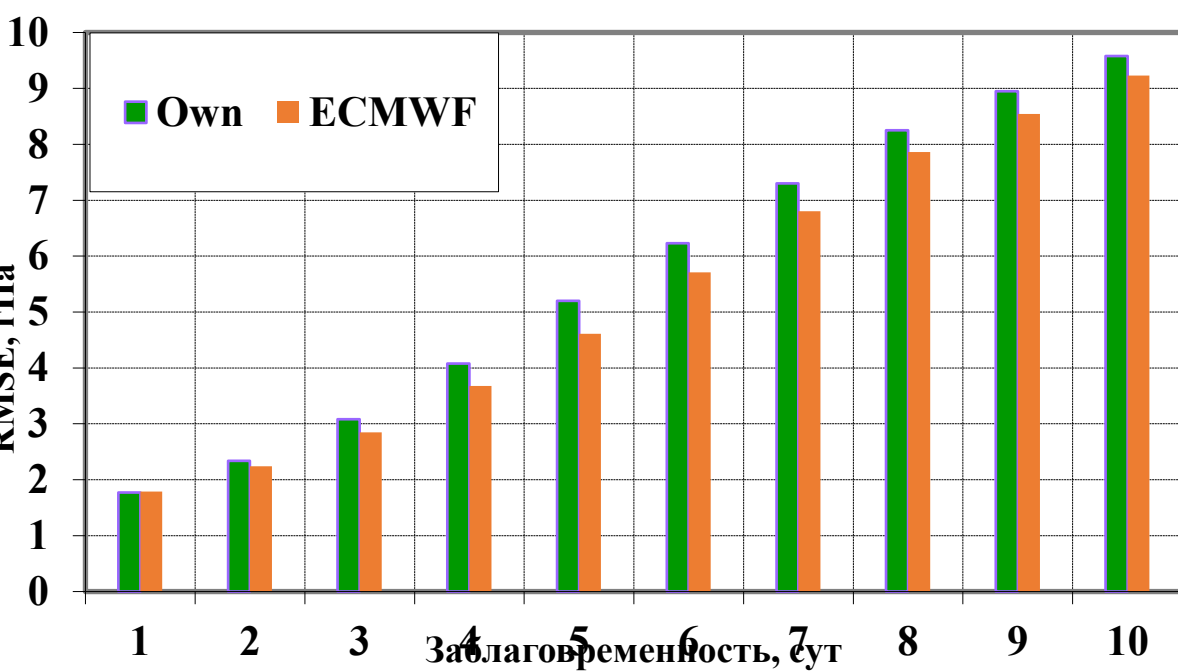
Relative root-mean-squared error for 500 hPa temperature with respect to ECMWF error for WP-MIP physical models



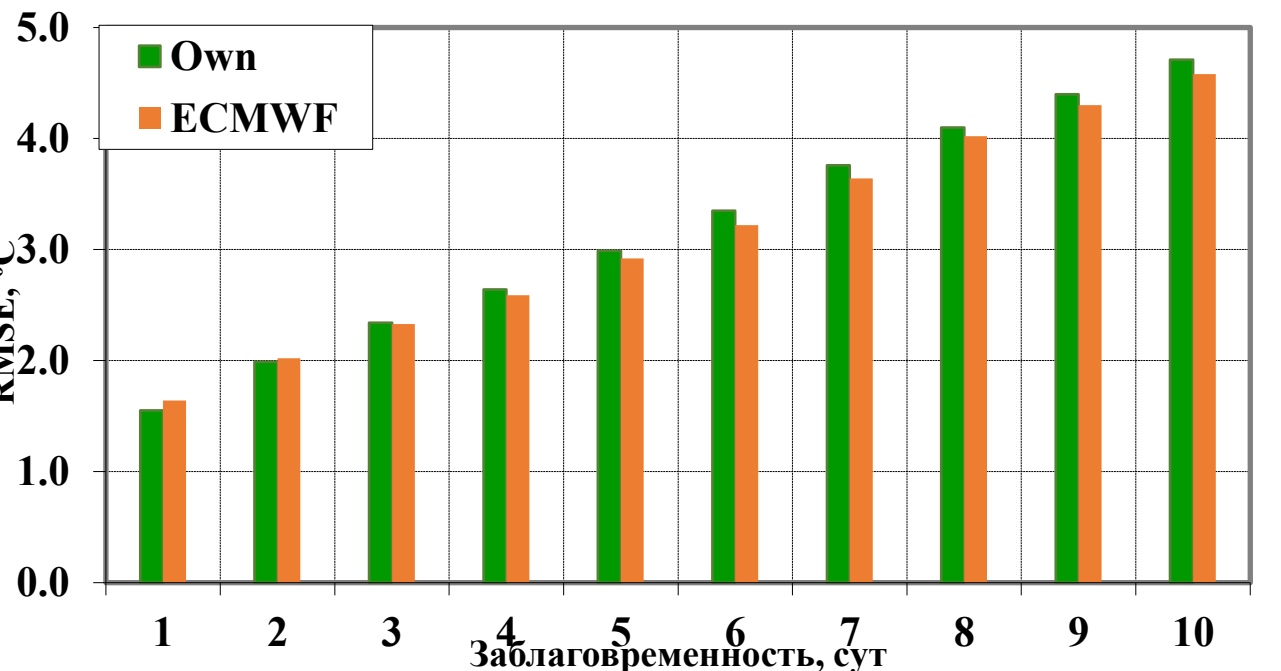
Спектр кинетической энергии на 500 гПа ПЛАВ10 с различными настройками диффузии и орографии



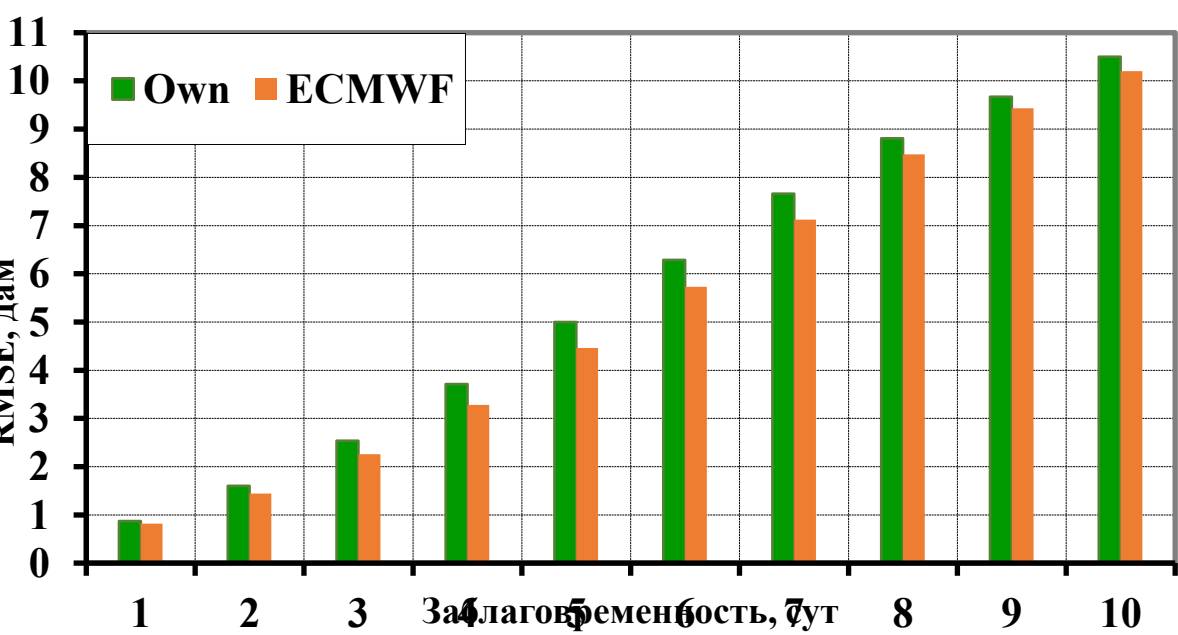
Среднеквадратическая ошибка прогноза MSLP за сентябрь-декабрь 2024



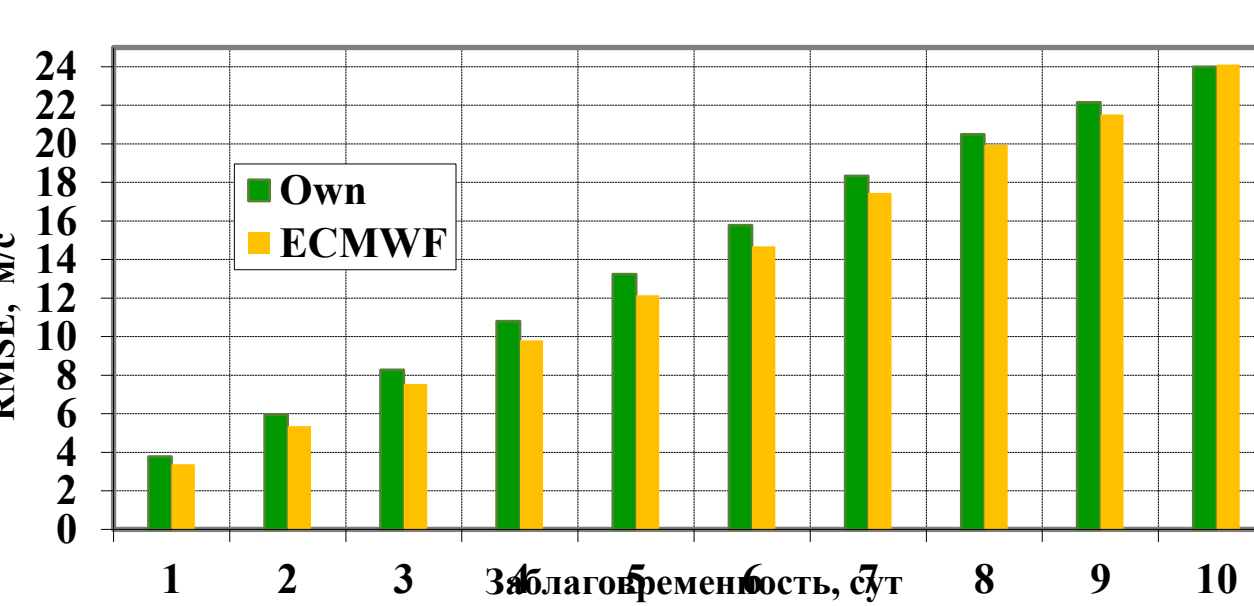
Среднеквадратическая ошибка прогноза T-850 за сентябрь-декабрь 2024 гг.
Южное полушарие



Среднеквадратическая ошибка прогноза H-500 за сентябрь-декабрь 2024



Среднеквадратическая ошибка прогноза W-250 за сентябрь-декабрь 2024 гг.



Further work

- Routine work on parameterization improvement
- AI model for subseasonal sea surface temperature
- Hybrid medium-range NWP model

Conclusions

- Participation in international WMO projects led to SL-AV model development and improvements, both scientific and technological:
 - S2S (2014-2024) – long-range forecast version
 - WP-MIP (2025-2026) – medium-range forecast version

Спасибо за внимание!
Thank you for attention!

- Развитие версии модели для субсезонного прогноза и прикладных методик выполняется при поддержке проекта РНФ 25-17-00314 в Гидрометцентре России

NWP Systems Info

Explore the WGNE overview of plans at NWP centres with Global Forecasting Systems



Home / Working Groups / Working Group on Numerical Experimentation (WGNE) / NWP Systems Info

[WGNE Overview of Plans at NWP Centres with Global Forecasting Systems — 2024](#)

(the information marked yellow has not been updated)

[WGNE Overview of Plans at NWP Centres with Global Forecasting Systems — 2023](#)

(the information marked yellow has not been updated)

[WGNE Overview of Plans at NWP Centres with Global Forecasting Systems — 2022](#)

(the information marked yellow has not been updated)

[WGNE Overview of Plans at NWP Centres with Global Forecasting Systems — 2021](#)

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