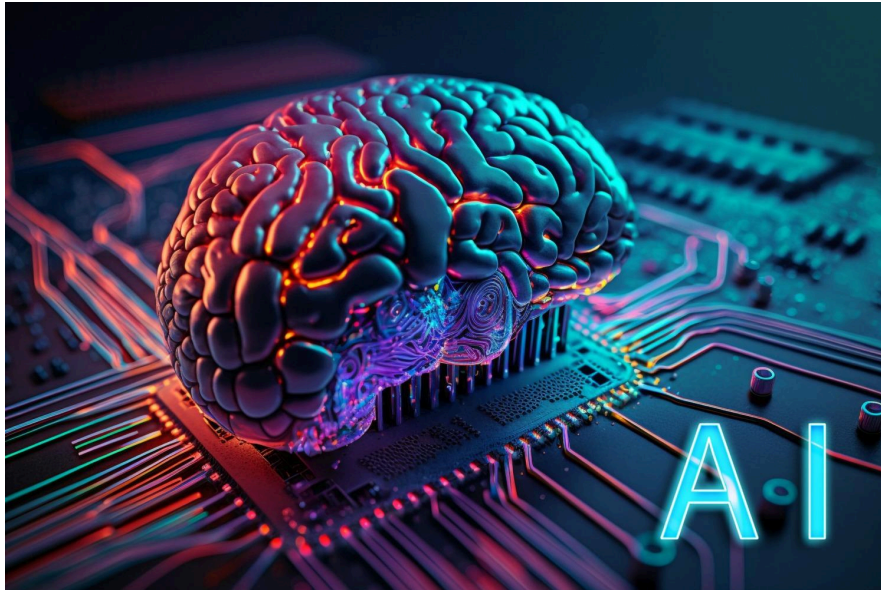# The ECMWF Artificial Intelligence Weather Model

The European weather model, known as ECMWF, has officially an artificial intelligence counterpart. It's a new weather model from the European Center for medium-range weather forecasting, which to this day is continuously being tinkered with as we see results in real-time for forecasting purposes. "AIFS", which stands for artificial integrated forecasting system - this model with machine learning was implemented back in October 2023.

AIFS is a system developed by ECMWF based on "deep learning". It is one of the first weather models using artificial intelligence or machine learning. In short, artificial intelligence can create a human face using certain data structures that depict objects and their relationships as points connected by lines in a graph. While complex, that is called a "graph neural network".

In other words, it's just machine learning algorithms that predict an image based on many points that connect. This above has been integrated into the weather model thanks to high computing power that allows the AIFS to learn complex weather patterns with high accuracy.

Why Could It Possibly Be Better?

The ECMWF AIFS has demonstrated some promising results, especially amongst other AI models. Below is a graph that compares the regular ECMWF to the new ECMWF AIFS, where the skill-score increases along in the vertical on the left, with forecast day on the bottom that goes out to day 10. Since its debut, its accuracy at a longer-lead time clearly shows promising results.
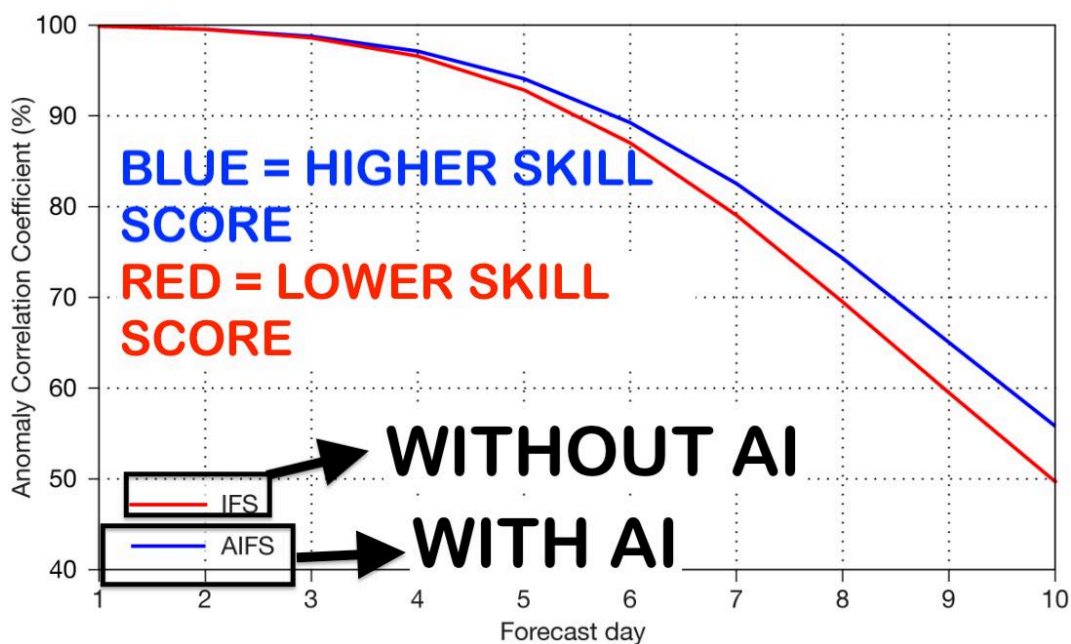
It does come with some limitations, however. For instance, the AIFS currently lacks some weather variables as it can struggle in the short-term and lacks high resolution parameters. This has implications on daily weather like trying to predict where thunderstorms may develop in a certain region or other specific applications. Another downfall is that it offers 6-12 hour intervals. For winter forecasting, while this may serve beneficial for picking out tracks of snowstorms and eliminating variability, it won't be utilized for predicting where snow bands may occur.

Implications For Winter

Since it has demonstrated better skill-score at longer forecast times, it'll help to show tracks of potential snow systems across the U.S. This will help to eliminate forecast uncertainty in the medium to longer range, especially once this model upgrades to a higher resolution data set.

Other important areas of research with this model will be to improve long-range forecasts like monthly and seasonal forecasts along with better representation of precipitation fields. A further area of exploration is the augmentation of AIFS training and initialisation with observations (i.e. satellite observations) to correct for analysis errors and allow the model to produce improved point forecasts. These developments will bolster and improve significantly uncertainty in the medium to long range, which would make the short-term even that much better.