



## A Case Study for the Application of the GraphCast AI Model in Hungary

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This study investigates the applicability of the recently released (2023) GraphCast artificial intelligence (AI) model for weather forecasting in Hungary. We assess the model's accuracy in forecasting for grid data at various points across Hungary for a case study of crossing of a cold frontal zone in March 2023. We compared GraphCast predictions with observations and established weather models to evaluate its potential for weather forecasting.

GraphCast is a machine learning system for weather forecast developed by DeepMind. Unlike traditional weather models that rely on complex physical equations, GraphCast leverages historical weather data to identify patterns and relationships between different locations. By feeding the model with data from two time points (6 hours apart), up to 7-day GraphCast predictions were made with 6-hour temporal and 1° spatial resolution. Model predictions were compared to the data of the nearest weather station.

Our analysis involves a detailed comparison between modeled outputs from GraphCast and actual measurement data series collected from Hungarian meteorological measurement stations, ERA5 reanalysis and the operational weather forecasts of the GFS numerical weather prediction model. The purpose of this comparison is to quantify the effectiveness of the model in reproducing grid point data across various time scales. To strengthen the generalizability of our findings, we explore the sensitivity of the model's predictions on different initialization times and forecast lengths overlapping the arrival of the cold frontal zone.

The findings from this research will contribute to the ongoing evaluation of AI-based predictive models. By analyzing GraphCast's performance in a case study, we can determine its potential for application in weather forecast.

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