

A Contribution to WMO Early Warning for All Program Earth Information Day

Paulo Nobre, Ph.D.

National Institute for Space Research - INPE
Ministry of Science, Technology and Innovation - MCTI

In Partnership with: CEMADEN, CENSIPAM, CERN, CIAAM, InovaUSP, IPT, RNP, SENAI-CIMATEC, SiDi

Belém, COP 30, 10 November 2025

Extreme Climate Events Grew 250%

During the last 4 years alone in Brazil!

Extreme Drought
Negro River
Amazon
2023-2024



Source: Revista FAPESP

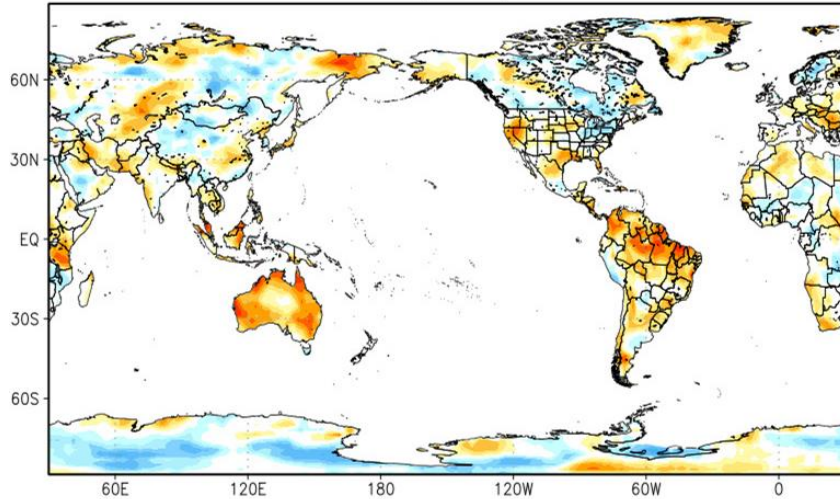
Historical Flooding
Porto Alegre,
Rio Grande do Sul
May 2024



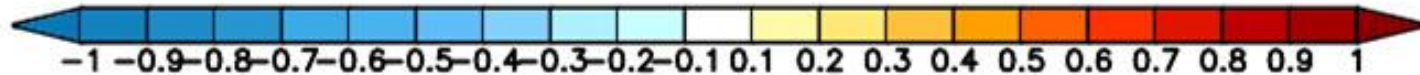
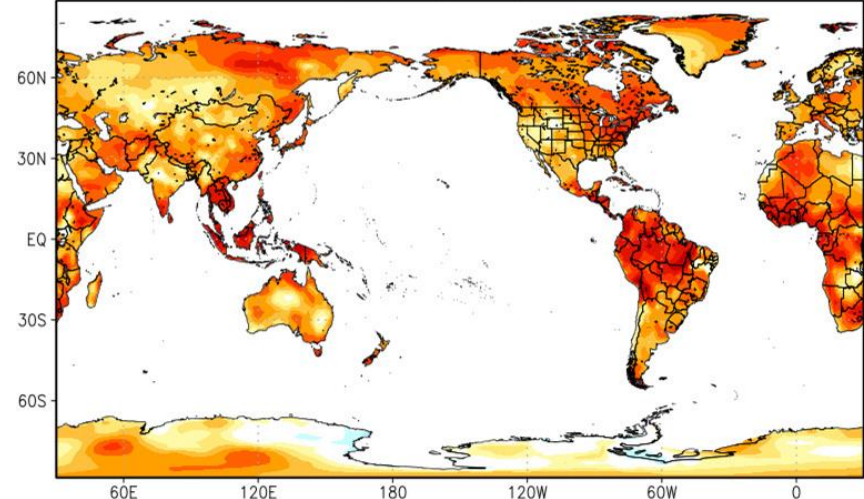
Source: G1

Predicting Climate Anomalies One Year in Advance!

PRECIPITATION



TEMPERATURE



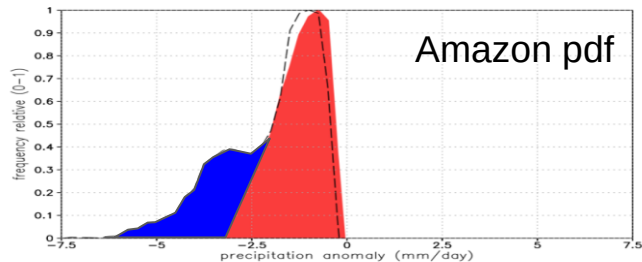
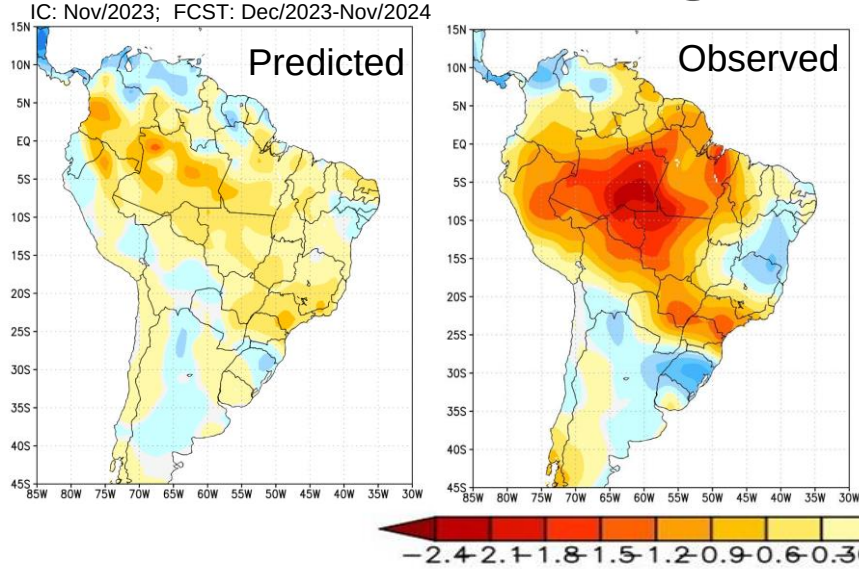
GrADS/COLA

INPE/BESM Annual Prediction ACC Skill Score

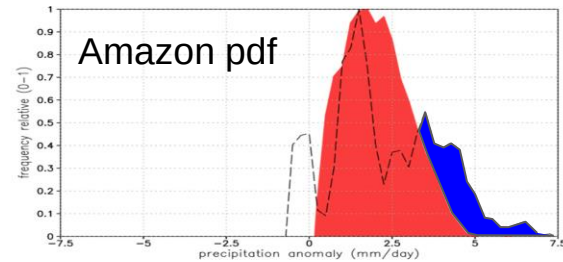
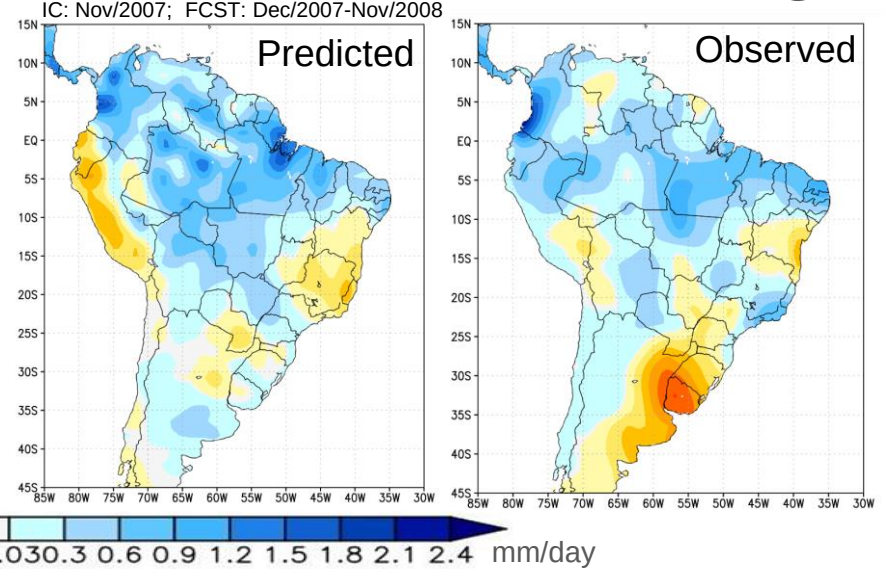
Source: Nobre et al, in preparation

Annual Rainfall Predictions

2024 Amazon Drought



2008 Amazon Flooding

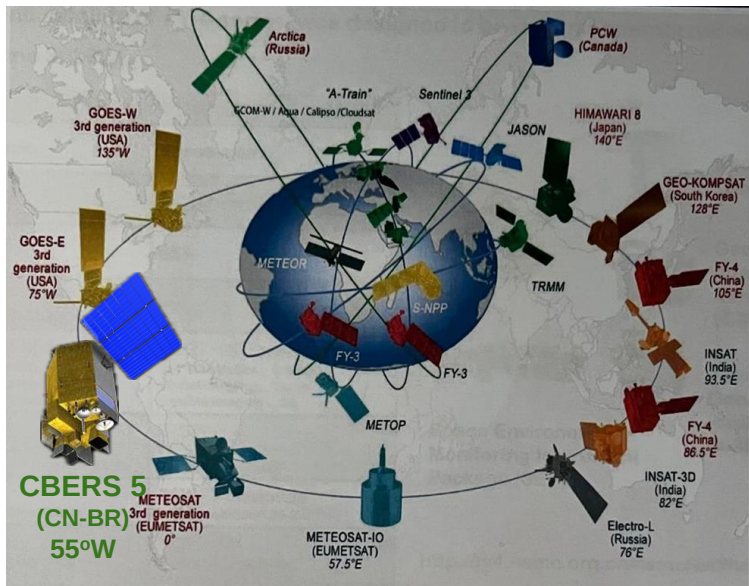


Source: Nobre et al, in preparation

Expanding Real-time Observation Network

China-Brazil CBERS 5 Program

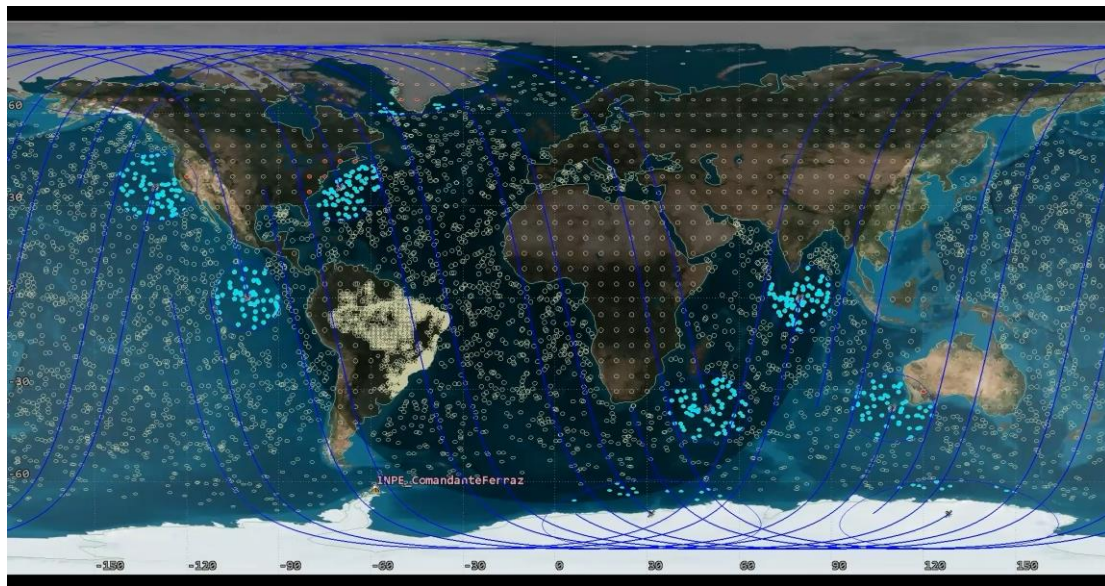
Geostationary Meteorological Satellite



- Full disc IR/Vis every 10 minutes
- Hyperspectral Temperature Profiles
- 1 min quick scan, 1,000 x 1,000 Km

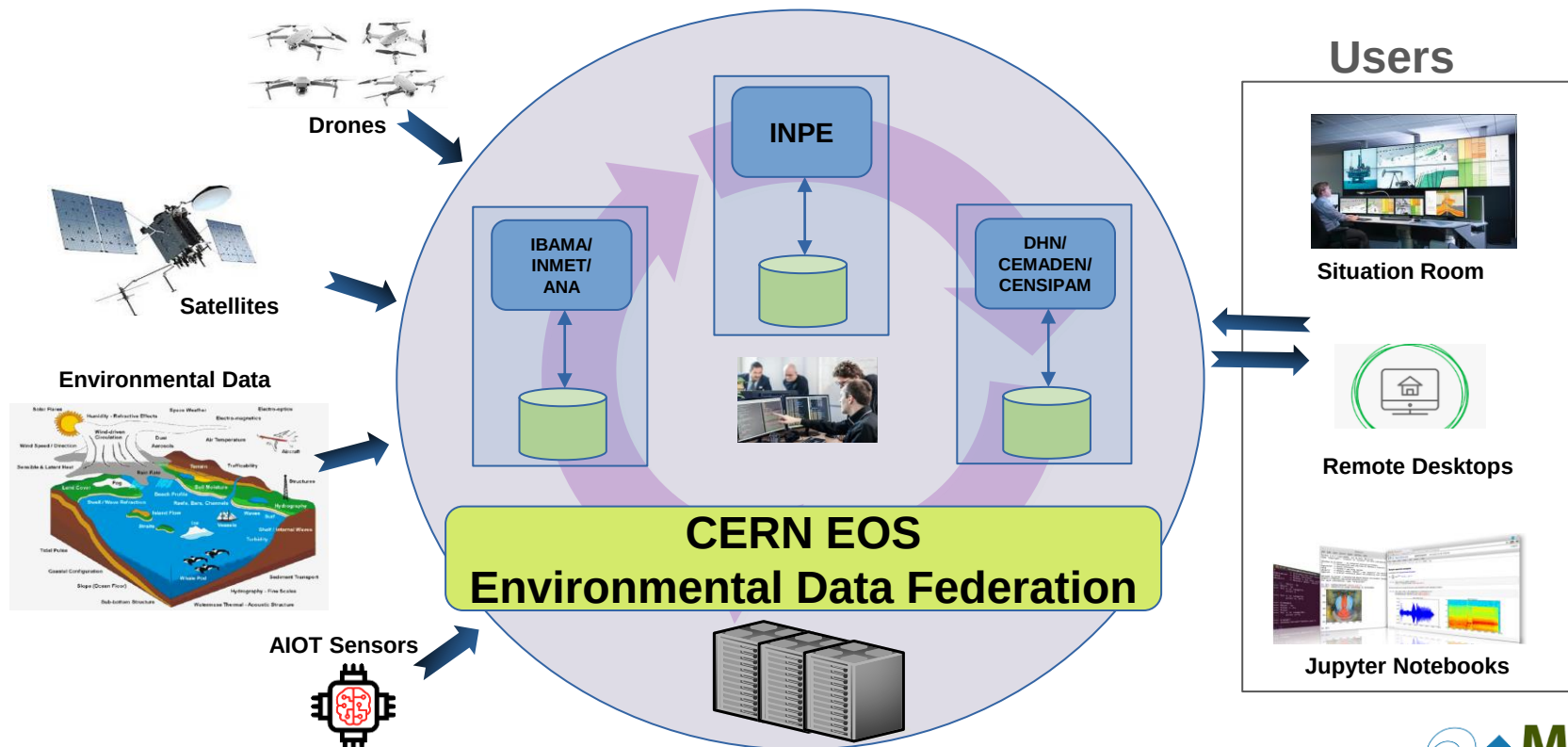
Brazil SCDg Goal

Polar Orbiting Data Collection Satellite Constellation

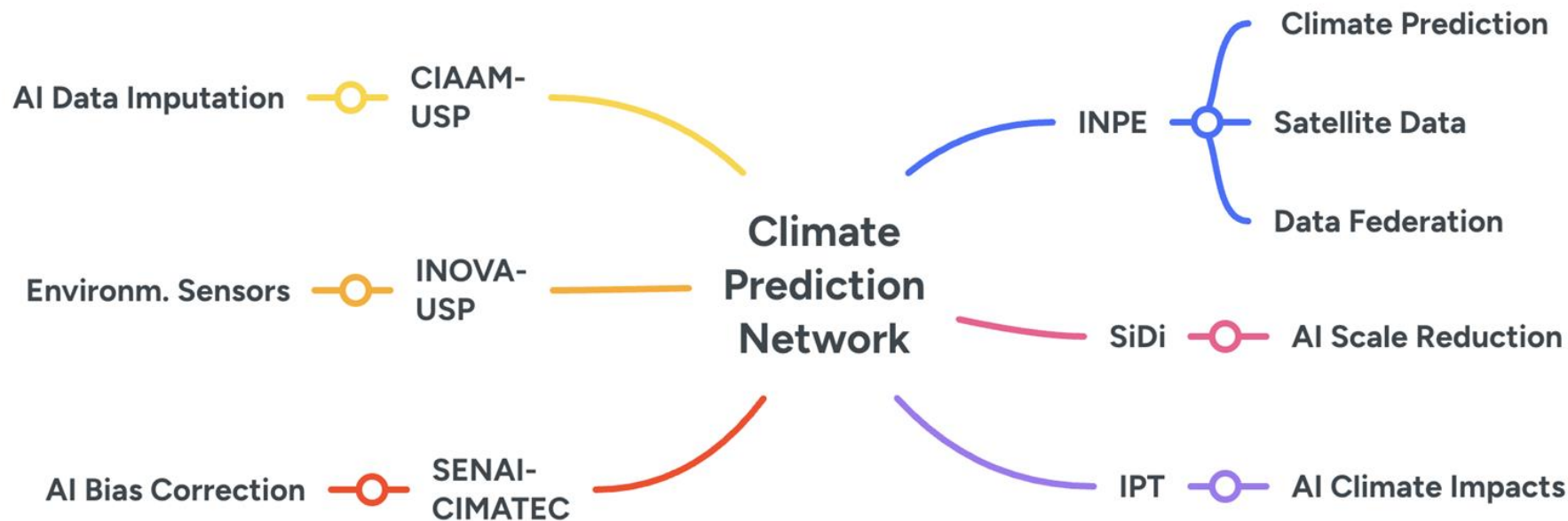


- 5,000+ low cost sfc met stations over Brazil
- Low altitude satellites data collection, globally

A Venue for Future AI Climate Prediction: National Federated Meteorological Database



A National Infrastructure for ESM-AI Climate Prediction



In Conclusion

- **Today:** BESM shows long lead temperature and rainfall prediction skill
- **Future:** Use of AI to predict the tail distribution of extreme climate events
- **Observations:** Growth of surface & satellite infrastructures for data collection
- **Accessibility:** Implementation of environmental data federation
- **Island States** to benefit from enhanced predictability to emerge from the combined use of **ESM - Global Data - AI** infrastructures.

Thank You!
paulo.nobre@inpe.br