

A circular image showing a dramatic sky with dark, heavy clouds and a bright lightning bolt striking down over a green field. The image is partially obscured by blue curved shapes on the left side of the slide.

AI Applications to Long Range Energy Forecasts

Benjamin Toms, PhD

Vice President of Artificial Intelligence for Weather



intersphere



Benjamin Toms, PhD
Founder



Jason Antic
Lead AI Engineer



Jack Cahill
Junior AI Engineer



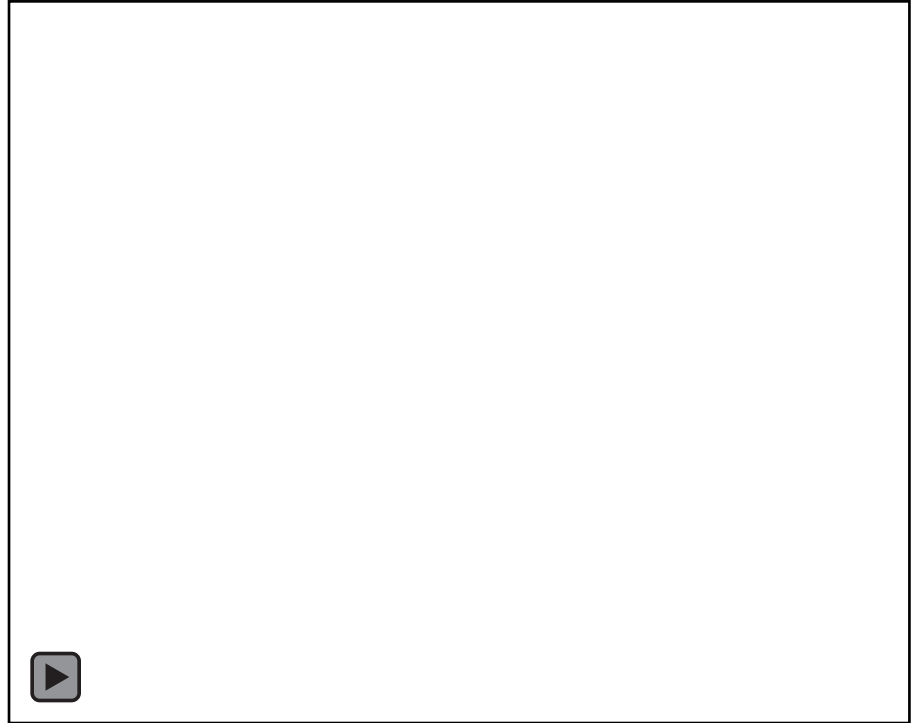
The National Science Foundation reviewed and approved our core AI technology.

Our funding came from the NSF, and we had no private investors.

Asset-level energy forecasts through the next year are possible

Shown:

Seasonal (3-month) wind power production anomalies forecasted 9 months in advance



01

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Recent Progress in Global AI Modeling

AI weather models are now more accurate than physics-based models out to 10 days

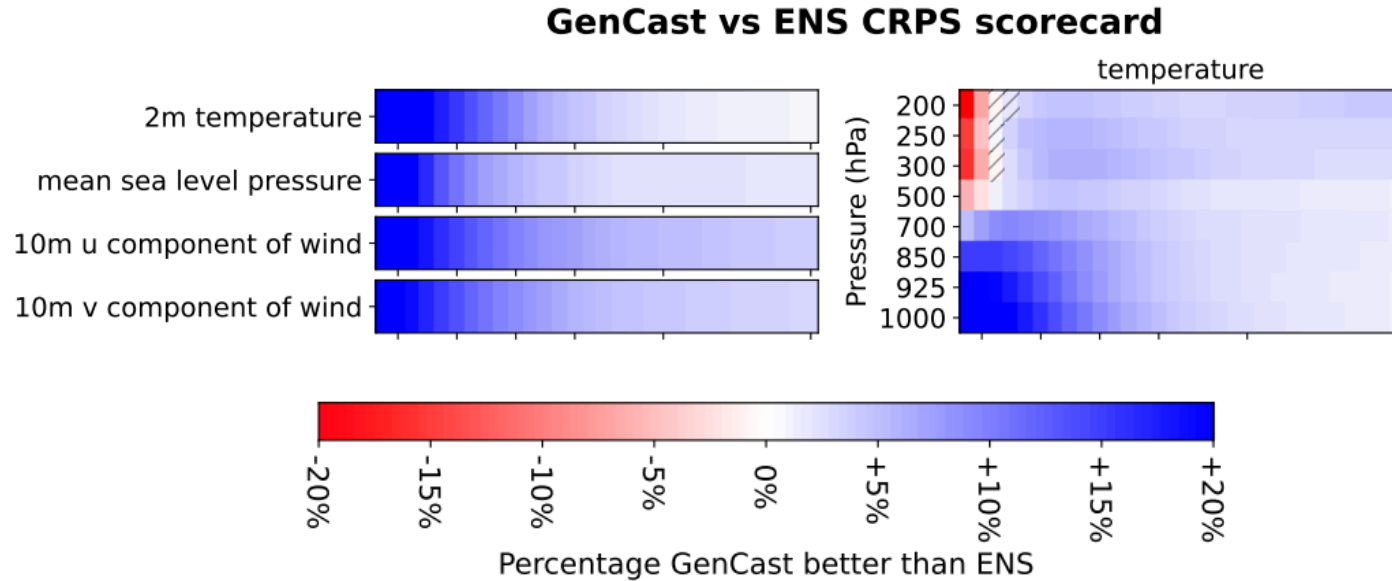


Figure from Price et al. (2024); <https://arxiv.org/pdf/2312.15796>

AI weather models are learning the correct physics of the climate system

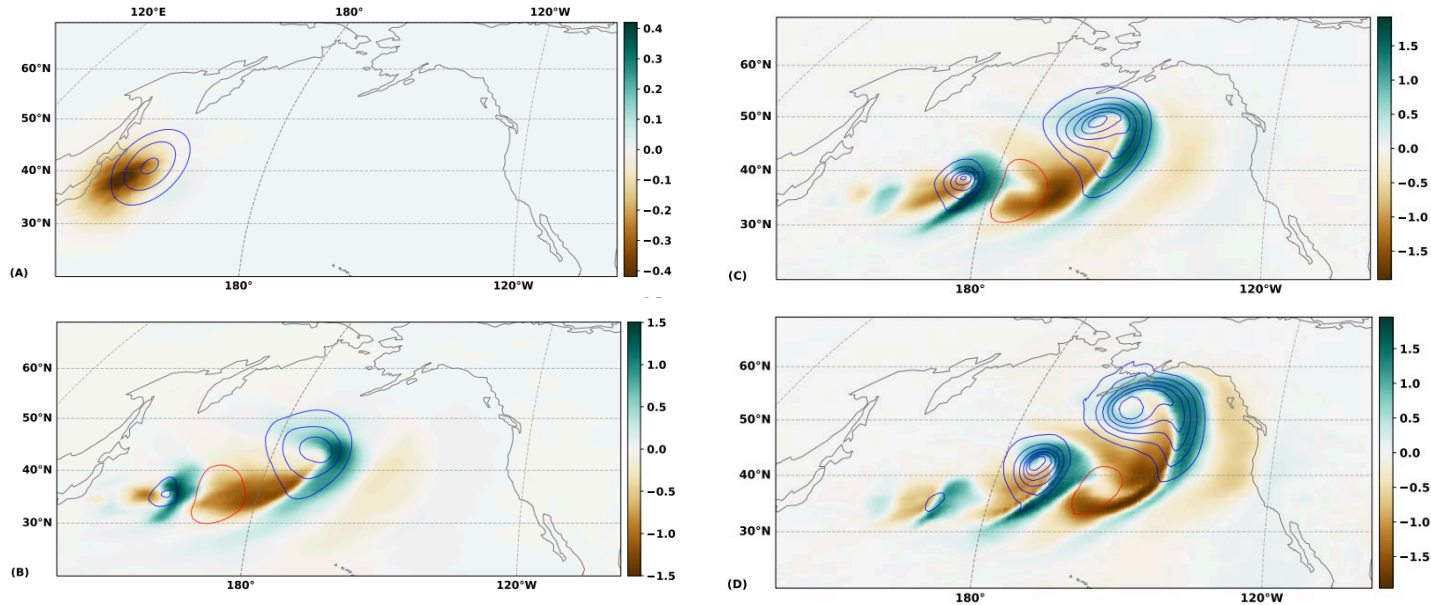


Figure from Hakim and Masanam (2023); <https://arxiv.org/pdf/2309.10867>

02

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Applying AI to Long-Range Weather Forecasts

S2S forecasting is known as a "desert" because making useful forecasts is challenging

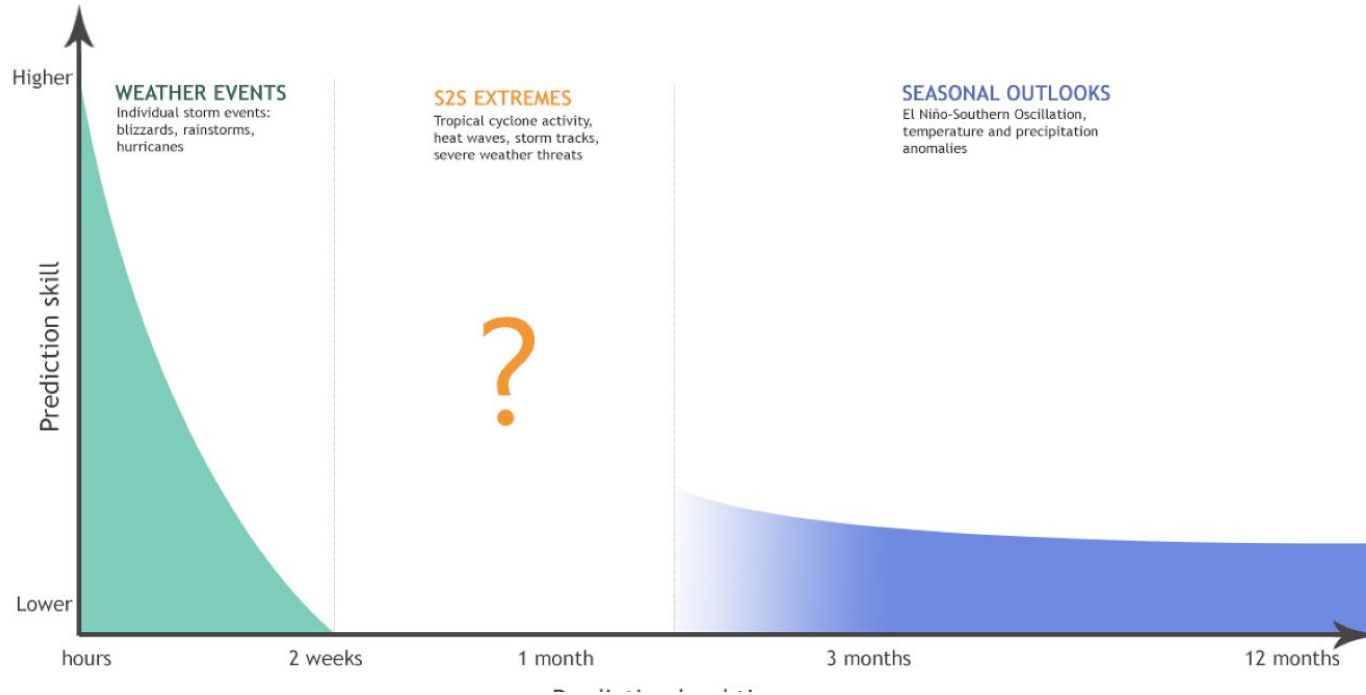


image courtesy of NOAA

We know the sources of predictability, but blending them together is challenging

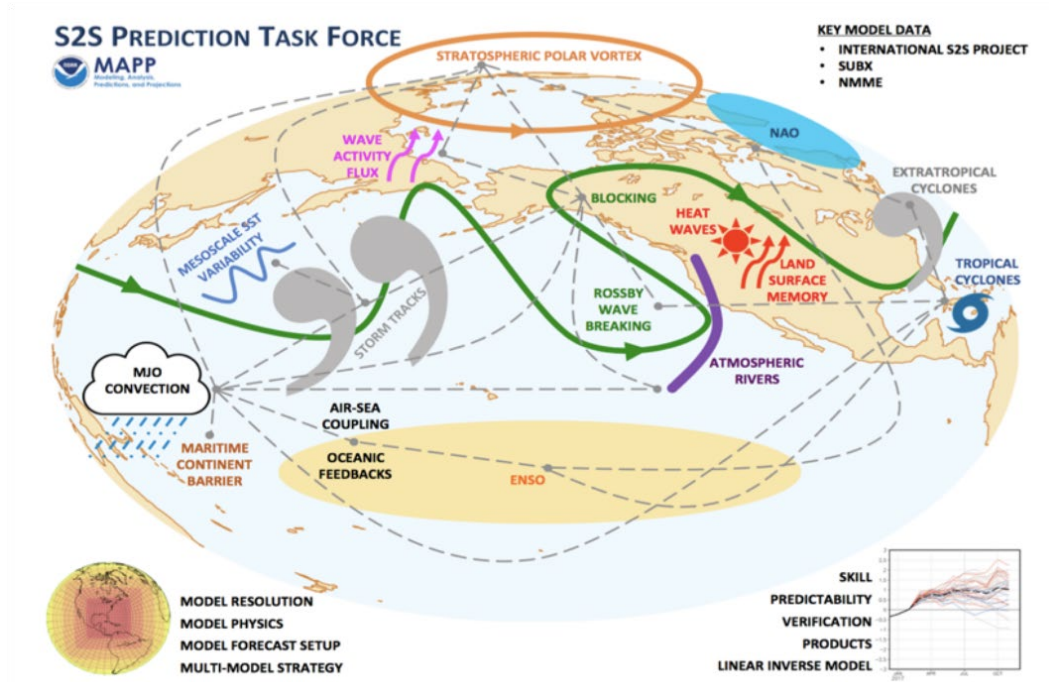
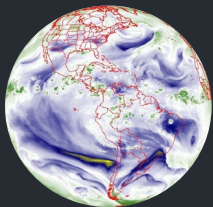
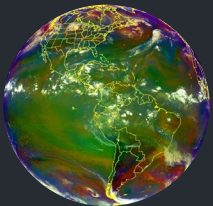


image courtesy of NOAA

Weather/Climate Data



Artificial Intelligence Modeling

Forecast Generation



forecast the next weeks
through next years

Downscaling



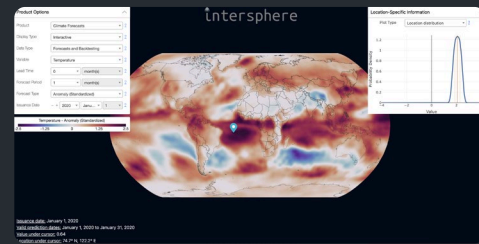
In-Cloud
Processing



Localized Forecast
Optimization



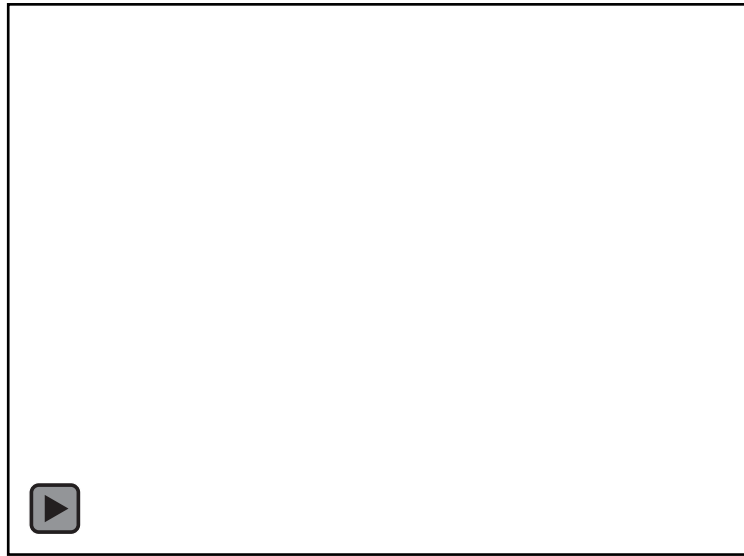
User Interface



Long-range AI models create physically realistic forecasts

Shown: three-month anomalies

Temperature

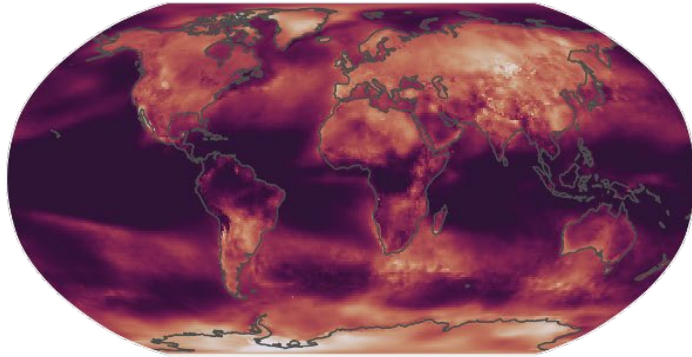


Wind Speed

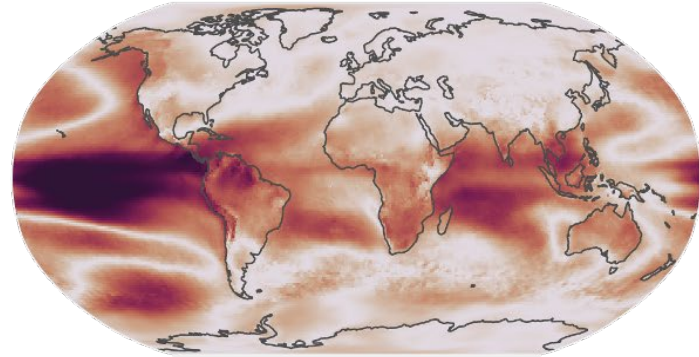


Long-range AI models create highly accurate forecasts

Accuracy from our forecasts



Accuracy from ENSO-based forecasts



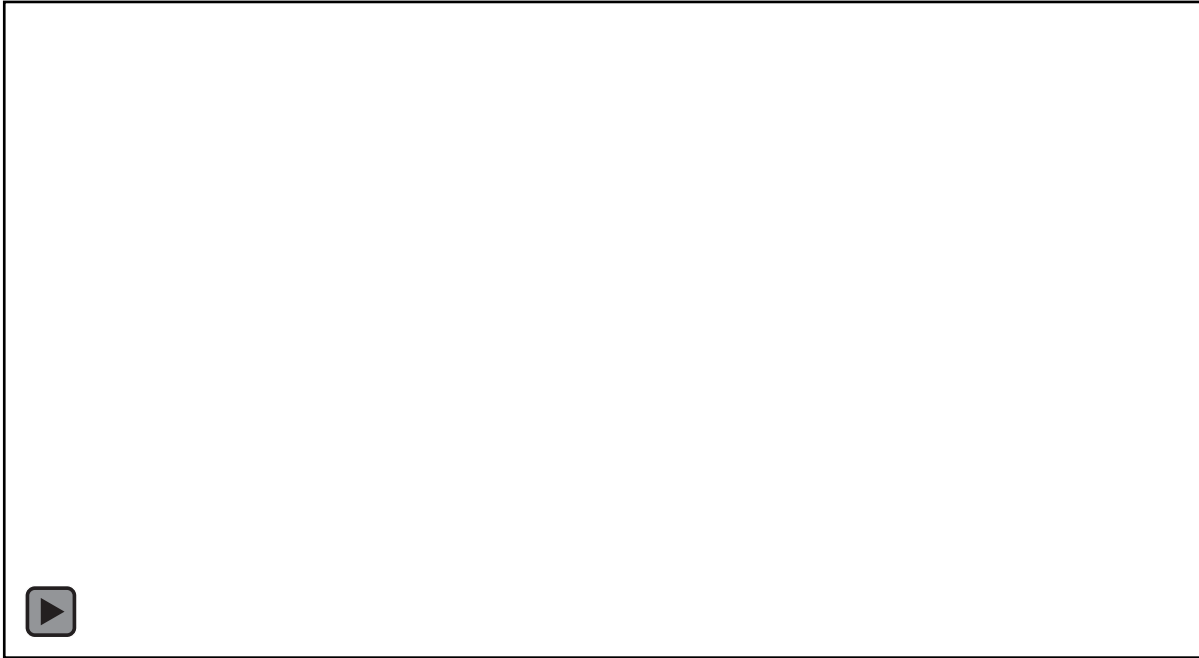
Accuracy (positive and higher is better)



←
negative

→
positive

AI models can be flexibly built to be both deterministic (single-value) and probabilistic



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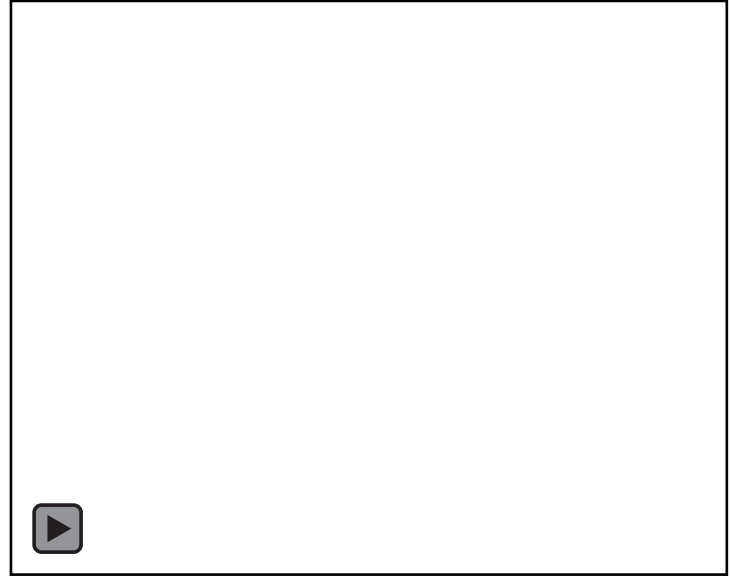


Translation from Weather to Energy Forecasts

Asset-level energy forecasts through the next year are possible

Shown:

Seasonal (3-month) wind power production anomalies forecasted 9 months in advance

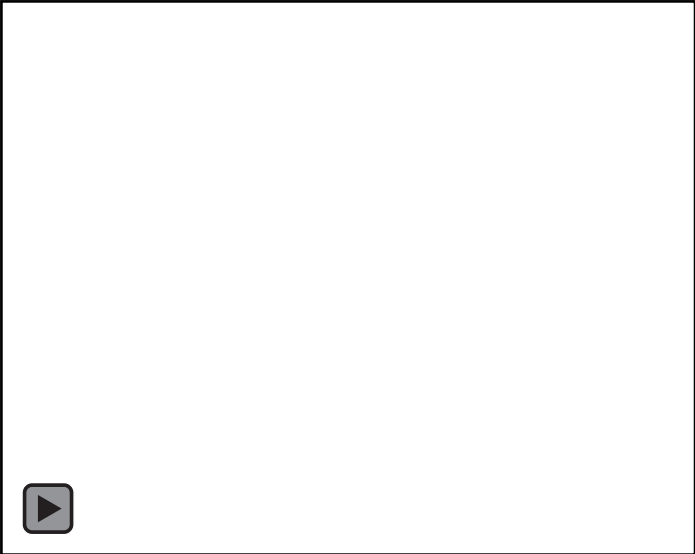


Asset-level energy forecasts through the next year are possible

Wind Speed



Power Production



04

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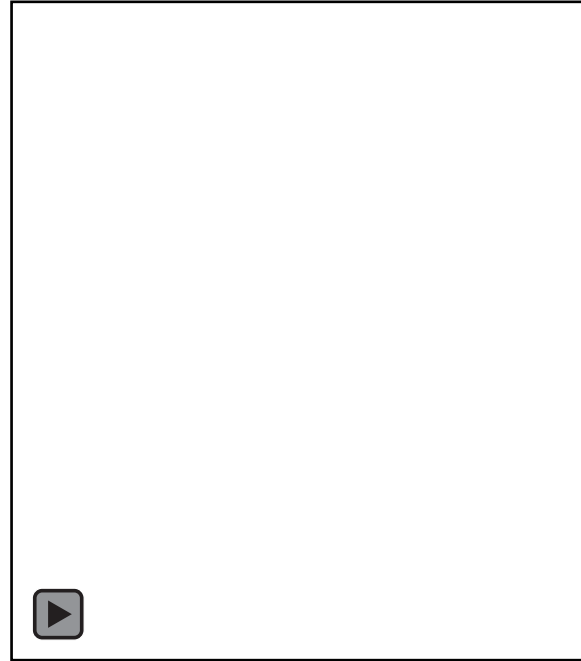


Additional Information About AI Weather Models

AI weather model forecasts are explainable

Shown:

Which pressure patterns are responsible for temperature anomalies at the blue dot?





Questions?

ben.toms@climavision.com

<https://www.linkedin.com/in/ben-a-toms/>