Bridging the Development of AI-Empowered Weather Forecasting Through PPE

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Shanghai Academy of AI for Science

Empower the innovative scientific discovery paradigm and industrial applications through AI

Founded in 2023 as a new R&D institution, SAIS focuses on the cutting-edge innovation of AI technologies for scientific discovery, key capability development facilitating interdisciplinary studies and applications in various industrial and public circumstances

Landscape of SAIS Research and Engineering

FuXi Weather Foundation Models

- FuXi-Ens Model
- FuXi-S2S Model
- FuXi-Extreme Model
- PI@Climate

Nüwa Life Science Foundation Models

- siRNA Drug Discovery Model
- Dynamic Protein Structure Model
- CardioMind Model

Suiren Material Foundation Models

- Large Molecular Foundation Model
- Large Catalysis Model
- Large Transition State Model

Chinese Civilization Foundation Models

- Paleography LLM
- Ancient Literature LLM
- Archaeological Video Model

Building AI4S Ecosystem

Facilitates Collaboration between AI Developers and Scientists

SAIS × Fudan university ×

Synergistic Talent System
AI Scientists
Engineers
Domain Scientists

Shanghai University
Silicate Research Institute
Taiping Insurance Group
Rona Therapeutics
...

SAIS NovaInspire AI4S Infrastructure

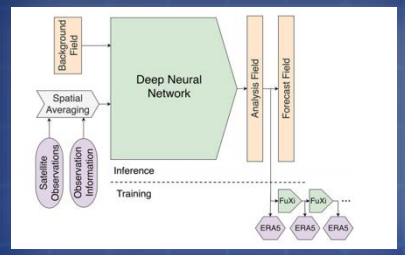
- Ready-to-use models
- Full-lifecycle Scientific Data Platform
- Dry-Wet Integrated Lab
- Scientific Multi-agent Collaboration
- AI4S intelligent computing and toolchain platform

AI Empowered Weather and Climate Models

Weather-climate Integration, Deterministic-probabilistic Forecasting Synergy

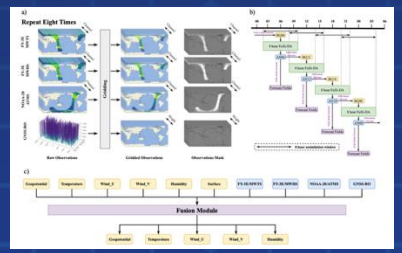
FuXi-DA (2024.04)
FuXi-En4DVar(2024.11)

a generalized deep learning DA framework for assimilating satellite observations



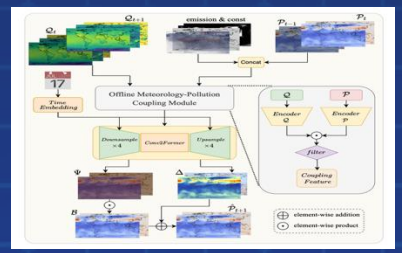
FuXi-Weather(2024.08)

first data-to-forecast machine learning system for global weather



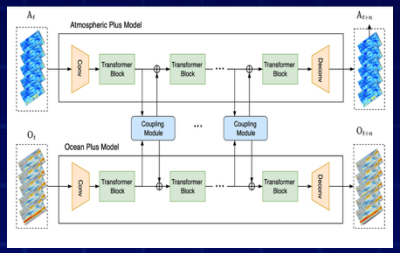
FuXi-GlobalAP

Global Air Pollution Forecasting Model



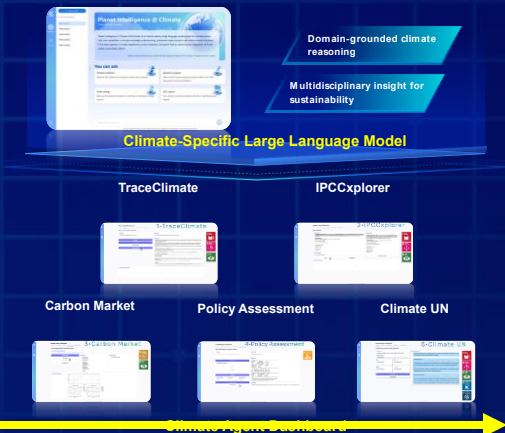
Fengshun-CSM Cop. with CMA

First atmosphere-ocean-sea ice-land surface coupling



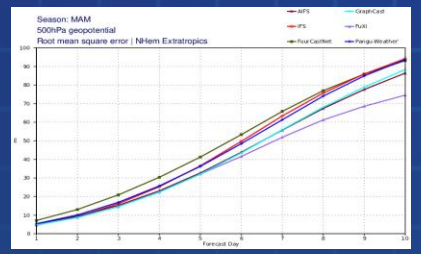
Planet Intelligence @ Climate Cop. with Fudan Uni.

Multidisciplinary large language model system for climate science



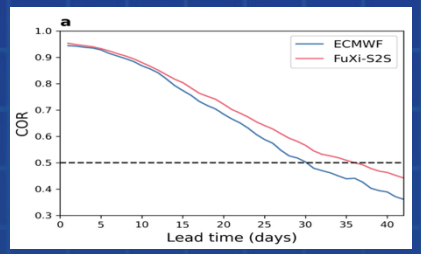
FuXi-Base (2023.06)
FuXi-ENS (2024.05)
FuXi-Extreme (2023.10)

Industry-leading medium-term forecast accuracy



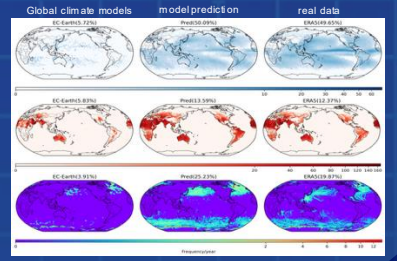
FuXi-S2S (2023.12)

MJO effective forecast duration 30→36 days



FuXi-Climate

Realizing climate downscaling projections under different SSP scenarios



0-15 days (medium-term forecast)

45-60 days (sub-seasonal forecast)

~100 years (climate projections)

Better AI for Better Adaptation to Risks

Strong & multiple functions

Multiple output dimensions

Meteorological services

Temperature, humidity, wind speed .....

Industrial applications

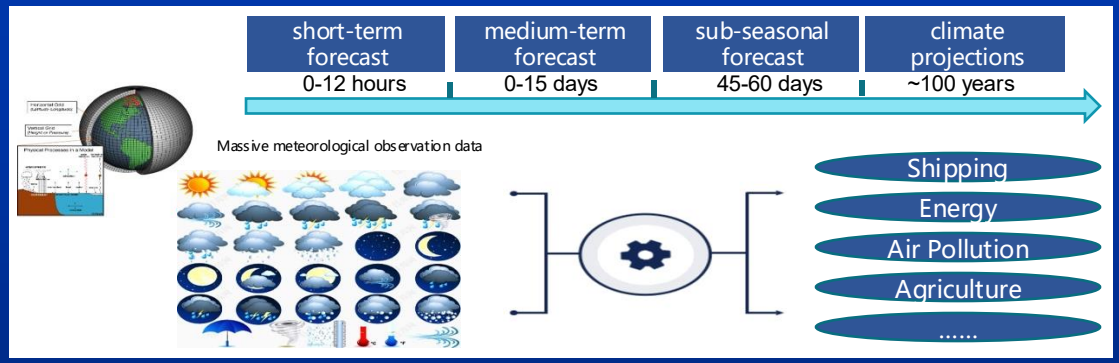
Pollutants, sea ice, extreme precipitation, solar irradiance, waves, clouds .....

Promising improvement compared with traditional methods

- ECMWF Reviews Best Overall Performance
- MJO effective forecast duration 30→36 days
- Extreme weather forecasting results better than EC
- Continuous optimization .....

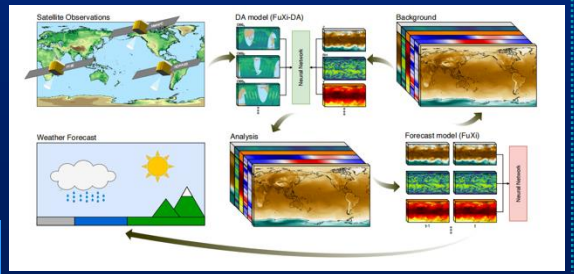
Serving for Various Circumstances

Multiple time scales and application scenarios



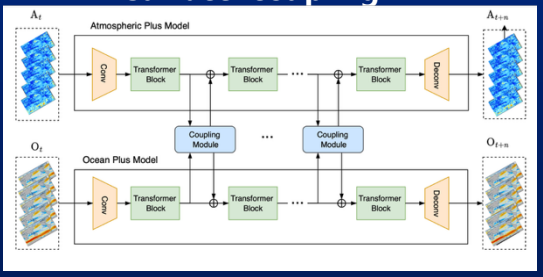
Rapid Computing

End-to-End system



Data-Mechanism Fusion

Atmosphere-ocean-sea ice-land surface coupling



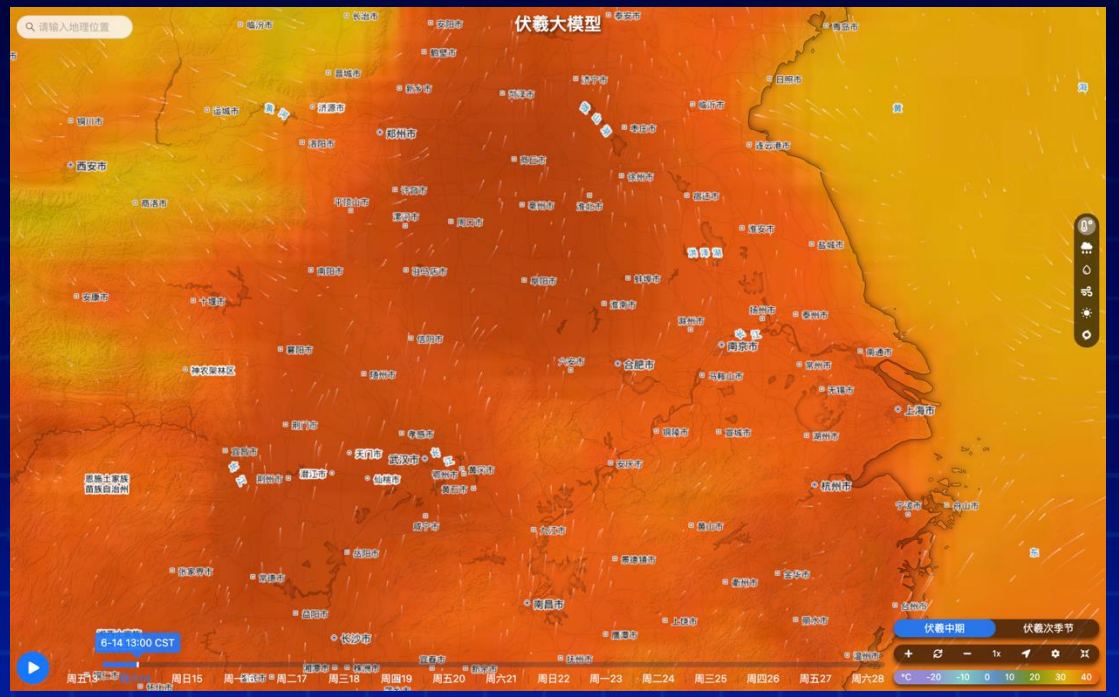
Open Science Benefits Public Meteorological Service

Local adaptation of AI models

Local knowledge + data

+

Model Customization and Adaptation



All-in-one Services

GPU and other computing hardware

+

AI Model

Capability Building for Global South

Technical training, workshops, and resources

SAIS and Shanghai Mete. Bureau jointly developed Regional Model to support public services

Public-Private Engagement : CMA’s Practices

“Digital Intelligent Meteorology ” Achievements

Collaborate with Tsinghua University, Shanghai Academy of AI for Science, Fudan University, Shanghai AI lab, etc.

0-3 hours forecast	0-15 days forecast	0-60 days forecast	Space weather
风雷 Fenglei	风清 Fengqing	风顺 Fengshun	风宇 Fengyu

AI Weather Forecasting Series Models of CMA (CMA-AIMS)

Cultivating AI Weather Talent

New R&D Organization

Xiongan Institute of Meteorological Artificial Intelligence Innovation

Innovation Platform Talent Highland

China Meteorological Administration (CMA) and Xiongan New Area Administrative Committee (XNAAC) sign MOU

Release of two policies

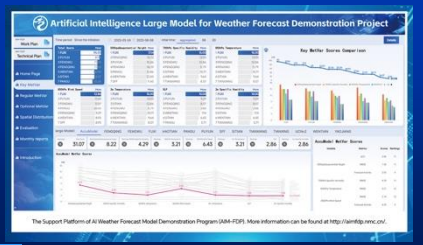
AI Application Service Approach

Constructing a legal system complementary to the development of AI meteorological application and establishing a governance system for application services.

Meteorological data identification

Objectively record the information of each subject and the whole process of meteorological data circulation, and support online traceability to verify the quality of data, the rights and interests of the subject, and the status of compliance.

AIM-FDP



14 AI models Participated including Pangu, Fuxi, et al.

Unlocking the Boundless Potential of AI for SDGs

Engagement with Mereological Department

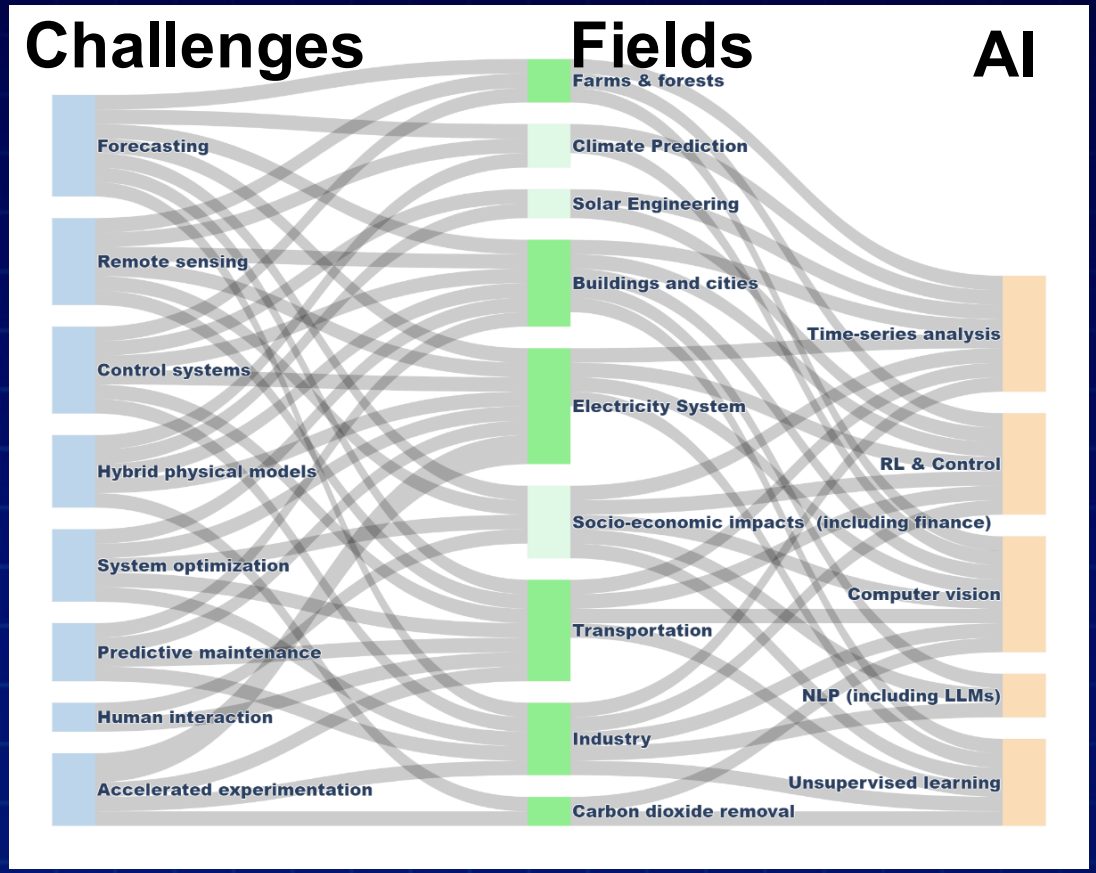

Effective Corporation Mechanism


Accurate Predictions


Sharper Identifications


Smarter Decisions


Effective Control



Source: Rolnick D. ACM Computing Surveys, 2022

Thank You!