



AI/ML Activities
Indian Institute of Tropical Meteorology
Pune, India
Ministry of Earth Sciences, Govt. of India



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**With inputs from Deepesh Kumar Jain
& colleagues in IITM & MoES**

WGNE40, Beijing, China

IITM-ESMv3

GFS Tco ~67 km

MOM4 ~25 km

SIS + Noah + LULC
+ Aerosol + BGC

ERPv2

Multi-physics framework:

~50 km

GFS + MOM4 + SIS + Noah



Plan

Climate and
Decadal
Projections

Ready

Seasonal
forecasts

Set

Mid-Range
forecasts

Go!

Short-Range
forecasts

**Monsoon Mission Coupled
Forecast System version 2.0
(MMCFSv2)**

GFS-SL ~38 km

MOM6 0.5° x 0.25°

CICE5

Noah

BharatFS ~6 km

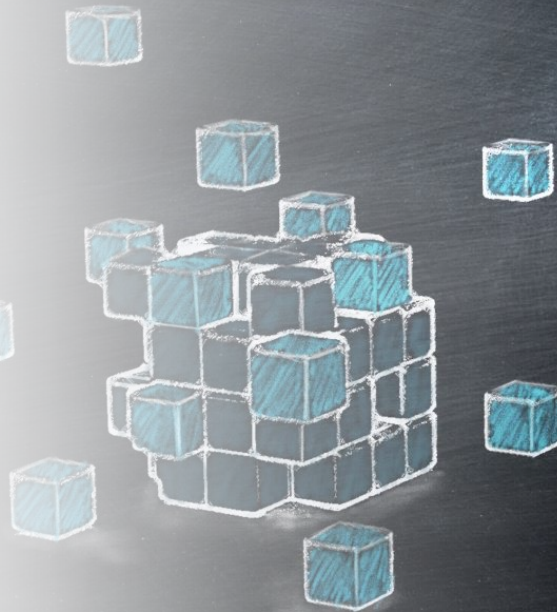
Triangular Cubic-
octahedral based GFS

**Monsoon Mission has enabled India's preparedness
across scales—**

building a weather-ready nation!

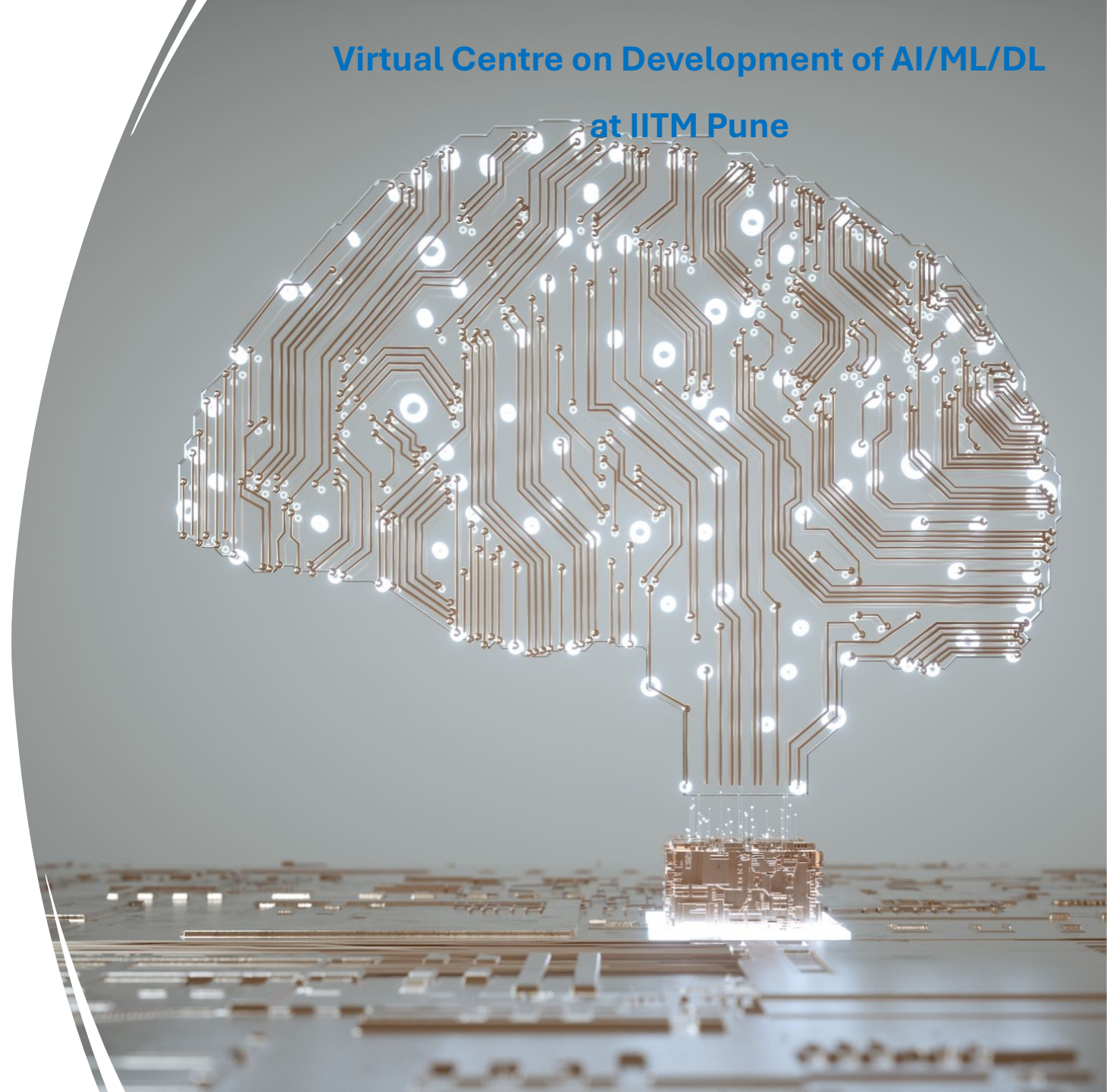
We are trying to use AI to develop applications

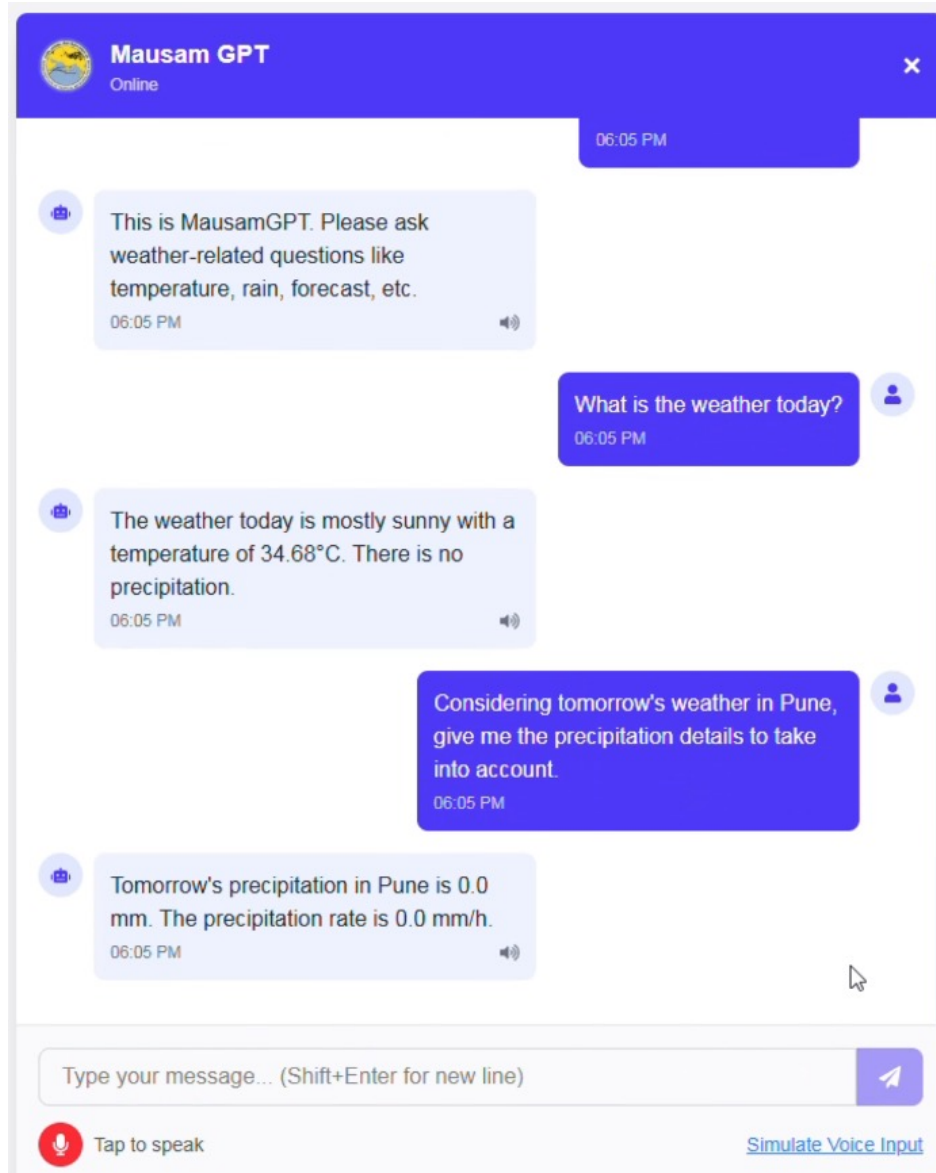
- Reach out to the citizens for proactive early warnings
- Requirement for sub km-scale forecasts
- Provide agricultural advisories
- Develop applications which are not yet supported by dynamical models – e.g. stubble burning, landslides
- Develop Hybrid models



We are trying to use AI to develop applications

- MausamGPT (WeatherGPT)
- Downscaling of precipitation data.
- Fire location Forecasting
- Fog Forecasting
- Lightning/Thunderstorm Forecasts
- Deep learning for improved global precipitation in the numerical weather prediction system.





MausamGPT

“Mausam” is Hindi word for Weather

I recommend checking a different source or waiting for an updated forecast closer to your trip for a more accurate idea of the weather in February.

3:10 pm

Can I sow wheat now in Pune?

3:10 pm

The current temperature in Pune is 34.68°C and it is expected to be 33.56°C tomorrow. Considering the temperature and no precipitation forecasted, it might not be the best time to sow wheat as

इस हफ्ते तापमान कैसा रहेगा? (Voice)

3:11 pm

I need to know which location you'd like the weather forecast for. Please specify a city or location.

3:11 pm

आज पुणे में मौसम कैसा रहेगा? (Voice)

3:12 pm

and no precipitation forecasted, it might not be the best time to sow wheat as Pune's climate is generally suitable for wheat during the winter season, typically from October to February, when temperatures are cooler.

3:10 pm

MausamGPT Weather Assistant

What will be the weather like in Pune in February? Help me pack for my trip.

3:09 pm
3:10 pm

I'm happy to help you with the weather forecast, but I have to inform you that the provided data is for April 18th and 19th, 2025, not February. Based on the current data, today will be sunny with a temperature of 34.68°C and a gentle breeze. Tomorrow, the temperature will dip slightly to 33.56°C with a similar wind pattern. Since I don't have February's data, I recommend checking a different source or waiting for an updated forecast closer to your trip for a more accurate idea of the weather in February.

3:10 pm

Ask about weather...

MausamGPT Weather Assistant

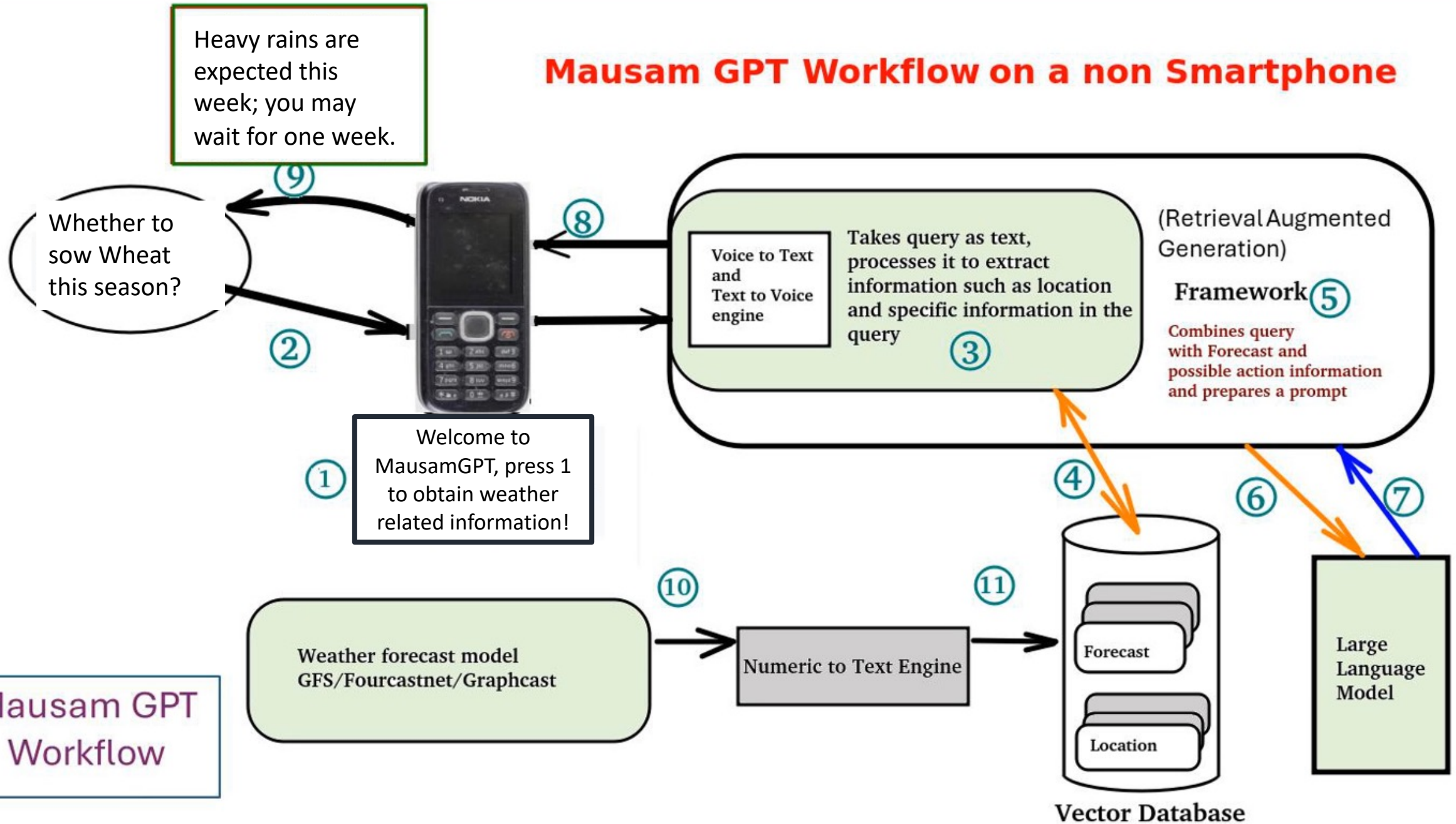
7-Day Forecast

Today		32° 26°
Tue		31° 27°
Wed		29° 26°
Thu		28° 25°
Fri		30° 26°
Sat		31° 27°
Sun		33° 28°

Namaste! Main MausamGPT hoon. Aaj ke mausam ke bare mein poocho!

3:08 pm

Mausam GPT Workflow on a non Smartphone



Mausam GPT Workflow on a non Smartphone

अगले एक हफ्ते में बारिश की काफी ज्यादा संभावना है, इसलिए अभी गेहू की बुआई ना करे। आप एक हफ्ता इंतज़ार कर सकते हैं

क्या इस साल गेहू की बुआई करनी चाहिए

मौसम जीपीटी में आपका स्वागत है। अगर आप मौसम का पूर्वानुमान जान ना चाहते हैं तो 1 दबायें

Mausam GPT
Workflow

Weather forecast model
GFS/Fourcastnet/Graphcast

Numeric to Text Engine

Forecast

Location

Vector Database

Large
Language
Model

Voice to Text
and
Text to Voice
engine

Takes query as text,
processes it to extract
information such as location
and specific information in the
query

(Retrieval Augmented
Generation)

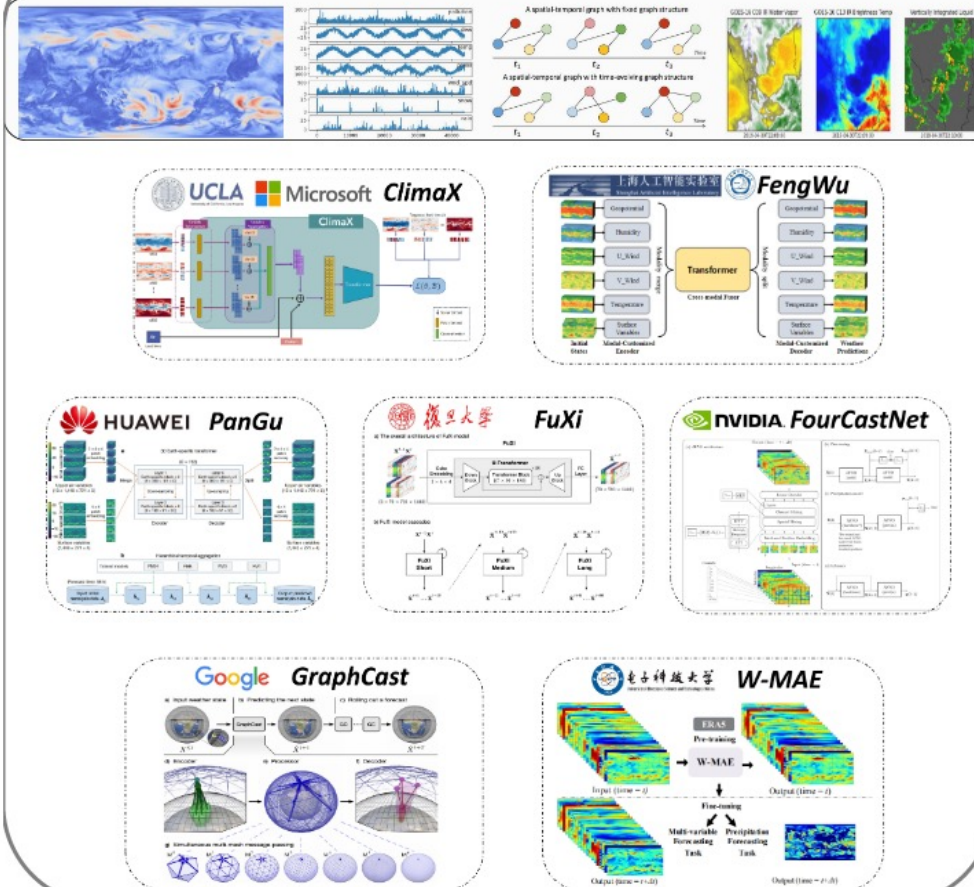
Framework ⑤

Combines query
with Forecast and
possible action information
and prepares a prompt

Large Foundation Models for Weather and Climate

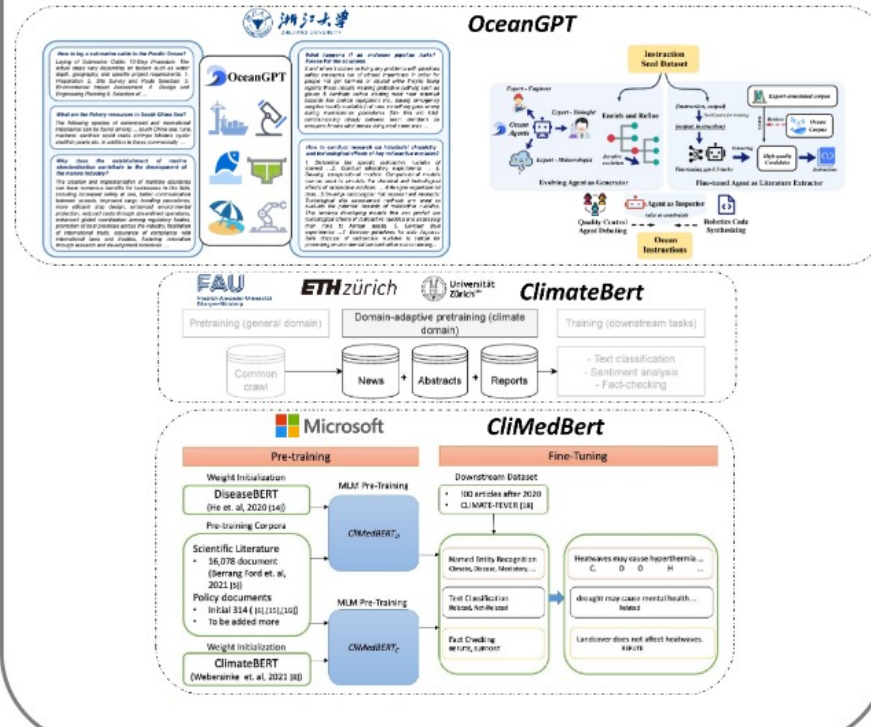


Weather & Climate Time Series



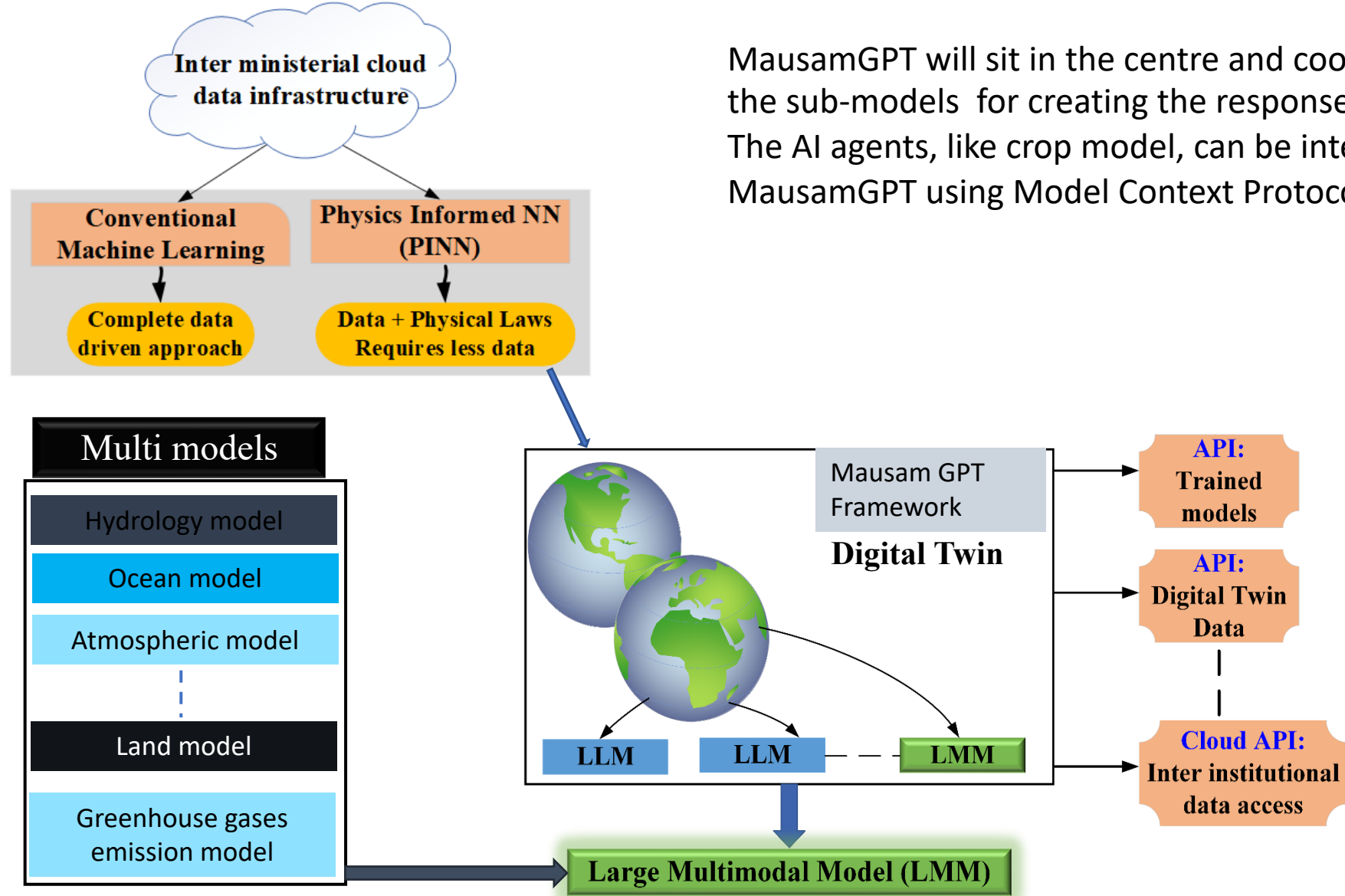
Climate Text

In March 2018 Congress authorized an additional \$10 billion to be used for reimbursements related to repacking and directed that a portion of the additional funds be used to **reimburse low power television stations, television translator stations and FM stations** that are required to modify their facilities on a temporary or permanent basis to accommodate changes made by television stations being repacked as well as for consumer education efforts.



An overview of large foundation models for weather and climate, **Left:** Foundation Models specialized in weather and climate time series (including time series, spatio-temporal series, video streams, etc.), **Right:** Foundation Models specialized in climate-related text data.

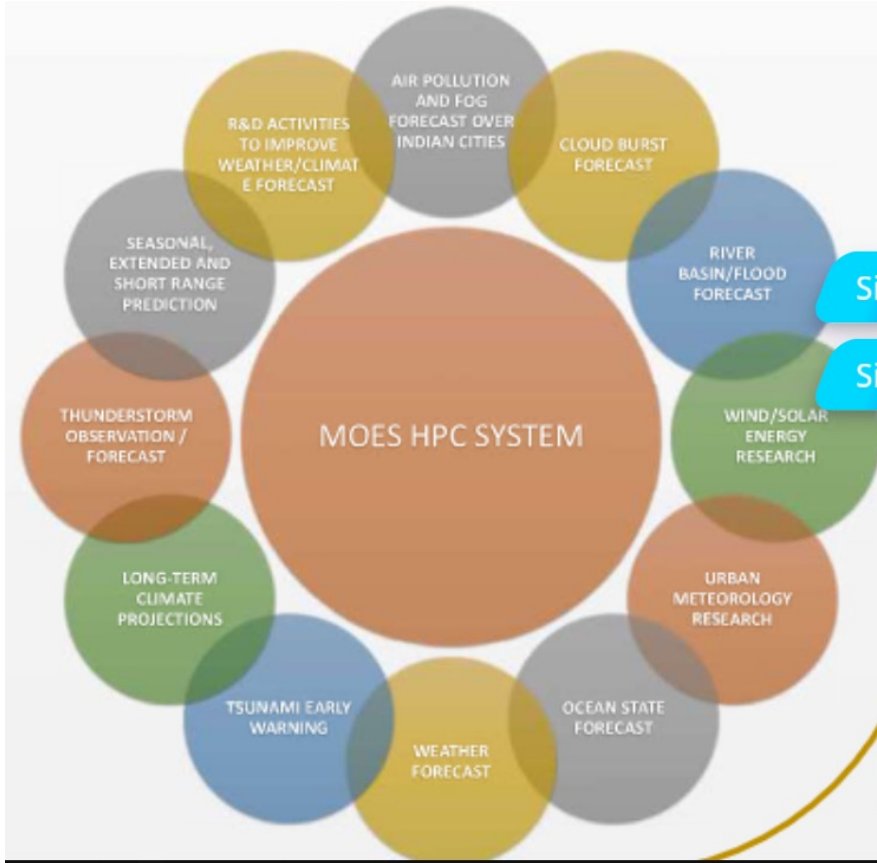
Prithvi AI – Prithvi Pratibimb



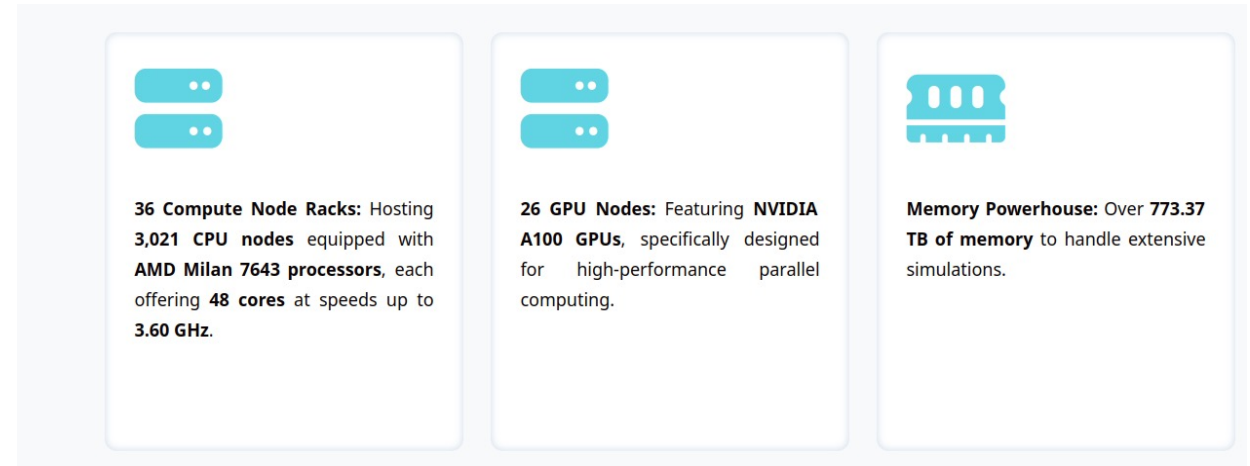
MausemGPT will sit in the centre and coordinate all the sub-models for creating the response. The AI agents, like crop model, can be integrated to MausemGPT using Model Context Protocol.

Inferences take a lot of GPU-CPU compute and memory

The Arka and Arunika HPC



ARKA



ARUNIKA



<https://arka.tropmet.res.in/Arka/introduction.html>

<https://nwp.ncmrwf.gov.in/computing/hpc-systems>

Peak Performance of 11.77PF and **dedicated 1.9PF for Artificial Intelligence research**

Harnessing deep learning for forecasting fire-burning locations and unveiling $PM_{2.5}$ emissions

Sushrut Gaikwad^{1,2} · Bipin Kumar¹ · Prafull P. Yadav^{1,5} · Rupal Ambulkar^{1,7} · Gaurav Govardhan^{1,6} · Santosh H. Kulkarni³ · Rajesh Kumar⁴ · Dilip M. Chate³ · Narendra Nigam¹ · Suryachandra A. Rao¹ · Sachin D. Ghude¹

Fig. 5 Ground Truth vs. forecast ($PM_{2.5}$ and wind as input) for the R1 region for 3 days lead time forecast. The date of these days are; 7–9th Nov, 2018

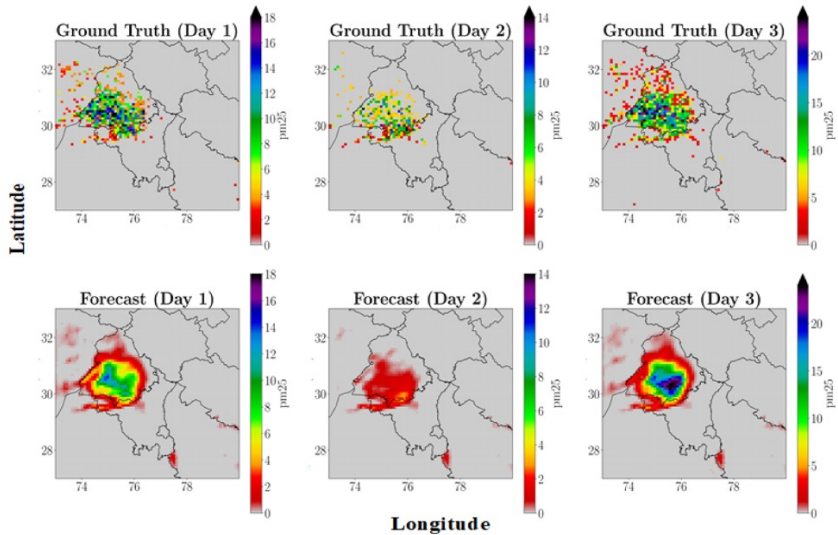
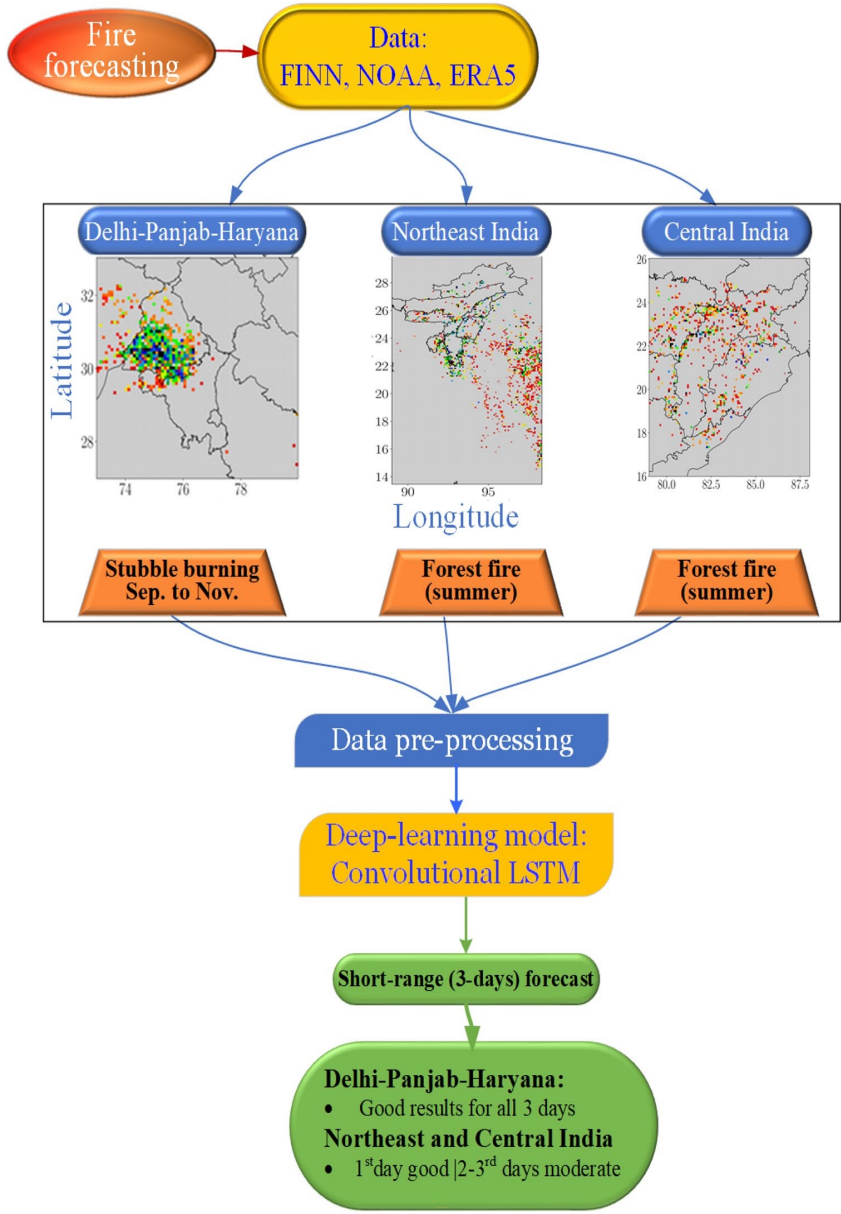
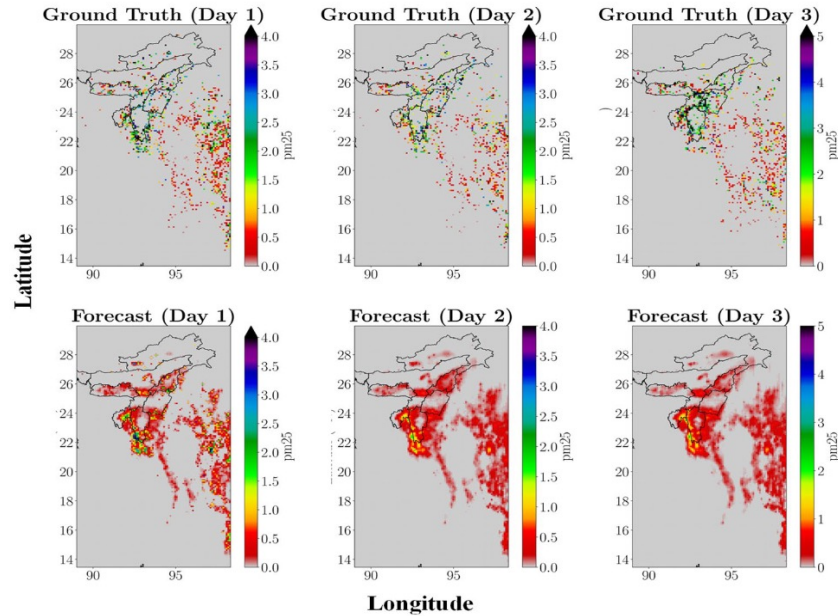


Fig. 9 Ground Truth vs. Forecast for the northeast Indian subcontinent region (R2). The 3 days shown here are 21 – 23rd March, 2018



A flowchart illustrating different steps for developing the deep learning fire location forecasting model

Thank You

Questions??

