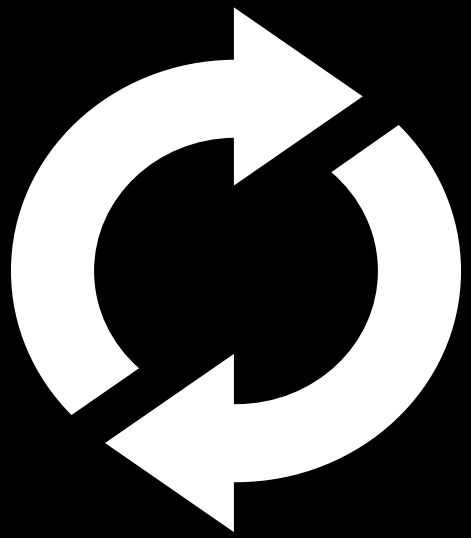
AI + SCIENCE

Anima Anandkumar

HOW IS ENGINEERING AND SCIENTIFIC RESEARCH DONE TODAY?

Human intuition

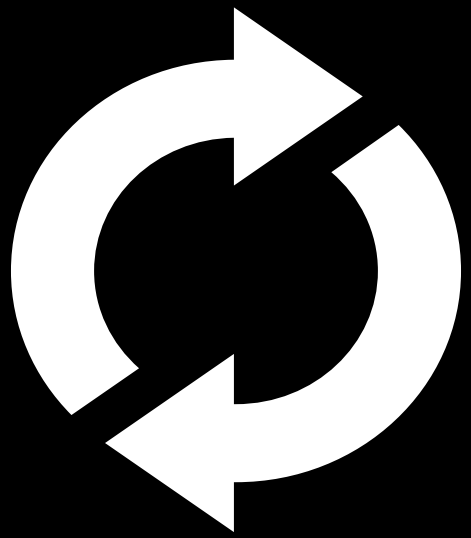


Bottleneck: simulation/physical experiments

(weeks - months)

THE FUTURE OF ENGINEERING AND SCIENTIFIC RESEARCH

Human intuition + AI



Can AI simulate, experiment and design?

Ideally real-time

IDEA GENERATION WITH AI

TEXT

Predict the next ???

word

token

character

GENOMES

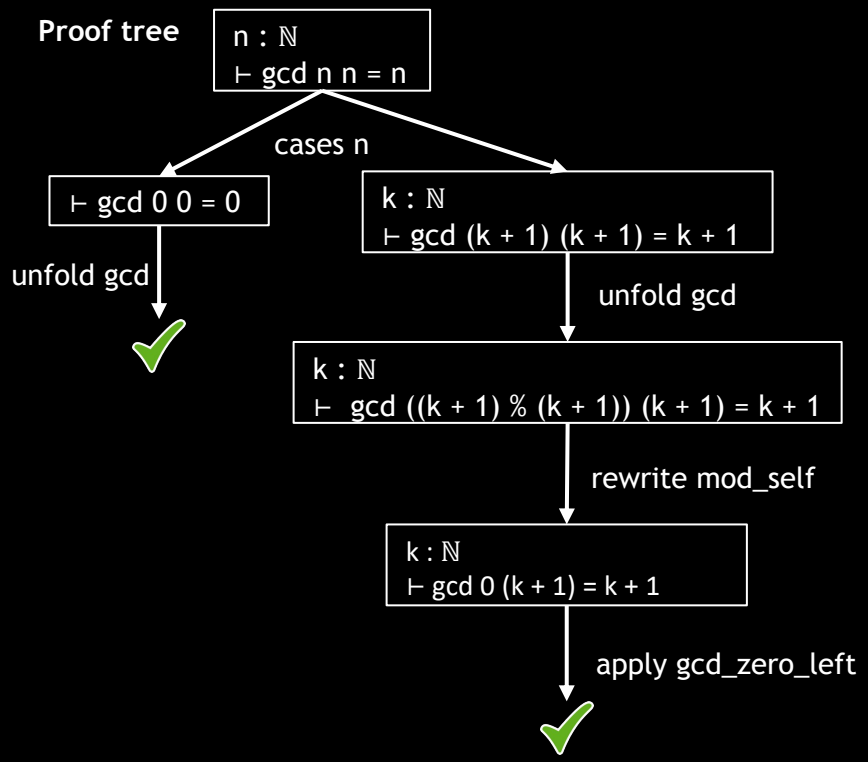
CTT TCG ATC ???

TCT

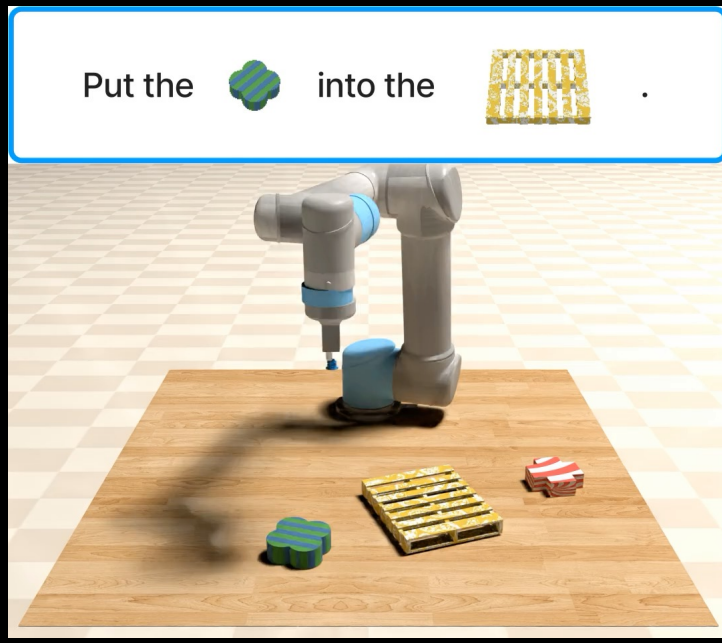
CAA

AGA

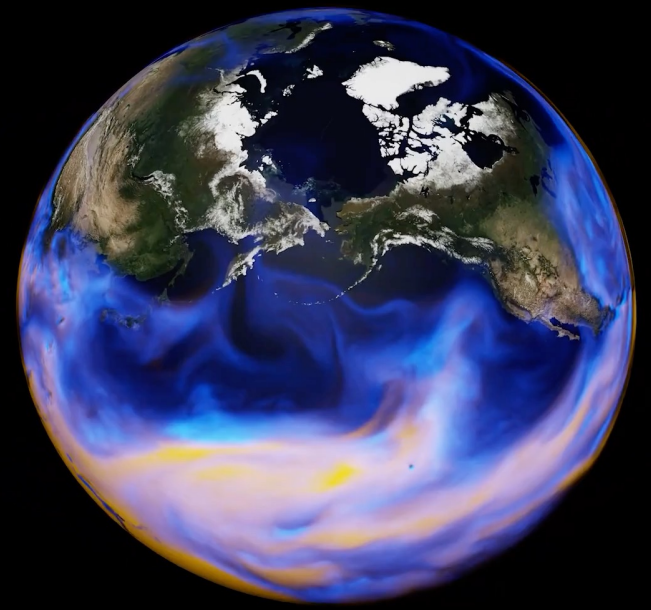
THEOREMS



EMBODIED AGENTS



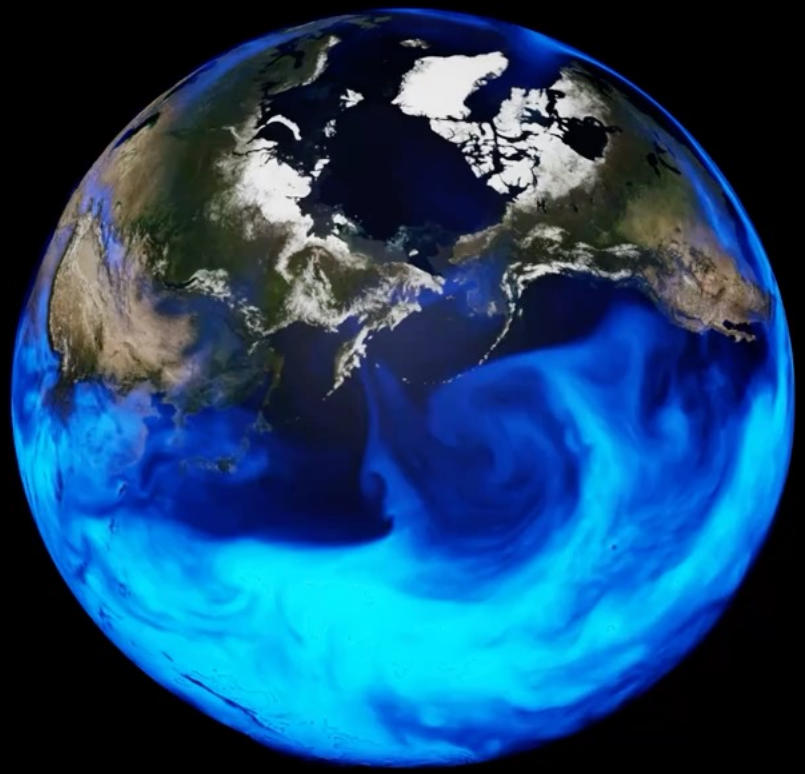
MULTI-SCALE PROCESSES IN NATURE



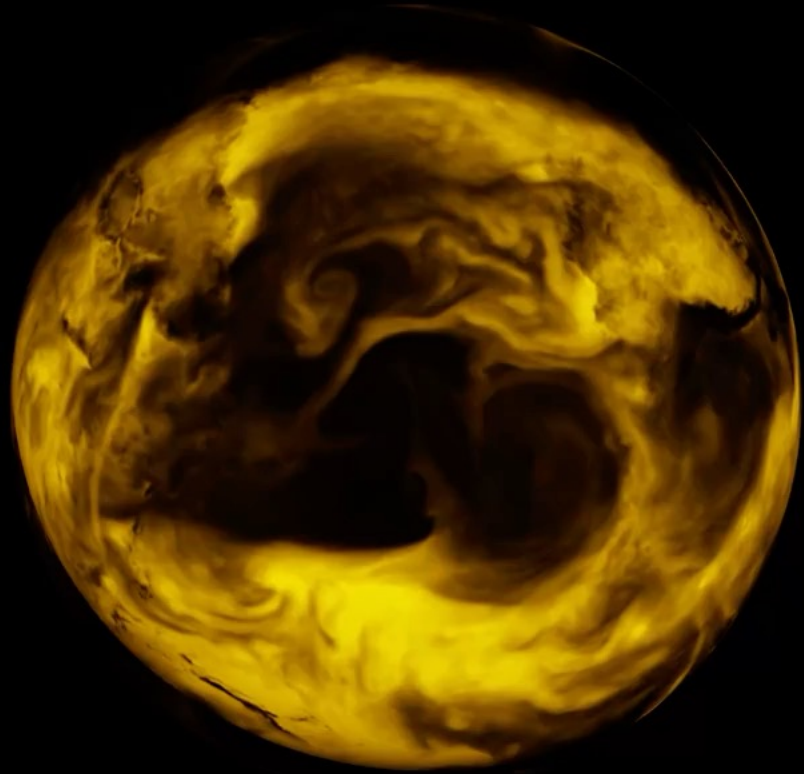
Mathematical equations govern the world at all scales

AI ACCELERATES WEATHER FORECASTING

Ground Truth



FourCastNet



Our AI (FNO) is **45,000 times** faster than current weather models

AI ACCELERATES WEATHER FORECASTING

ECMWF | Charts

Help Log in

Home / Charts catalogue

FourCastNet

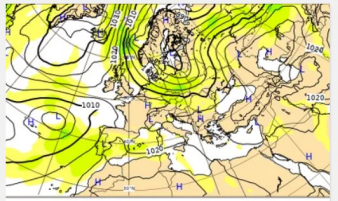
Range
- Medium (15 days)
- Extended (42 days)
- Long (Months)

Type
- Forecasts
- Verification

Component
- Surface
- Atmosphere

Product type
- High resolution forecast (HRES)
- Ensemble forecast (ENS)
- Combined (ENS + HRES)
- Extreme forecast index
- Point-based products
- Experimental: AIFS
- Experimental: Machine learning models
- Atmospheric composition

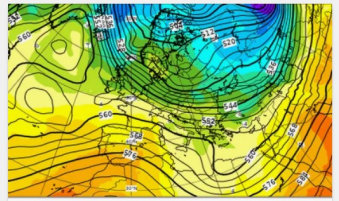
Parameters
- Wind



Latest forecast

Experimental: FourCastNet ML model: Mean sea level pressure and 850 hPa wind speed

FourCastNet v2-small:a deep learning-based system developed by NVIDIA in collaboration with researchers at several US universities.It is initialised with ECMWF HRES analysis. FourCastNet operates at 0.25° resolution.



Latest forecast

Experimental: FourCastNet ML model: 500 hPa geopotential height and 850 hPa temperature

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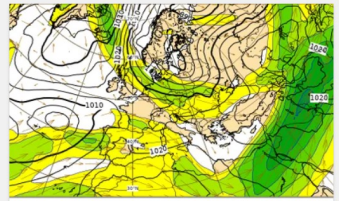
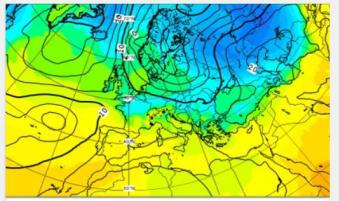


Latest forecast

Experimental: FourCastNet ML model: Mean sea level pressure and 200 hPa wind

FourCastNet v2-small:a deep learning-based system developed by NVIDIA in collaboration with researchers at several US universities.It is initialised with ECMWF HRES analysis. FourCastNet operates at 0.25° resolution.



Latest forecast

Experimental: FourCastNet ML model: Temperature and geopotential at various pressure levels

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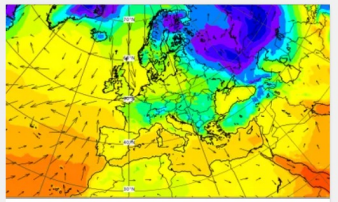
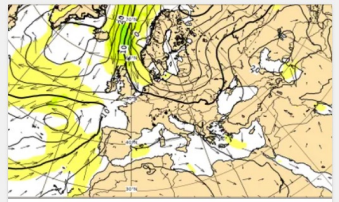


Latest forecast

Experimental: FourCastNet ML model: 2 m temperature and 10 m wind

FourCastNet v2-small:a deep learning-based system developed by NVIDIA in collaboration with researchers at several US universities.It is initialised with ECMWF HRES analysis. FourCastNet operates at 0.25° resolution.



Latest forecast

Experimental: FourCastNet ML model: Wind and geopotential heights at various pressure levels

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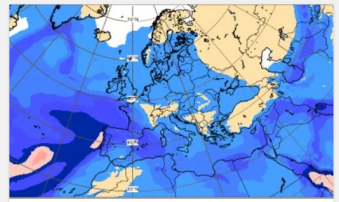


Latest forecast

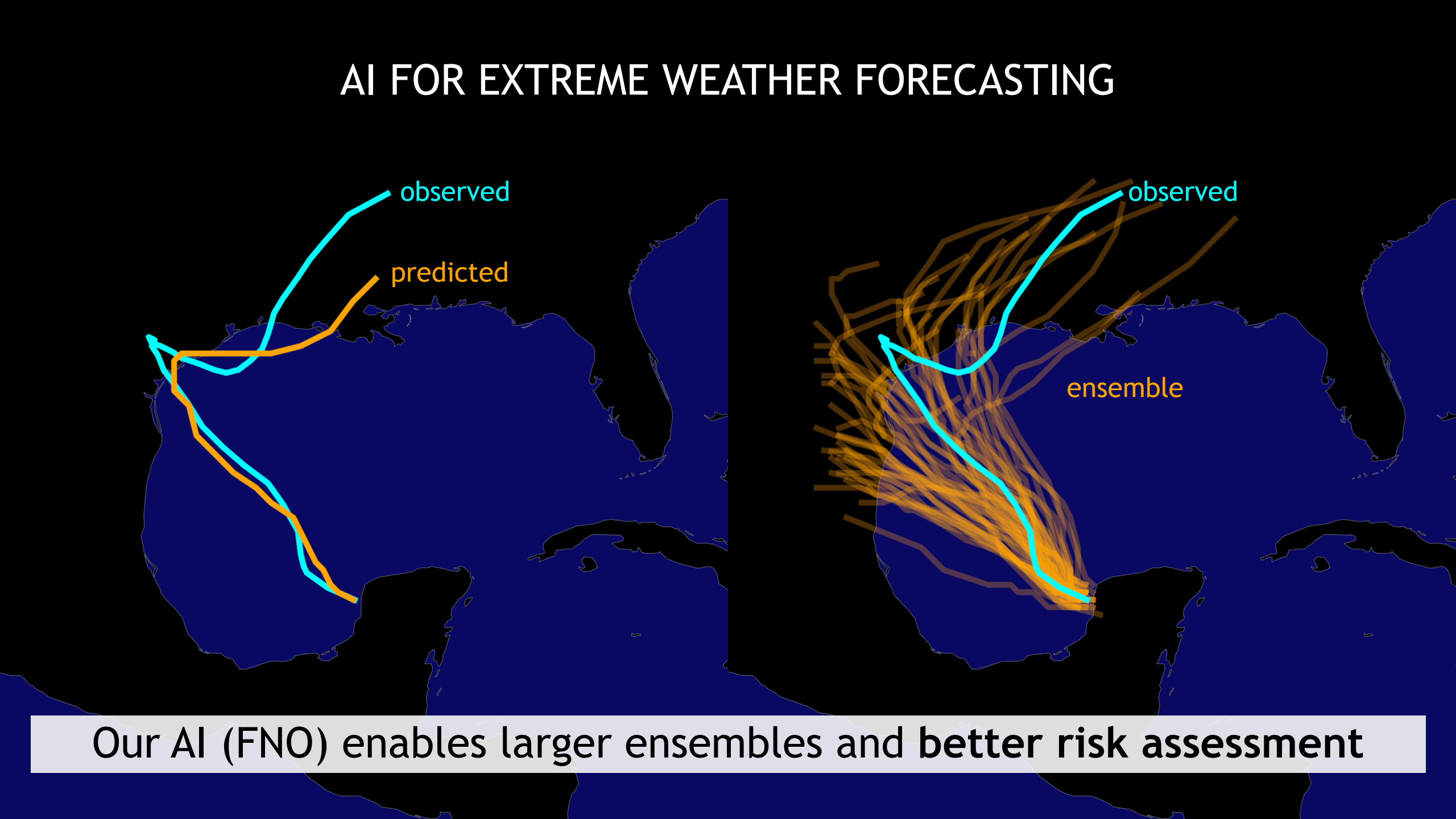
Experimental: FourCastNet ML model: Total column water

FourCastNet v2-small:a deep learning-based system developed by NVIDIA in collaboration with researchers at several US universities.It is initialised with ECMWF HRES analysis. FourCastNet operates at 0.25° resolution.

https://charts.ecmwf.int/products/fourcast_medium-z500-t850

Our AI weather model is deployed at ECMWF, giving real-time forecasts

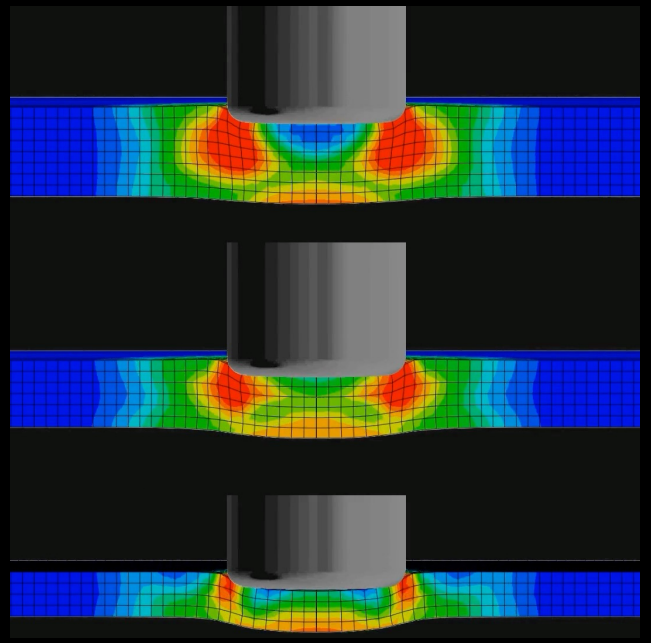
AI FOR EXTREME WEATHER FORECASTING



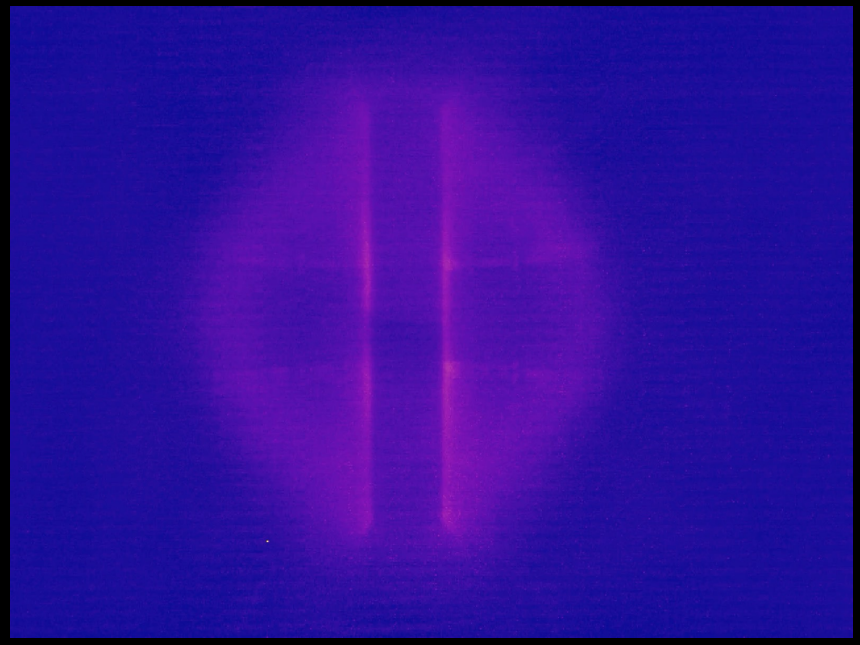
Our AI (FNO) enables larger ensembles and **better risk assessment**

NEURAL OPERATORS (FNO) - SIMULATION

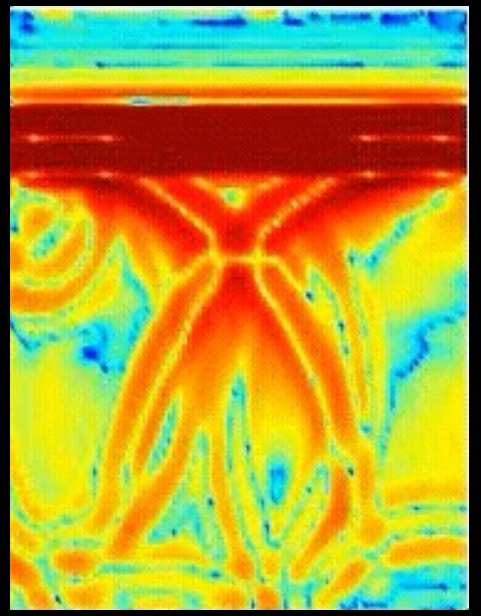
Deformation



Fusion



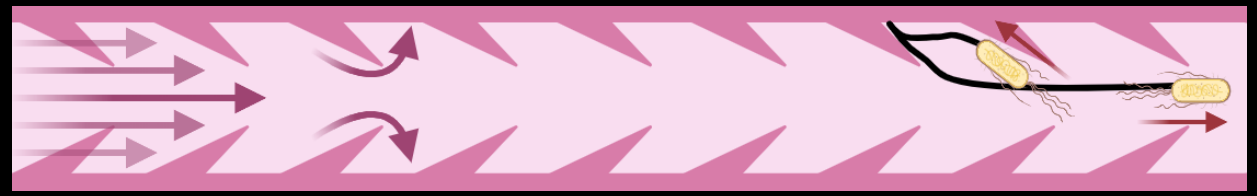
Ultrasound

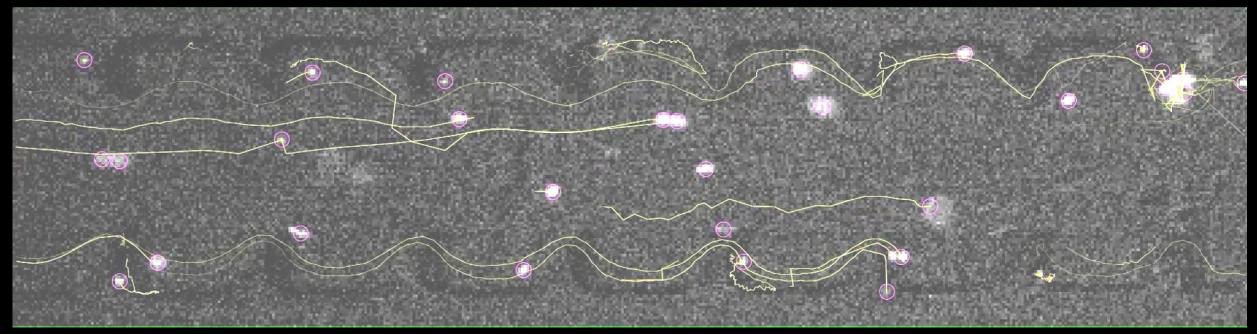


Our AI (FNO) is ~**100,000 times** faster

NEURAL OPERATORS (FNO) - DESIGN

Catheter

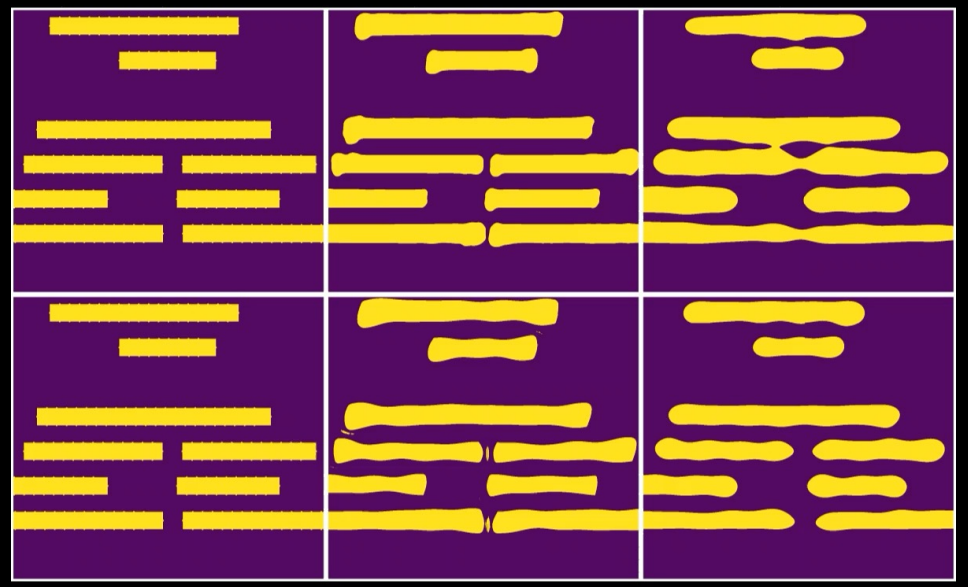




Lithography

Epoch 1
AI: MSE 920798 EPE 382
ILT: MSE 717711 EPE 123

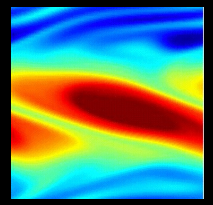
Design Mask Resist



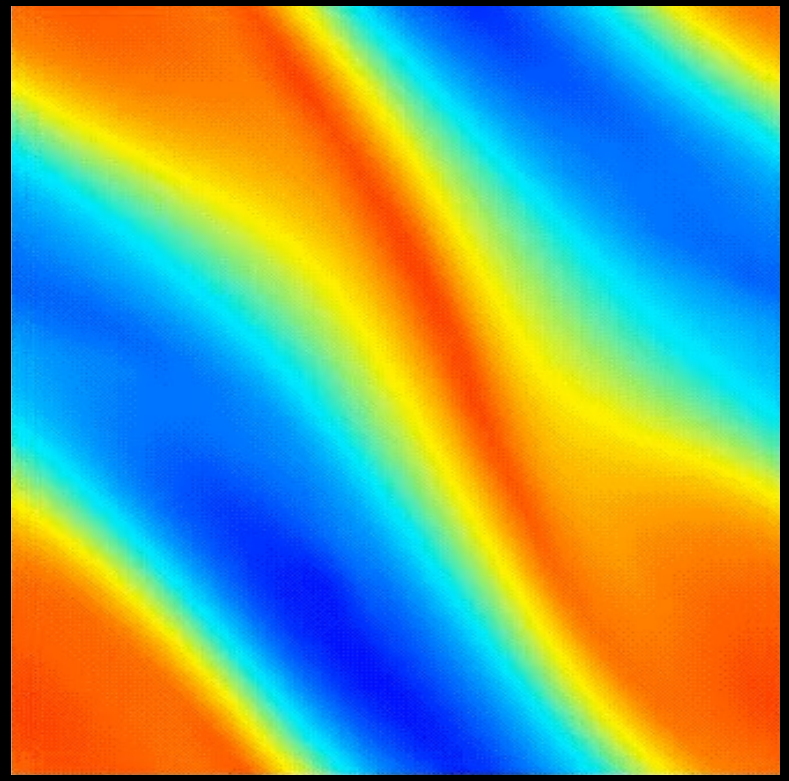
Our AI (FNO) is **differentiable** and can do **inverse design**

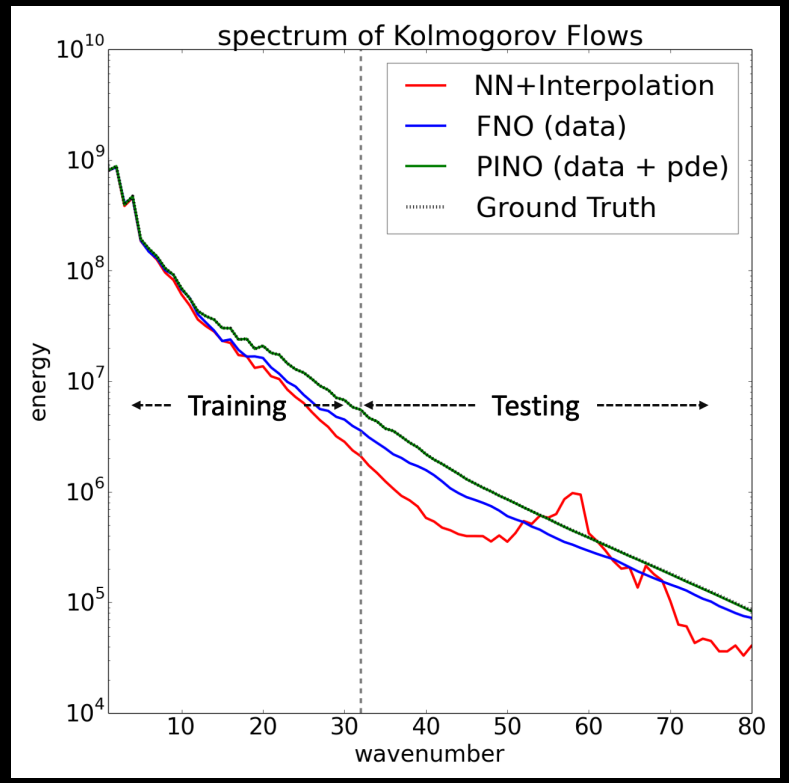
PHYSICS INFORMED NEURAL OPERATORS

training data
(64x64)



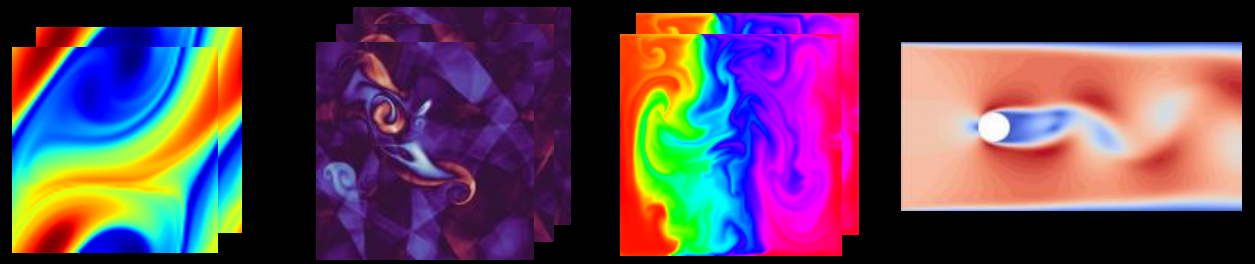
prediction
(256x256)





Our AI model (PINO) perfectly learns physical effects at all scales

FOUNDATION MODEL FOR SCIENCE AND ENGINEERING



Foundation Model

Universal understanding of multi-scale multi-physics processes