Foundation models
for weather and climate

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Modeling weather and climate is crucial

Thousands of Migrant Workers Died in Qatar's Extreme Heat. The World Cup Forced a Reckoning

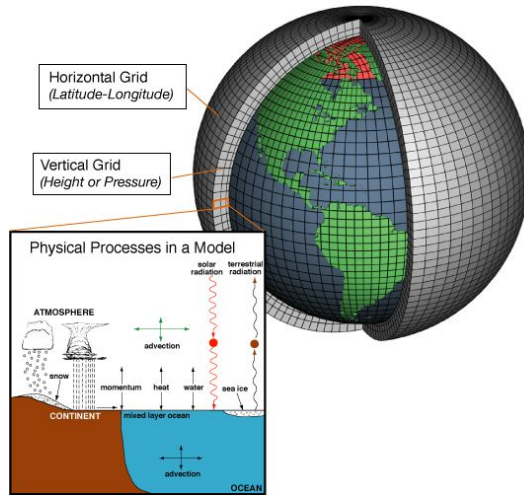**Droughts Take Widening Toll On World's Largest Economies**

E&E NEWS

CLIMATE CHANGE

Report on California Climate Impacts 'Paints a Pretty Grim Picture'

Devastating floods in Pakistan

UNICEF is on the ground working with partners to help children and families.

Numerical methods

❏ Employ explicit equations based on the laws of physics, fluid motion, and chemistry
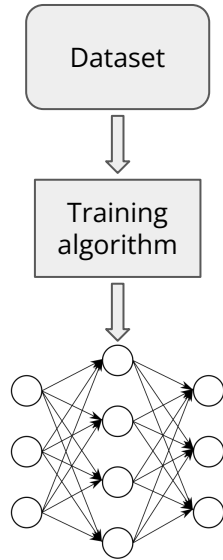

✔ Accurate and general-purpose

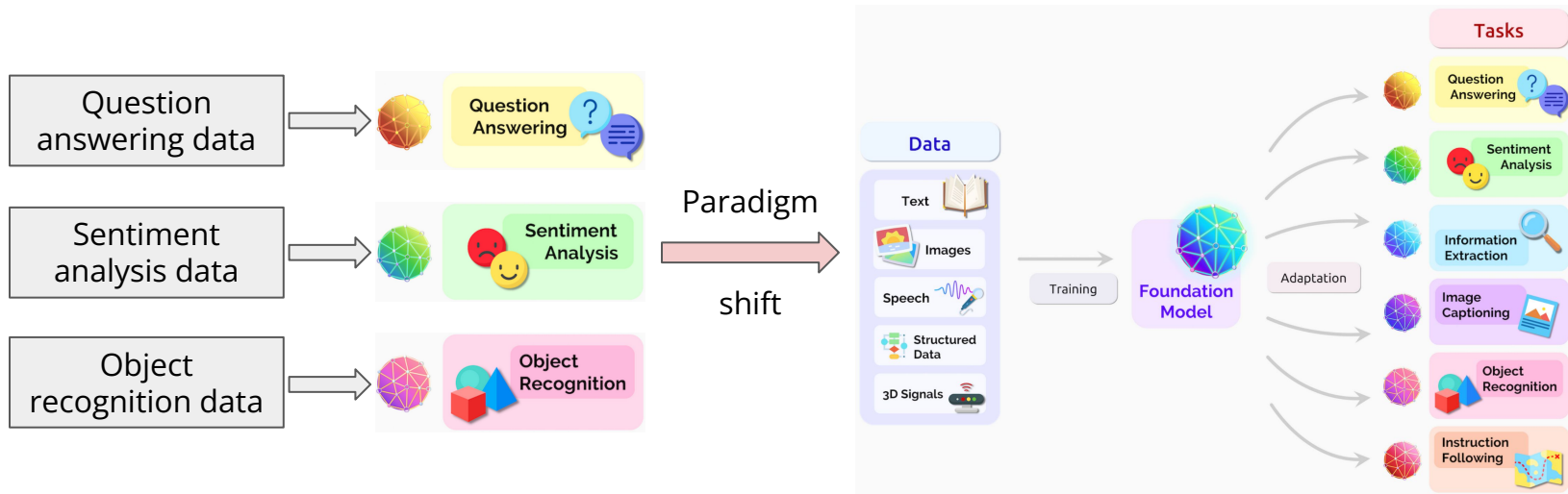✘ Slow and computationally expensive

Data-driven approach

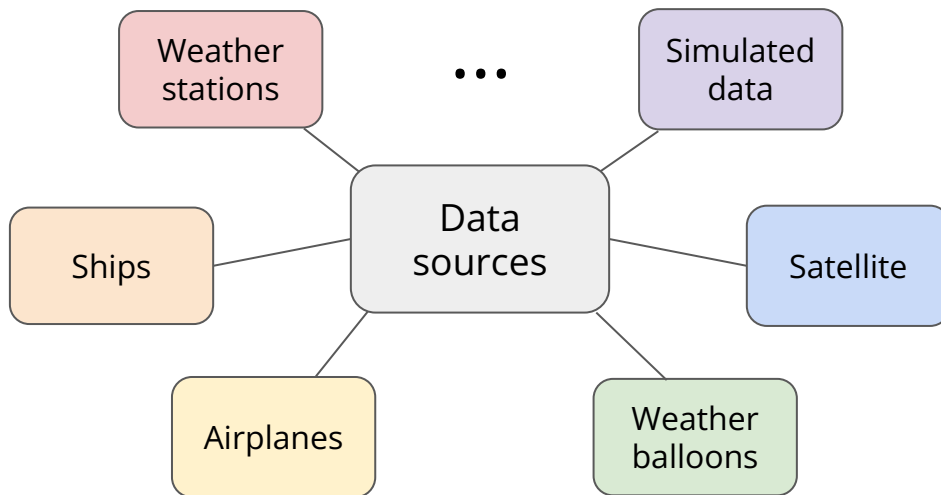❏ Train a deep neural network from historical data to solve a certain task, e.g., weather forecast

✔ Competitive accuracies and fast prediction

✗ Data-hungry and not general-purpose

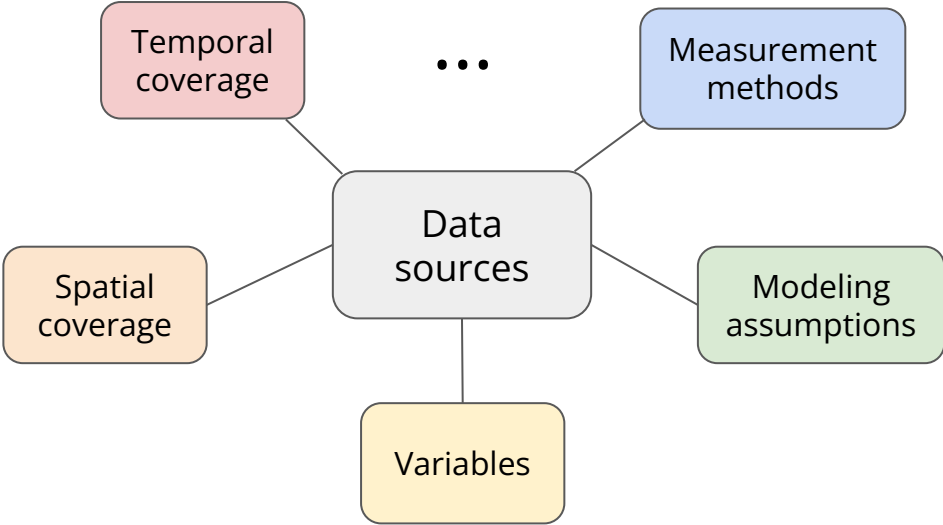# From task-specific to foundation models
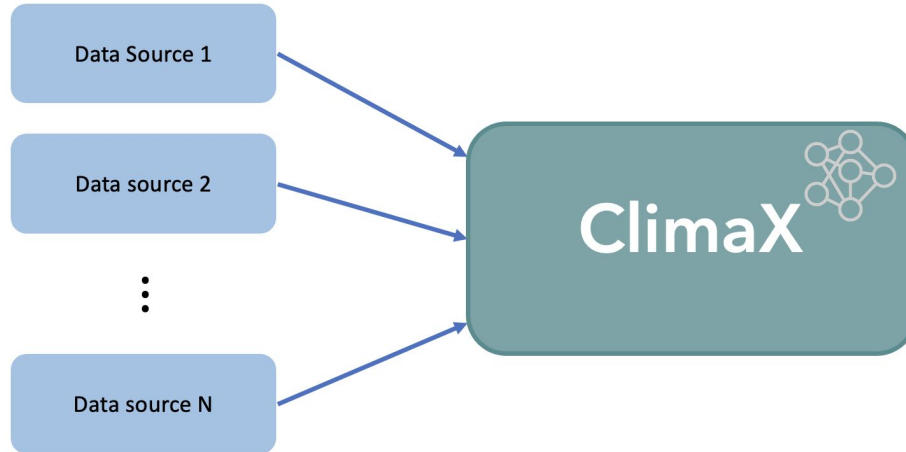
Opportunities: Plenty of data

ECMWF receives 800 million observations daily!

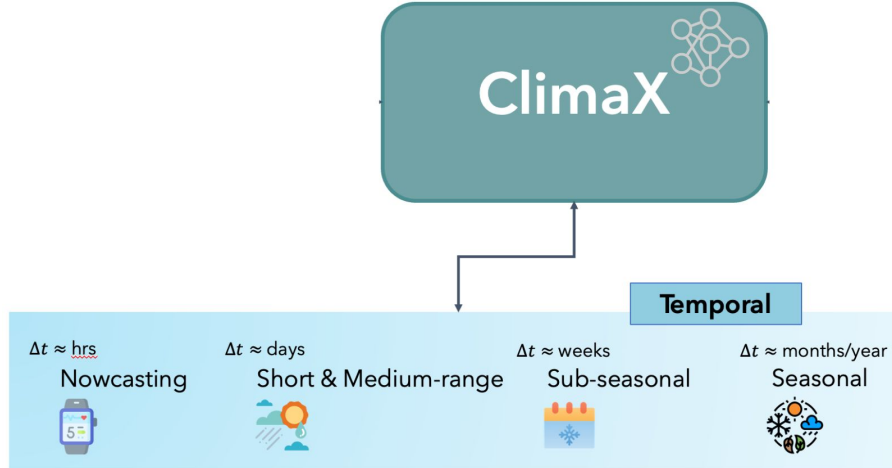# Challenges: Data heterogeneity

ClimaX

- ❏ We develop and demonstrate ClimaX – the first foundation model for weather and climate
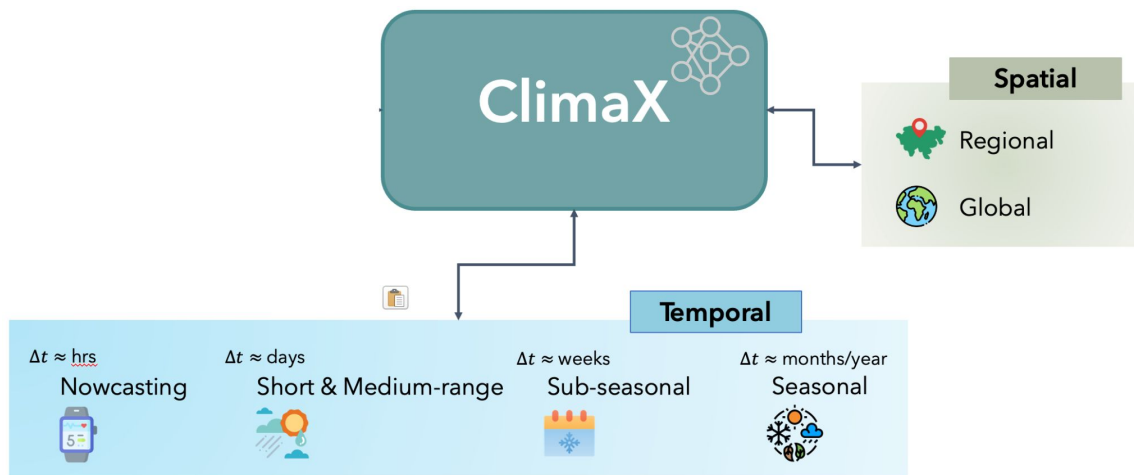 - ❏ ClimaX can be *pretrained* on heterogeneous datasets

ClimaX

❏ We develop and demonstrate ClimaX – the first foundation model for weather and climate
  ❏ ClimaX can be *finetuned* for various climate and weather tasks under different settings

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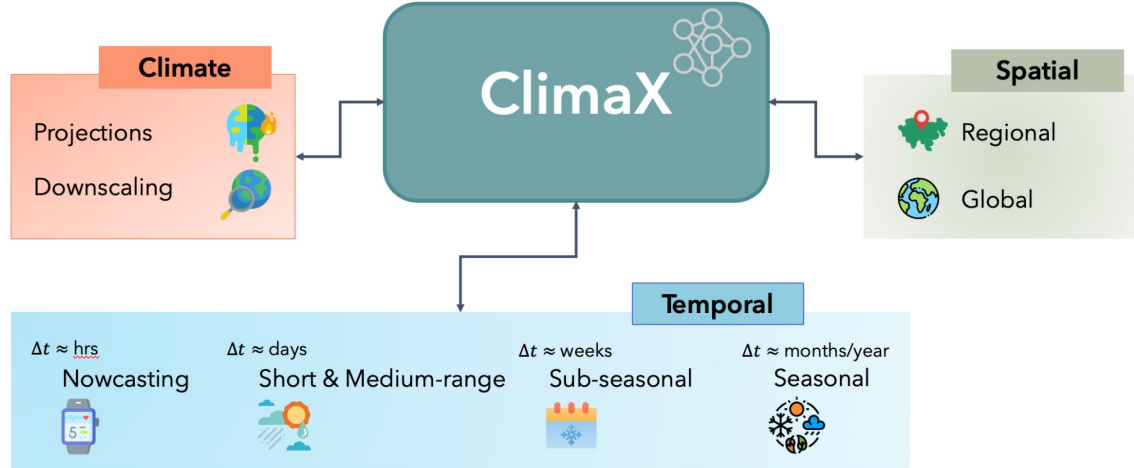   ❏ ClimaX can be *finetuned* for various climate and weather tasks under different settings

Future directions

- ❏   Scale up with respect to data size and model size

- ❏   Make ClimaX general to more downstream tasks

- ❏   Better architecture and/or pretraining objective

- ❏   GPT-3 style for weather and climate

Thank you for listening!

Paper: https://arxiv.org/abs/2301.10343

Code: https://github.com/microsoft/ClimaX

Website: https://microsoft.github.io/ClimaX/

More: https://aditya-grover.github.io/ml4climate/about

Paper Link

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