

AI + SCIENCE

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Caltech



nVIDIA®

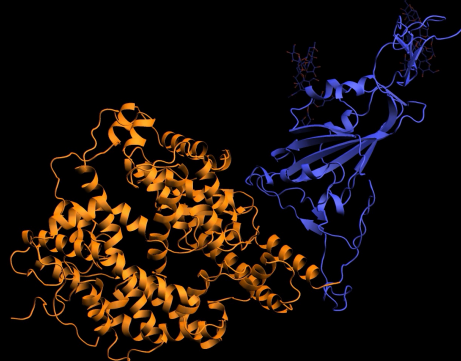
GENERATIVE AI



new

color toxicity
PROPERTIES
sentiment classification

The classical development of neural networks has been based on mappings between finite-dimensional Euclidean spaces, which has been generalized to neural operators that learn mappings between infinite-dimensional function spaces.



old

DISCRIMINATIVE AI

FROM LANGUAGE TO GENOMES

TEXT

Predict the next

???

word

token

character

NUCLEOTIDES

CTT TCG ATC

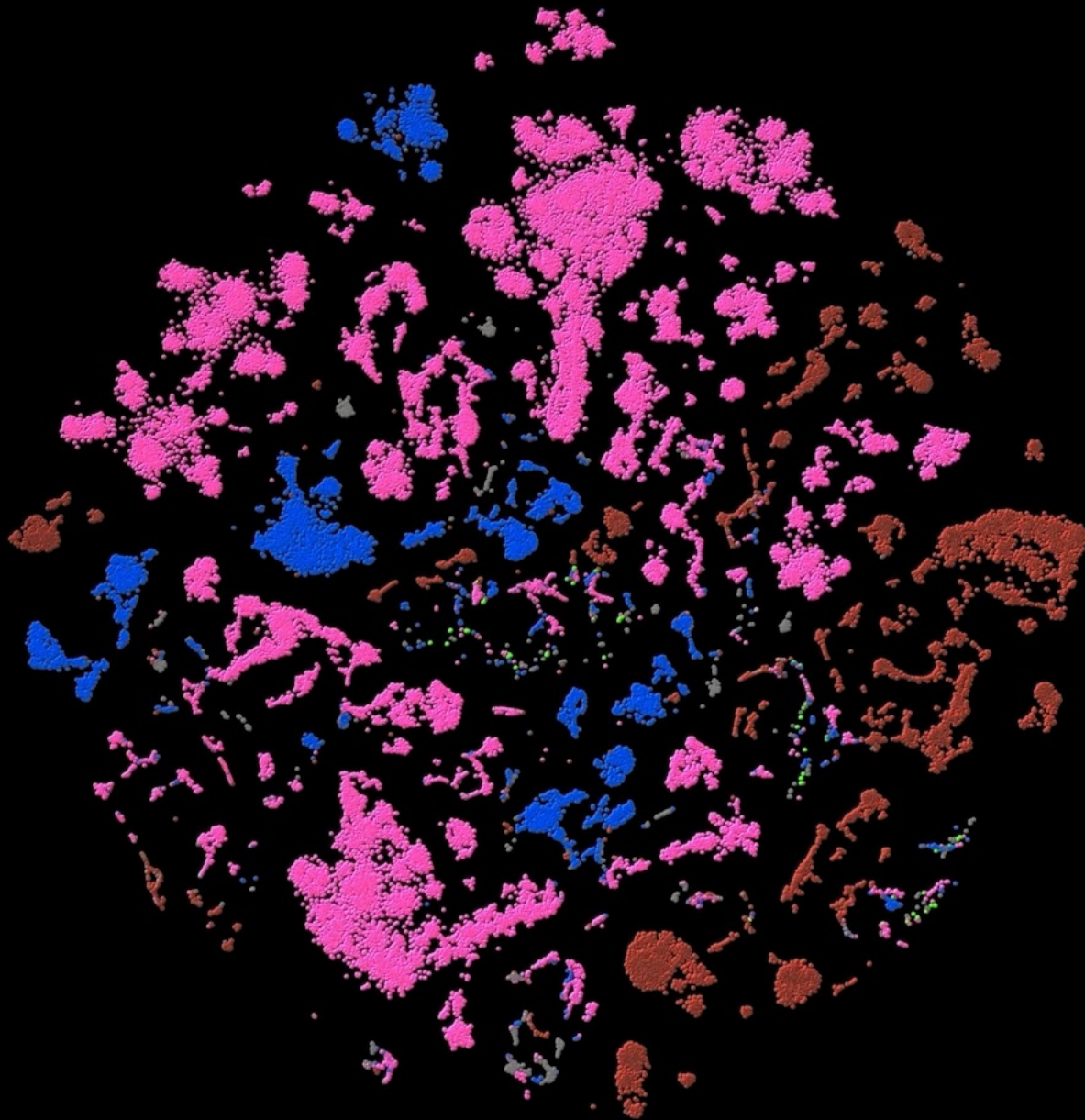
???

TCT

CAA

AGA

ALL SARS-CoV-2 GENOMES



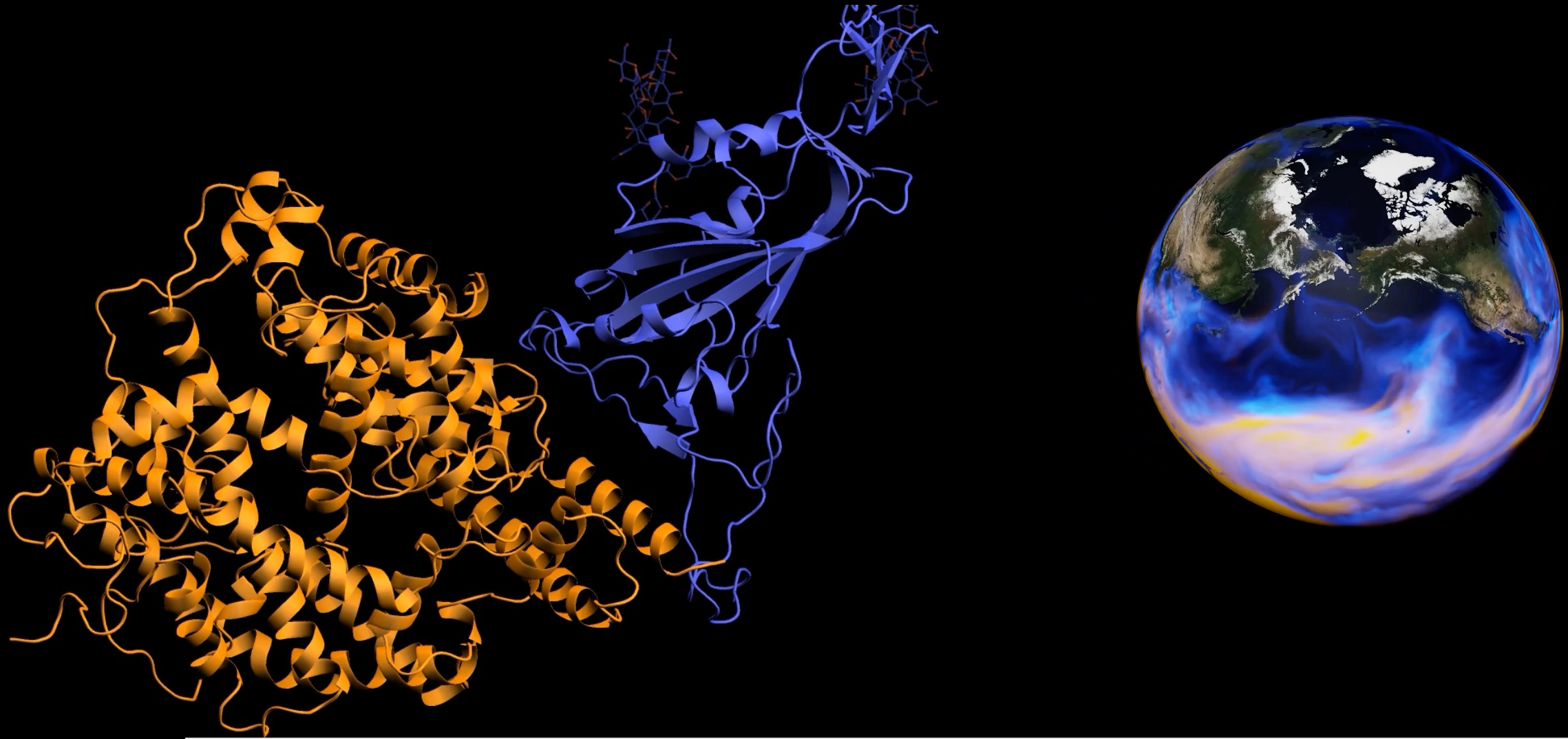
CODON

```
JA GUC CGG GUC AGC GAC ACG GCG CGU GU  
JC GAG CGU GAG AUG GCG ACU GCU CGA GA  
AG GAU CGA GAU AUU GCU ACA GCA CGC GA  
AU GAA CGC GAA AUA GCA ACC GCC CUG GA  
AA GAC CUG GAC AUC GCC CGG UGG CUU GA  
AC GCG CUU GCG AAG UGG CGU UGU CUA GC  
CG GCU CUA GCU AAU UGU CGA UGA CUC GC  
UU GCA CUC GCA AAA
```

PREDICTED VARIANTS

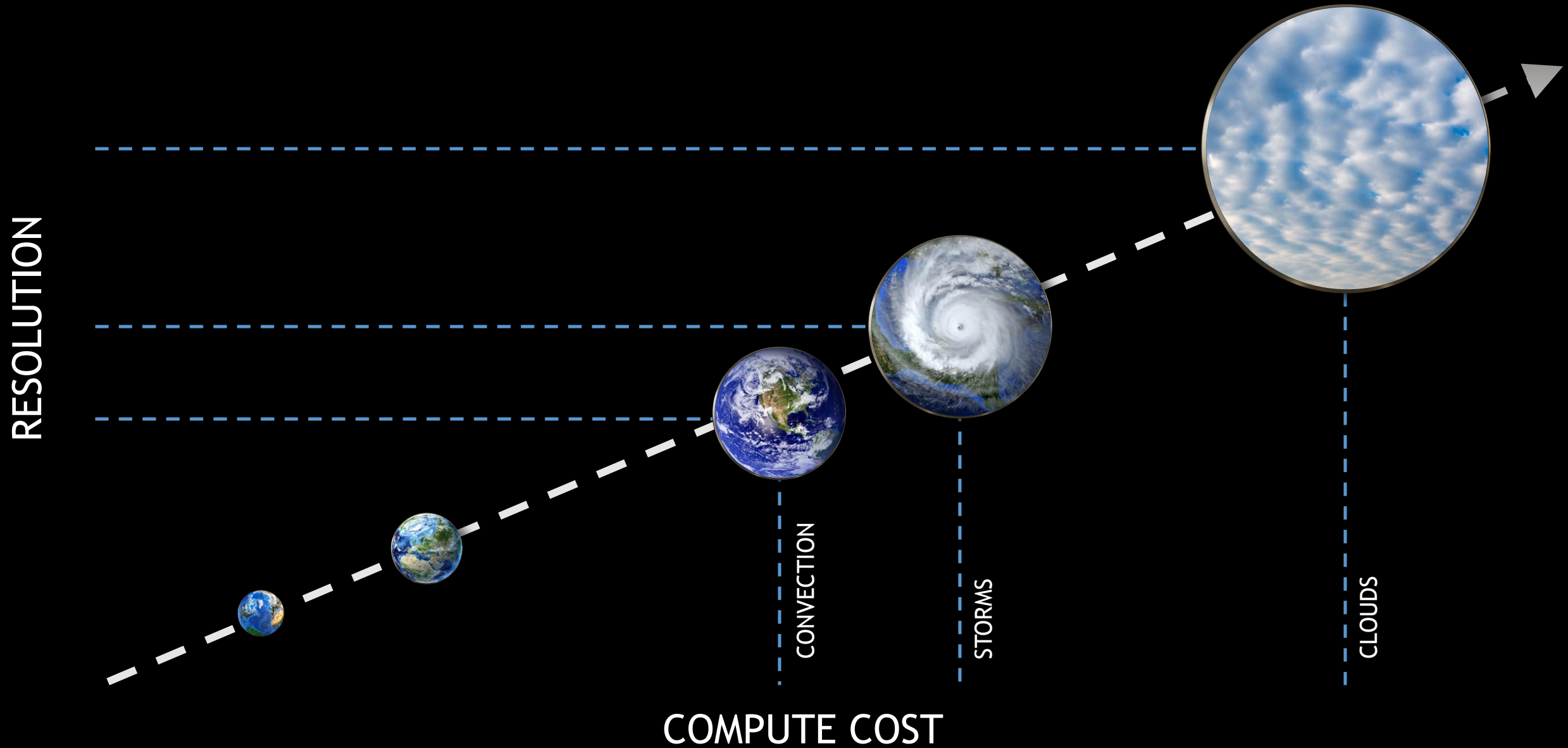
-  ALPHA
-  BETA
-  DELTA
- OMICRON

MULTI-SCALE PROCESSES IN NATURE

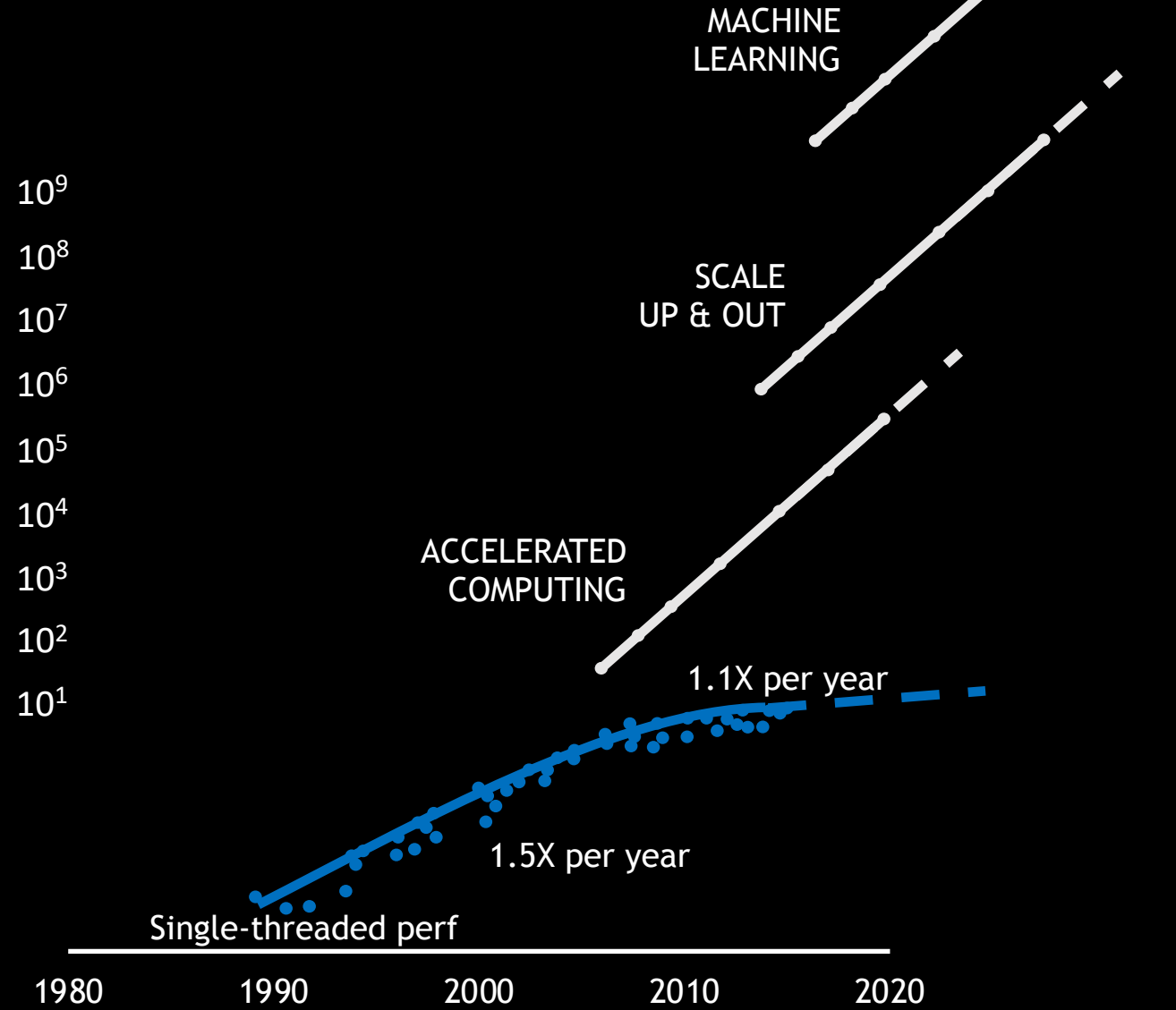


Mathematical equations govern the world at all scales

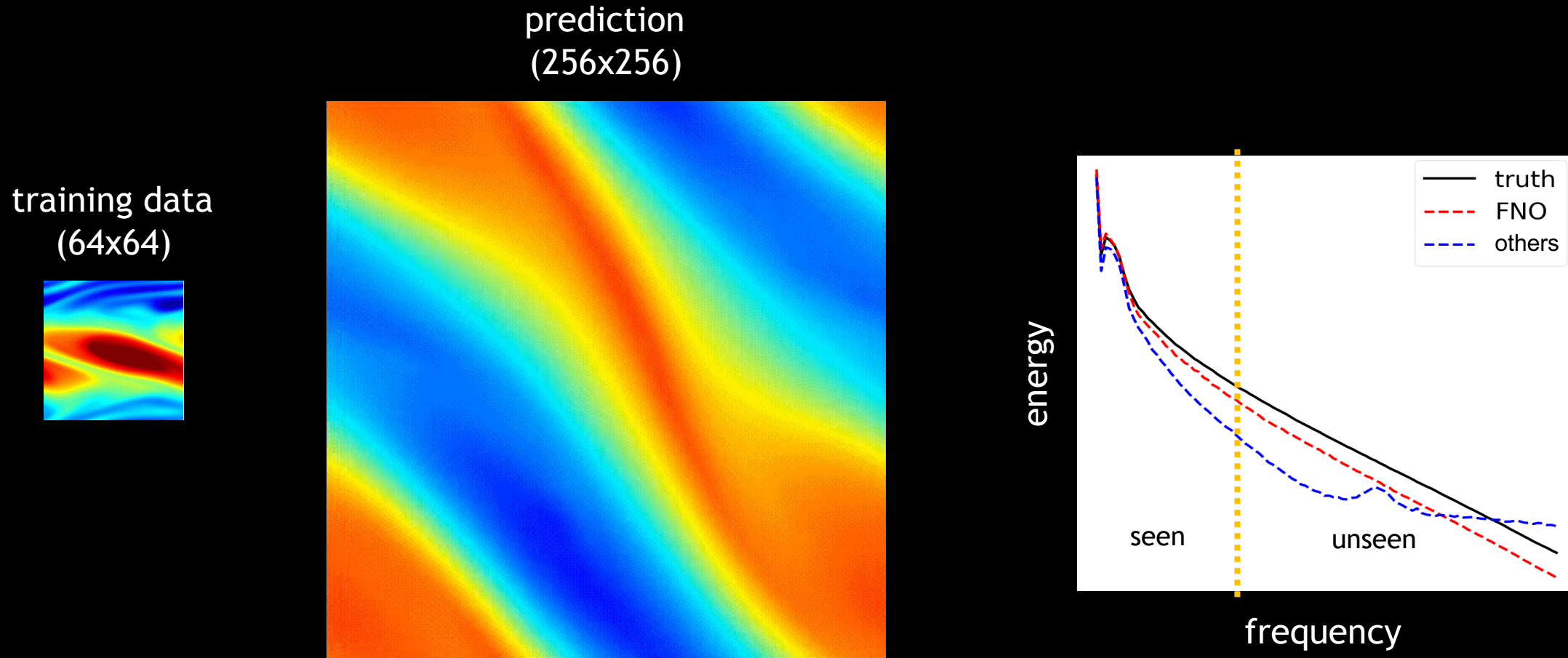
CAPTURING FINE-SCALES TOO EXPENSIVE CURRENTLY



SPEEDUP WITH AI



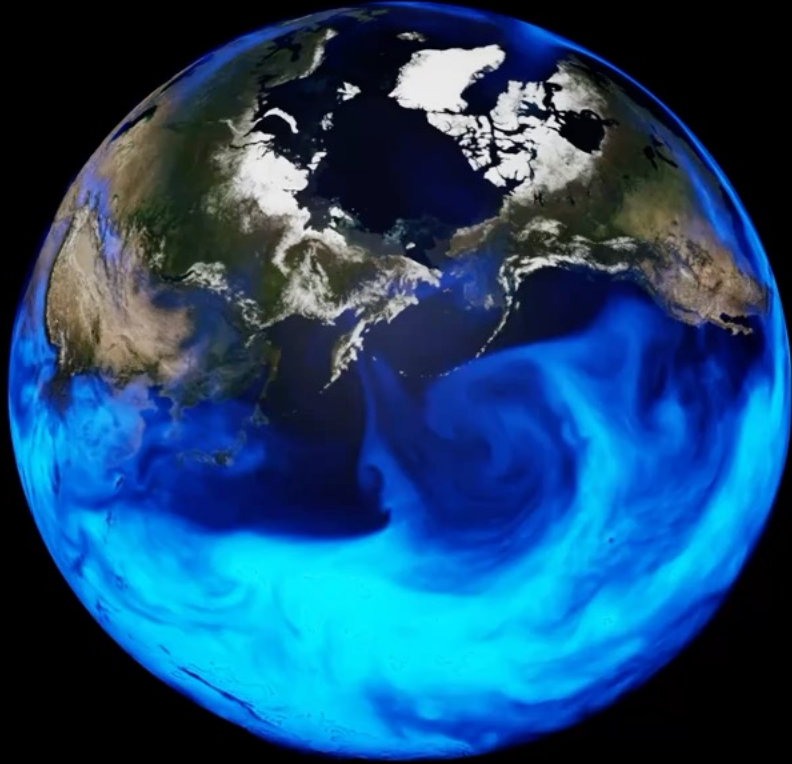
LEARNING ACROSS RESOLUTIONS WITH NEURAL OPERATORS



Our AI model (FNO) learns physical effects at all scales

AI ACCELERATES WEATHER FORECASTING

Ground Truth

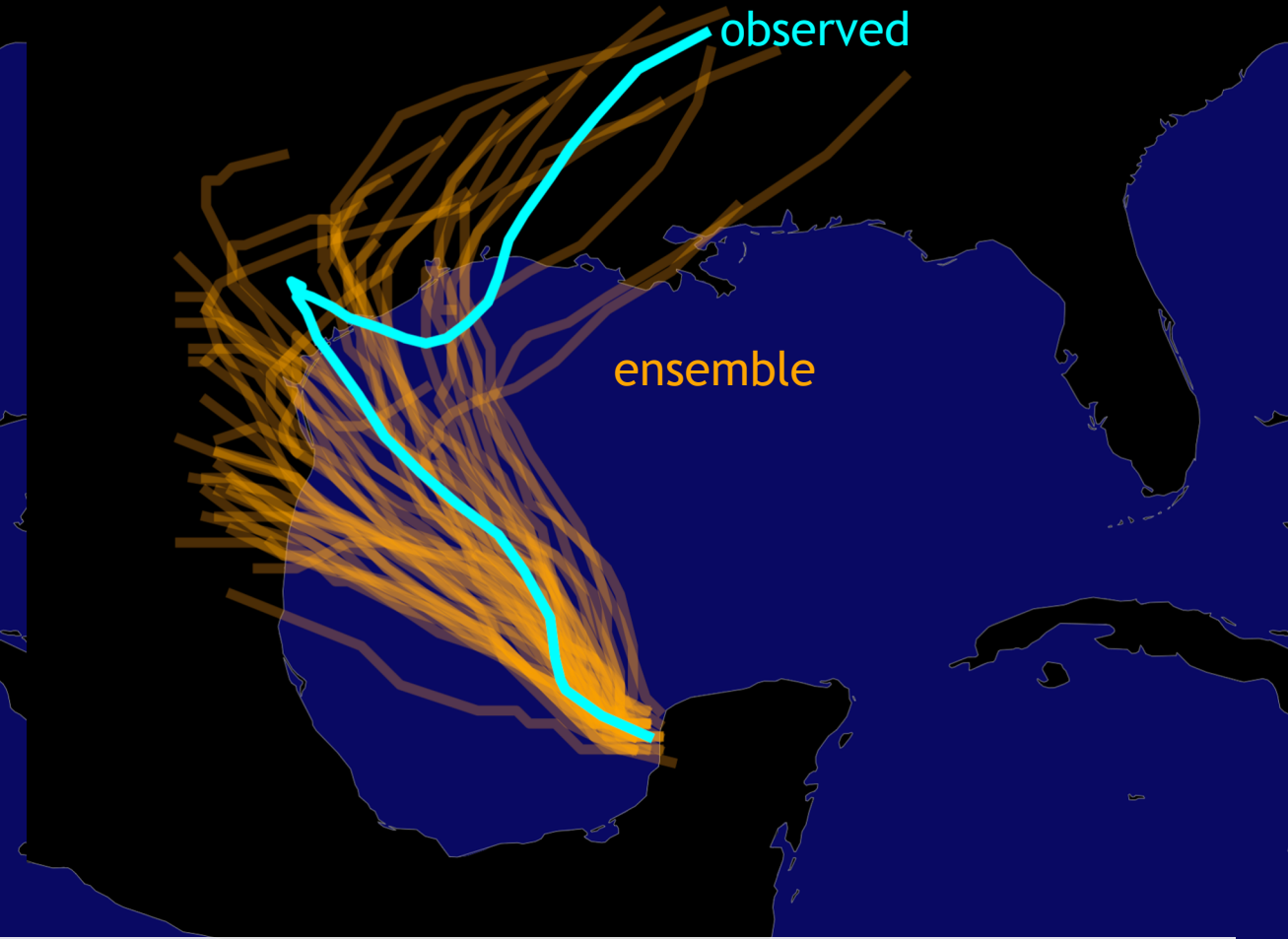
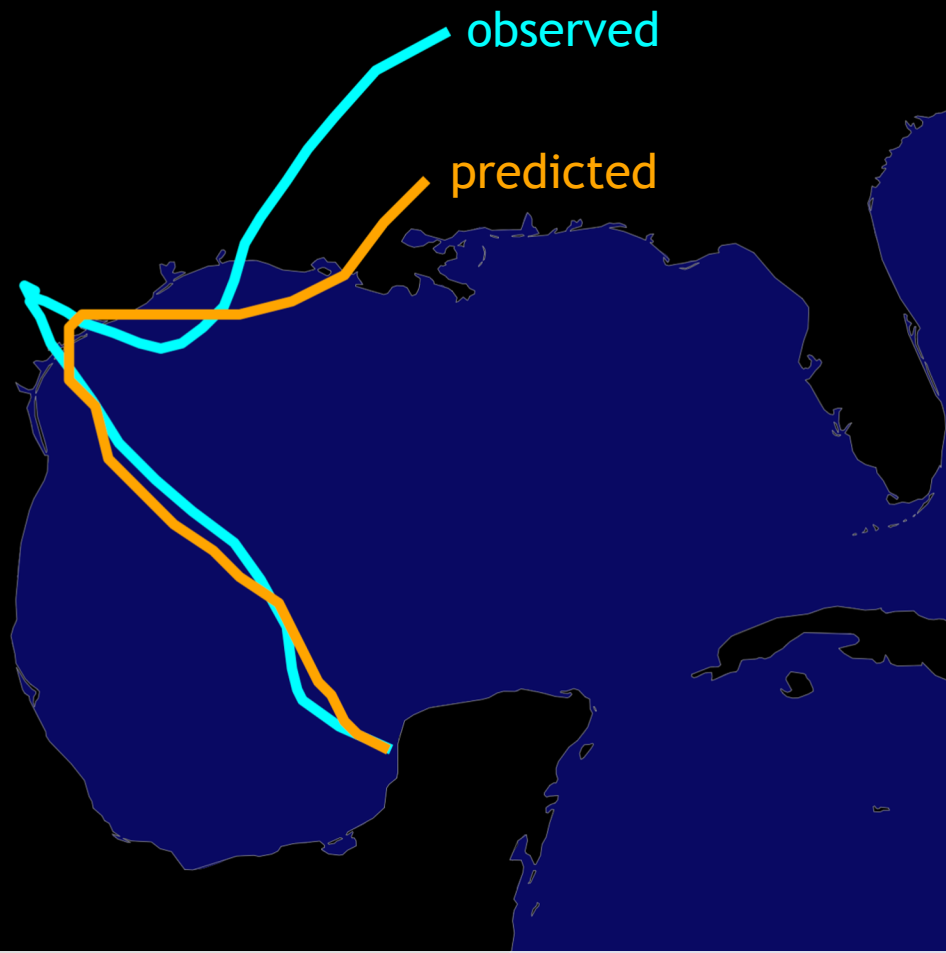


FourCastNet



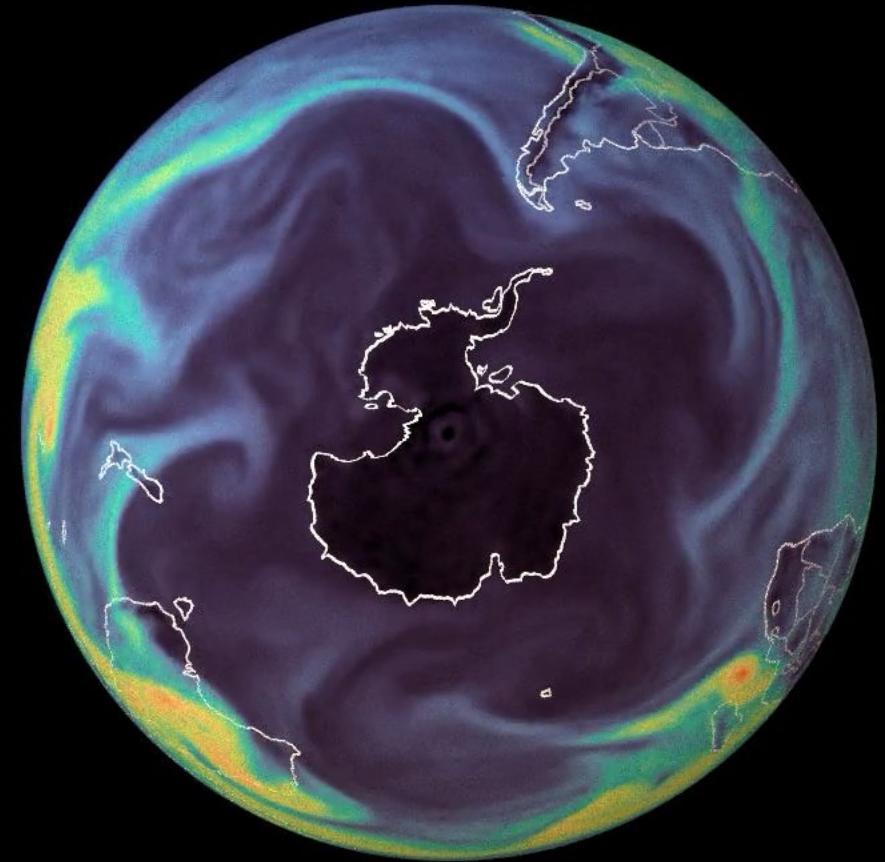
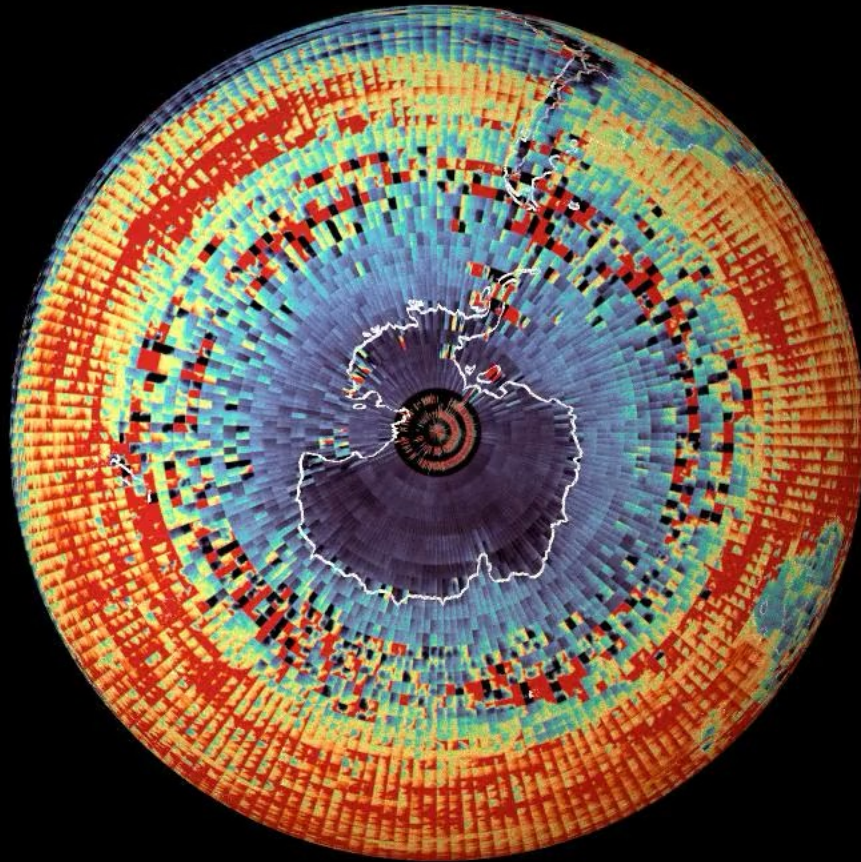
Our AI (FNO) is 45,000 times faster than current weather models

AI FOR EXTREME WEATHER FORECASTING



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

DATA + DOMAIN KNOWLEDGE



Adding spherical geometry to AI allows stable long roll-outs

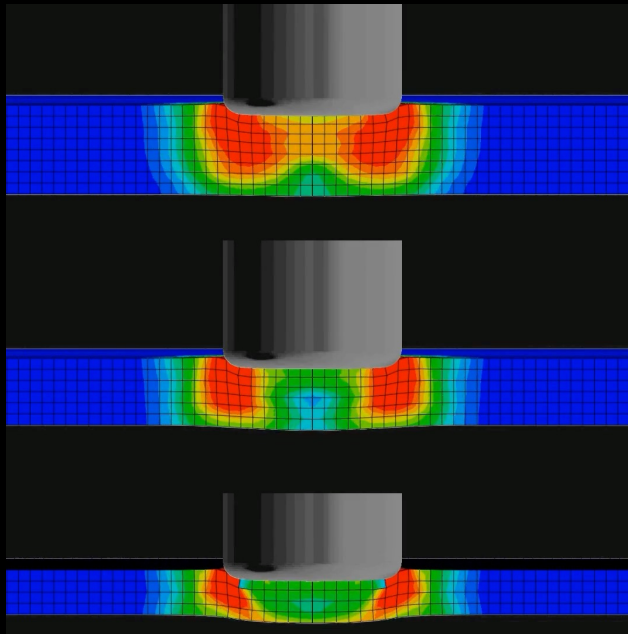


CLIMATE CHANGE MITIGATION: CO₂ STORAGE

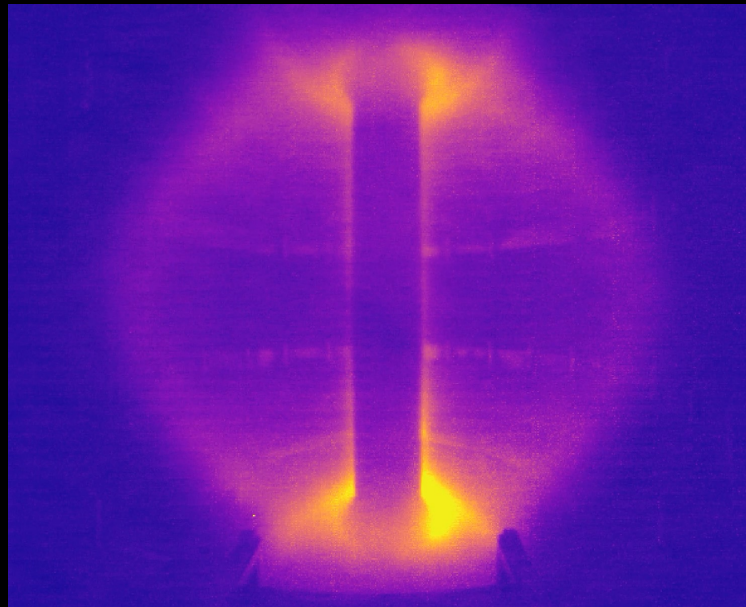
Our AI Model (FNO) is 700,000 times faster

NEURAL OPERATORS (FNO) - SIMULATION

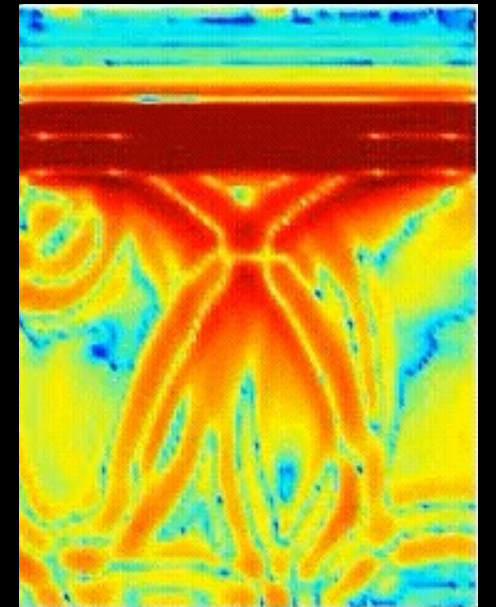
Deformation



Fusion



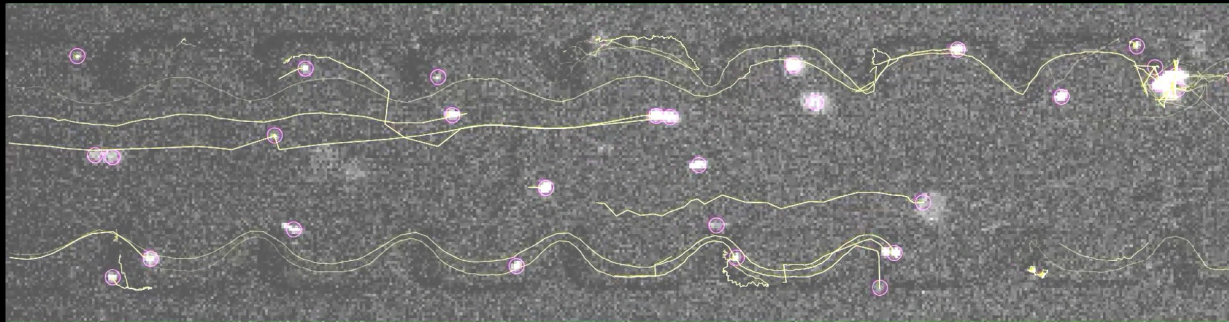
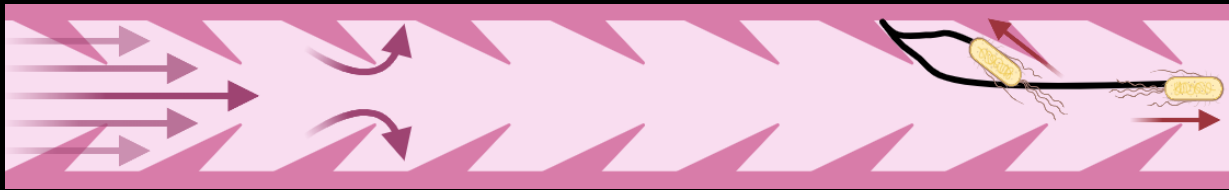
Ultrasound



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

NEURAL OPERATORS (FNO) - DESIGN

Catheter



Lithography

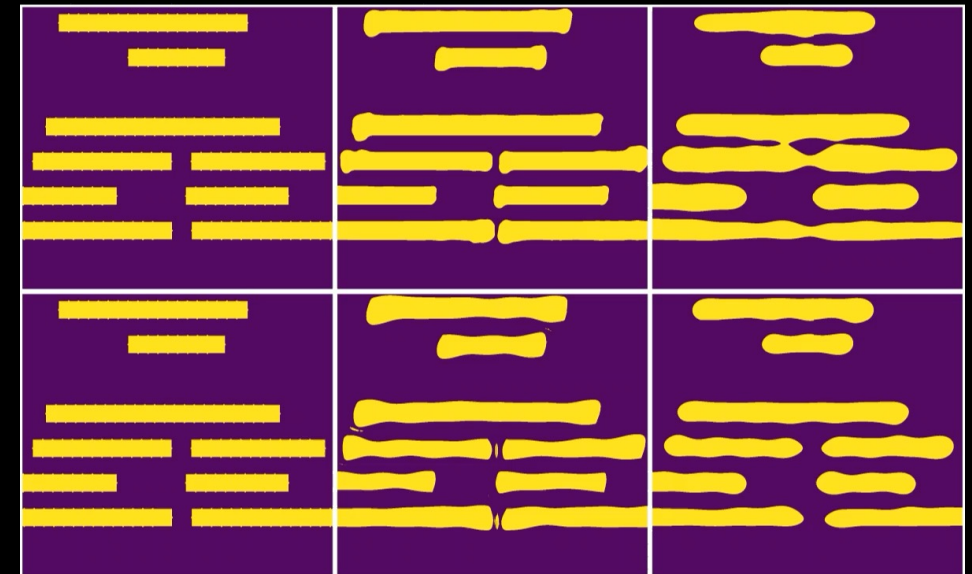
Epoch 1

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

Design

Mask

Resist



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

FOUNDATION MODELS

+

COMPUTE