ECMWF

UEF 2025, 15-18 September, Bologna, Italy

Using ECMWF Forecasts in the Weather Forecasting Room at NIMH, Bulgaria

Anastasiya Stoycheva, Ilian Gospodinov, Boryana Tsenova

National Institute of Meteorology and Hydrology, Sofia, Bulgaria

e-mail for correspondence: anastassia.stoycheva@meteo.bg

Before 2009

Bulgarian National Institute of Meteorology and Hydrology received ECMWF numerical prediction data

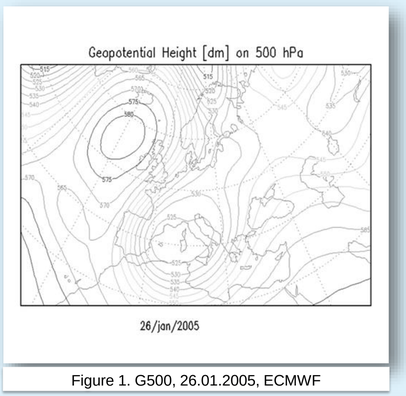


Figure 1. G500, 26.01.2005, ECMWF

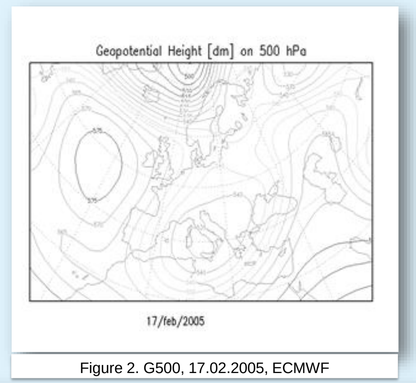


Figure 2. G500, 17.02.2005, ECMWF

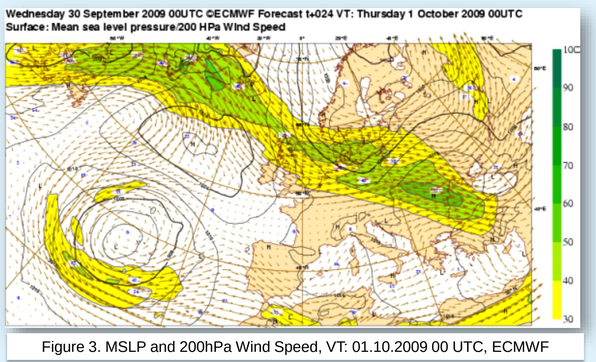


Figure 3. MSLP and 200hPa Wind Speed, VT: 01.10.2009 00 UTC, ECMWF

ECMWF data was used to produce operational weather forecasts even before 2009. Examples can be found in Figure 1 to Figure 4. After 2009, access is via the ECMWF web-page (Figure 3 and Figure 4). However, in 2009 and previous years, G500, MSLP and T850 data were plotted with self-developed software (extraction of GRIB data via GTS (WMO)), as shown in Figure 1 and Figure 2.

Historical Background:

In Bulgaria there were already plans to obtain operational data from ECMWF more than 30 years ago - in 1993. Although the format and transmission channels were different, the receipt of forecast data began in the years before 2009. ECMWF data was used both for operational forecasting and for scientific research related to the specific climate and weather conditions in Bulgaria. Over the years, the need for Bulgaria to become a member/associate member of the ECMWF has increased. The access to ECMWF forecast data provides forecasters with greater confidence in preparing weather forecasts for the benefit of society, and it gives scientists a wide field for developing new products. As the demand for more accurate and timely forecast information increases, ensuring rapid access is being addressed through enhanced computing resources. Fully leveraging this potential also requires the development and engagement of qualified human resources.

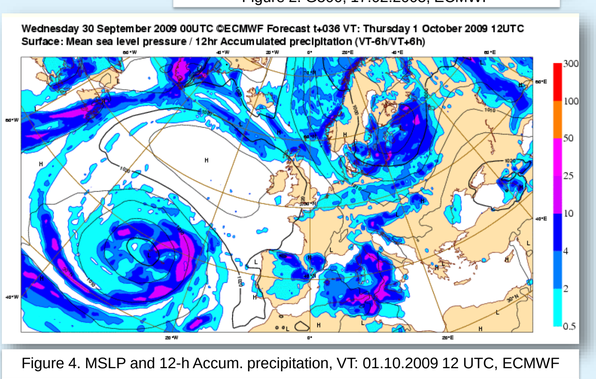
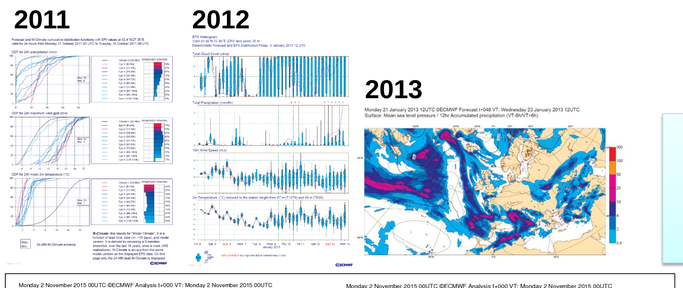
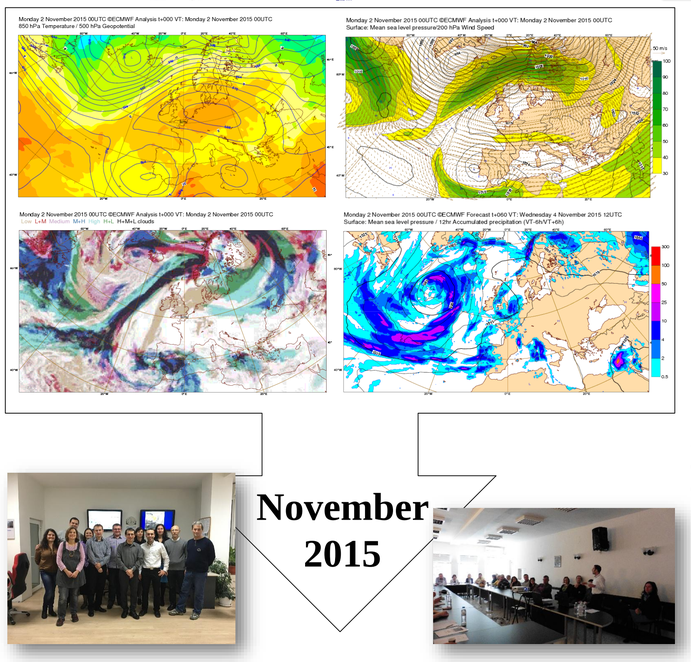


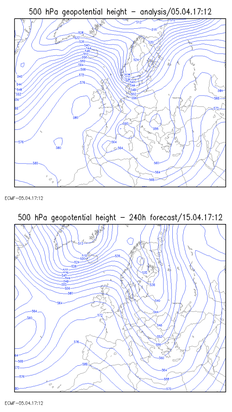
Figure 4. MSLP and 12-h Accum. precipitation, VT: 01.10.2009 12 UTC, ECMWF

After 2009

Bulgaria became a cooperating member of ECMWF in 2009

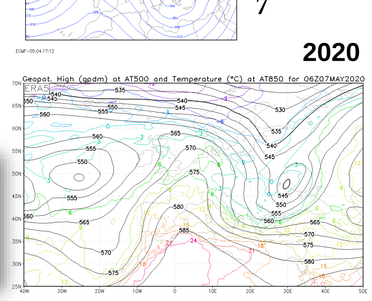


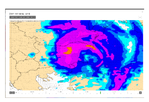




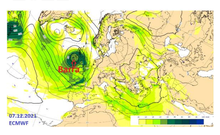
April 2017

November 2015

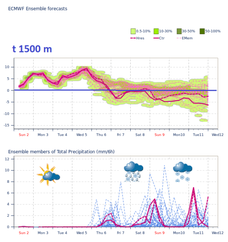




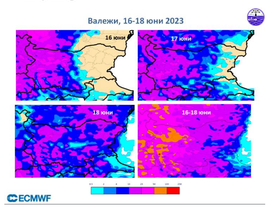
2021



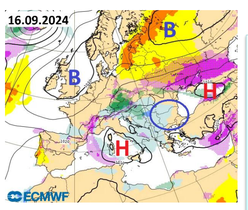
2022



2023

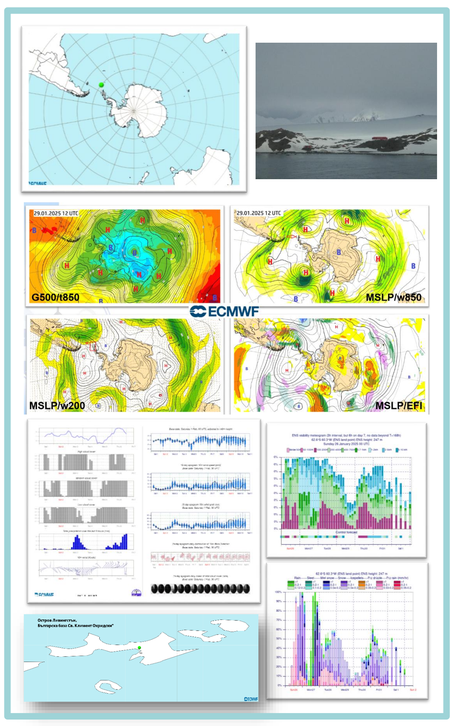


2024



ECMWF data is a major source for producing national medium and long-range weather forecasts. Over the years, thanks to training courses, meetings, and visits to the ECMWF, Bulgarian meteorologists have acquired the knowledge and skills needed for quick and easy access to high-quality forecast information. This information is also used as a guide in preparing warnings for extreme weather events. In addition to Bulgaria, daily weather forecasts are produced for Europe and the Balkan Peninsula.

Examples of ECMWF information used over the years can be found on the left. The intensive use of this data continues today (see below). Above the presented materials is the year in which they were part of the operational practice in the office of the forecasters of the National Institute of Meteorology and Hydrology.



2025: During the most recent winter season (summer in the Southern Hemisphere — January and February 2025), an attempt was made to prepare a weather forecast for Livingston Island, the location of the Bulgarian Antarctic Base.
www.meteo.bg/meteo7/sites/storm.cfd.meteo.bg.meteo7/files/FullBook_GK.pdf

Bulgaria's National Institute of Meteorology and Hydrology receives real-time numerical prediction data and products to prepare forecasts and warnings

IFS-ECMWF for NWP models & for SEASONAL forecasts in BULGARIA

	ALADIN-BG	AROME-105	AROME-IFS	AROME-DA
Horizontal resolution	5 km (256x200)	2.5 km (320x240)	2.5 km (320x240)	2.5 km (320x240)
Vertical levels	105	105	90	105
LBCs, frequence	ARPEGE, 3h	ARPEGE, 1h	IFS, 1h	ARPEGE, 1h
Forecast range	72h/48h	72h/48h	72h/48h	72h/48h
Data assimilation	No	No	No	Surface data assimilation

Table 1. ACCORD canonical configurations based on cy43t2 that are run in NIMH 4 times daily: 00, 06, 12 and 18UTC

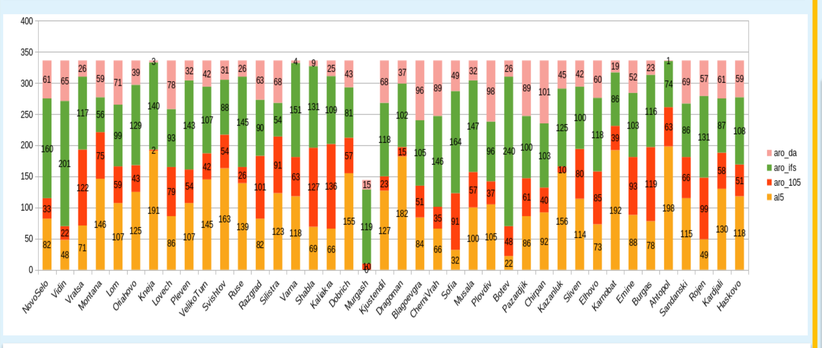


Figure 5. January-July, 2025: Number of cases with best performance (lowest mean monthly RMSE) for T 2m between the NWP models run in NIMH

Figure 5 presents a verification of the 2m temperature of the NWP models run at NIMH and described in Table 1 for the period from January to July 2025. Measurements from synoptic stations in Bulgaria were used for the verification. The results for the AROME-IFS model are presented in green. AROME-IFS are used in the operational weather forecasting activities at NIMH. The forecasters use the results of the NWP model on a daily basis. Figure 6 shows an example of the 3-h accumulated precipitation for 30 August 2025 06 UTC from the specified model configurations. Figure 7 presents the forecast of maximum temperatures for 30 August 2025 from both the AROME-IFS and IFS-ECMWF models (steps 30 and 126). The measured values of the maximum temperatures are shown on the last map in Figure 7.

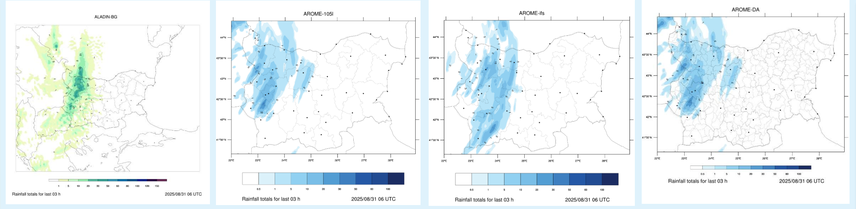


Figure 6 3-h precipitation forecast VT 31.08.2025 06 UTC, ALADIN-BG, AROME-105, AROME-IFS, AROME-DA (left to right)

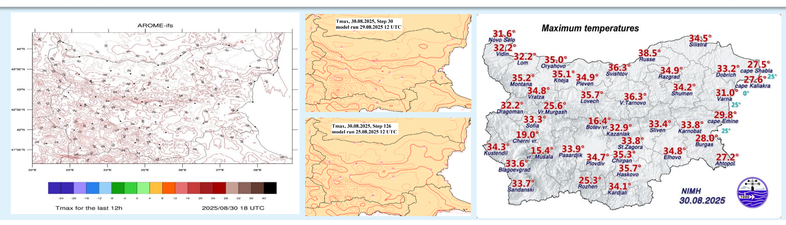


Figure 7. T 2m forecast VT 30.08.2025, AROME-ifs, IFS-ECMWF (left and middle); T 2m measured, SYNOP stations (right)

The oldest seasonal forecast maps downloaded to a local computer in Sofia (Figure 8, the two left) for the purpose of documenting the source of the national seasonal forecast. The year is 2007. The forecast issue date is 15 Dec 2006 and the forecast is for the mean temperature anomaly and mean precipitation anomaly for JMF 2007 – one of the warmest winters in Bulgaria. The version of the long-range ensemble prediction is System with 40 members.

More recent maps from November 2014 for the winter season DJF 2014-2015 (Figure 8, the two right). It is System 4 with 51 members. This is the first month when the colors for precipitation anomalies changed form blue-yellow (better for colorblindness to red-green) to green-brown.

The earliest EUROSIP maps archived in Sofia are from June 2008. Figure 9 shows the SST anomaly forecast for JAS 2008. EURO SIP is the predecessor of the C3S multimodel ensemble. In 2008 the contributing countries were ECMWF, Meteo France, and MetOffice.

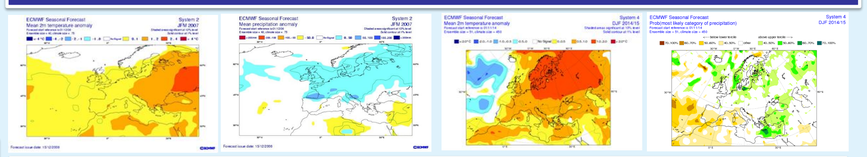


Figure 8. Mean temperature anomaly, mean precipitation anomaly – forecast for JFM 2007 from December 2006; Mean temperature anomaly, mean precipitation anomaly – forecast for JFM 2007 from December 2006 (from left to right)

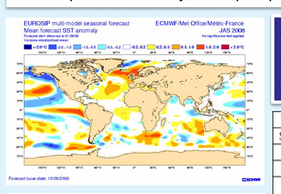


Figure 9. June 2008 SST anomaly forecast for JAS 2008 – EUROSIP

Currently maps are no longer archived in Sofia. The seasonal forecast is available online in color-table and text – Fig. 10 (www.meteo.bg/en/forecasts/seasonal)

Seasonal forecast	10-days period		Month		Season	
Summer-autumn 2025	temperature	precipitation	temperature	precipitation	temperature	precipitation
June (assessment)			1.98	-1.85		
July (assessment)			1.98	-1.38		
August 01-10						
August 11-20						
August 21-31						
September						
October						
November						

Summer / Autumn

Figure 10. One of the latest national seasonal forecasts for season summer and autumn 2025. The seasonal forecast is updated every month in the interval 27-th-30-th.

ECMWF, thank you for 50 years of hard work for more predictable meteorological future!