How to Design an Operational Ocean Forecast System

Francis P. A., INCOIS
francis@incois.gov.in

- Background study before designing an operation ocean forecast system….
- Elements of Operational Ocean Forecast System
- Example: The HOOFS
- Global Operation Ocean Forecast/Analysis Systems - Ocean Predict

User requirements

- Geographical location
- Purpose
- Parameters
- Spatial and temporal scales
- Accuracy levels
- Format/template of products
- Elements of risks

Scientific/Technical Assessment

- Physical/biogeochiemcal/environmental processes
- Availability of atmospheric forcing
- Availability of bathymetry and coastline data
- Availability of realtime data for assimilation
- Data assimilation strategy
- Availability of data for process study/forecast & analysis verification
- Tools required for verification
- Dissemination methods

System requirements

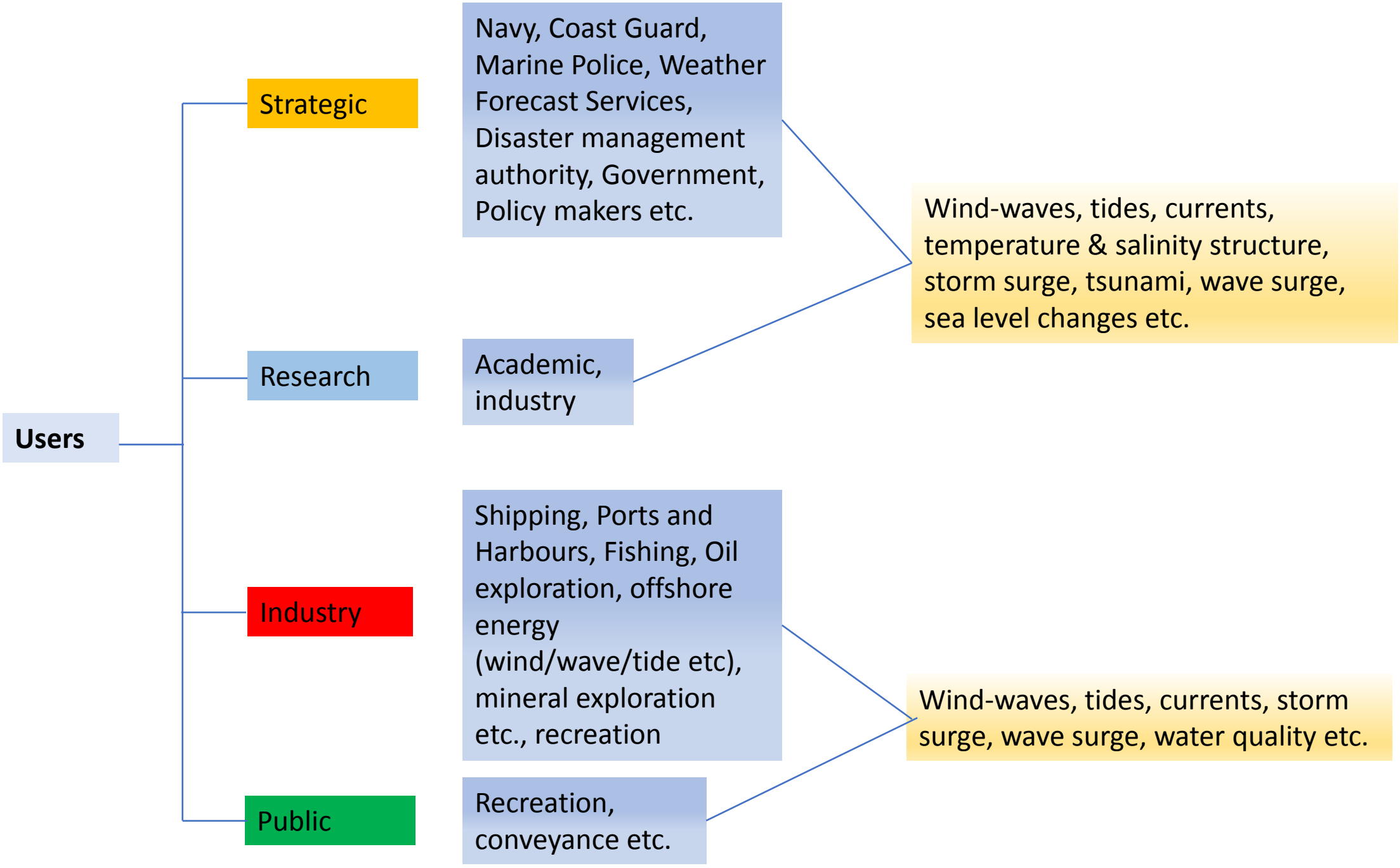
- Choice of Model (s)
- Observations
- Choice of Data assimilation system
- Computational resources
- Manpower requirements
- Dissemination channels

System Development

- Model configuration
- Deployment of observation systems
- Analysis of data (model & observation) and identify source of errors
- Further model improvements
- Development/integration of Data assimilation system
- Development of pre & post processing tools
- System integration (scripting)
- Dissemination of products

Documentation

- System documentation
- Operational SOP
- Error Statistics
- Validation/Verification statistics

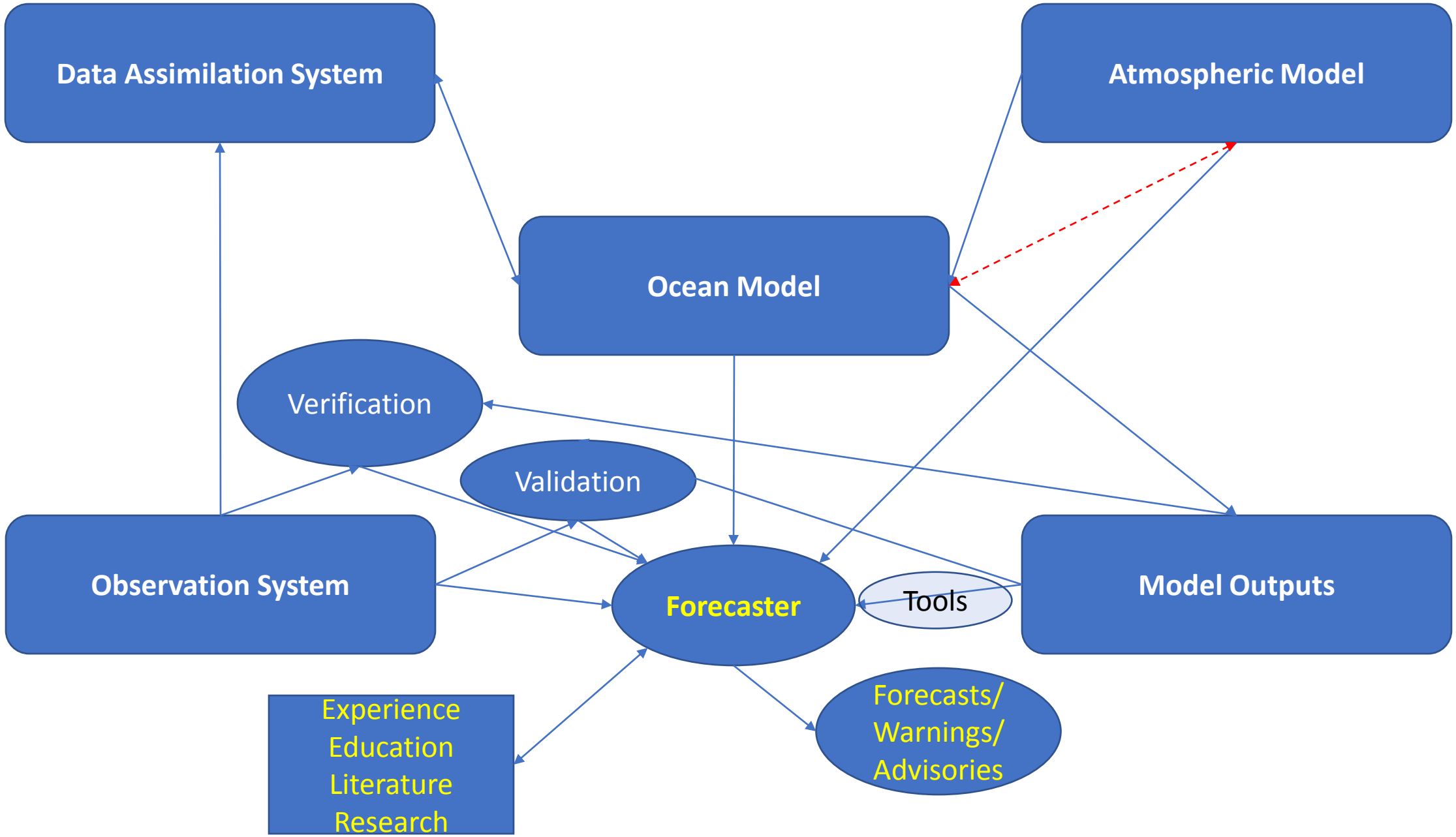

Users
Strategic
Research
Industry
Public
Navy, Coast Guard, Marine Police, Weather Forecast Services, Disaster management authority, Government, Policy makers etc.
Academic, industry
Shipping, Ports and Harbours, Fishing, Oil exploration, offshore energy (wind/wave/tide etc), mineral exploration etc., recreation
Recreation, conveyance etc.
Wind-waves, tides, currents, temperature & salinity structure, storm surge, tsunami, wave surge, sea level changes etc.
Wind-waves, tides, currents, storm surge, wave surge, water quality etc.

Components of Operational Ocean Forecast/Analysis System

1. Numerical models
2. Atmospheric forcing (if not coupled)
3. Pre-processing tools
4. Ocean observations (for assimilation and verification)
5. Data Assimilation system
6. Post processing tools
7. Product generation tools
8. Dissemination system
9. System integration (scripts)
10. Documents

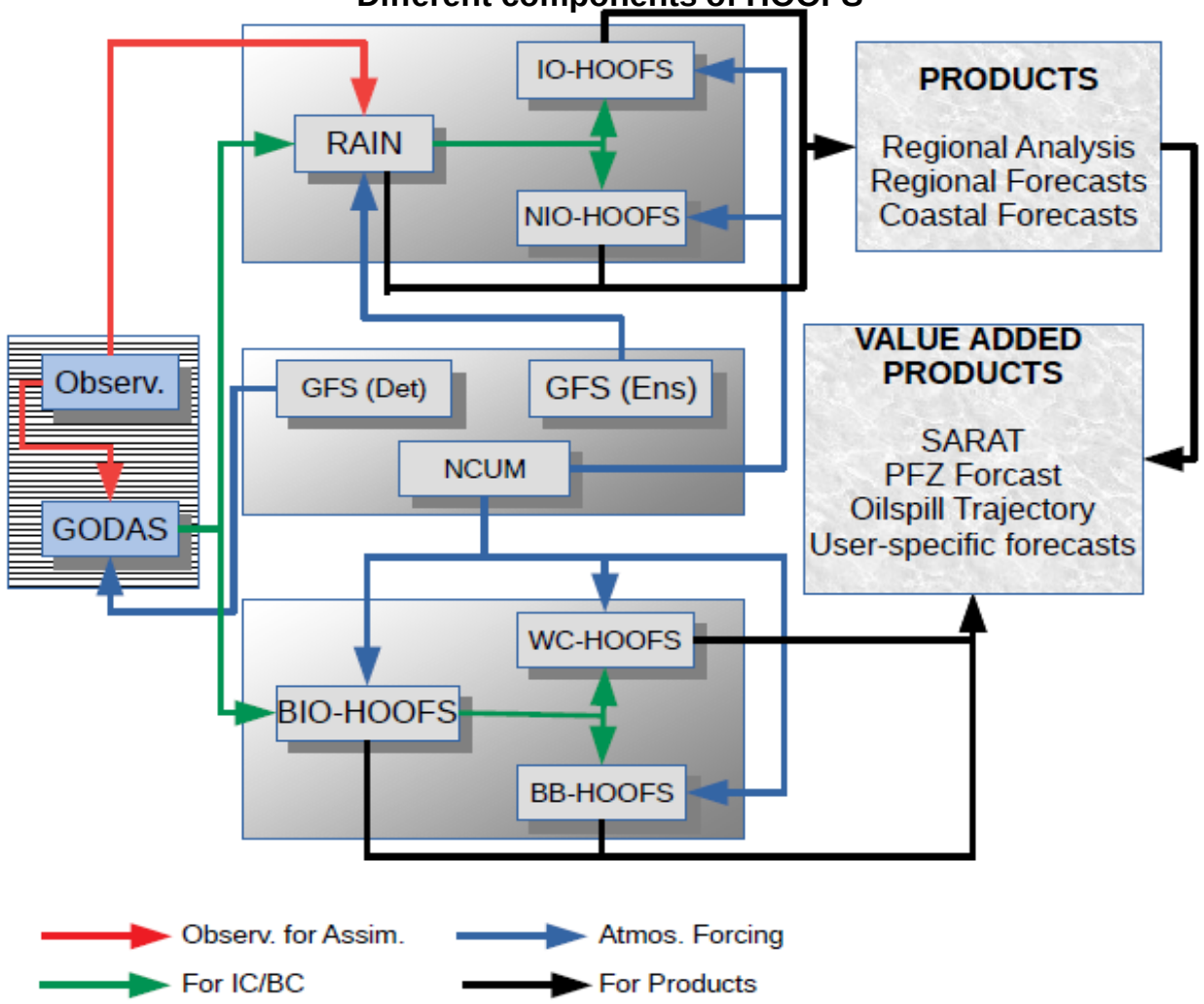
Reliability on any operation forecast system depends on the

- **Timeliness of the services**
- **Accuracy of the products**
- **Availability of expert advises**

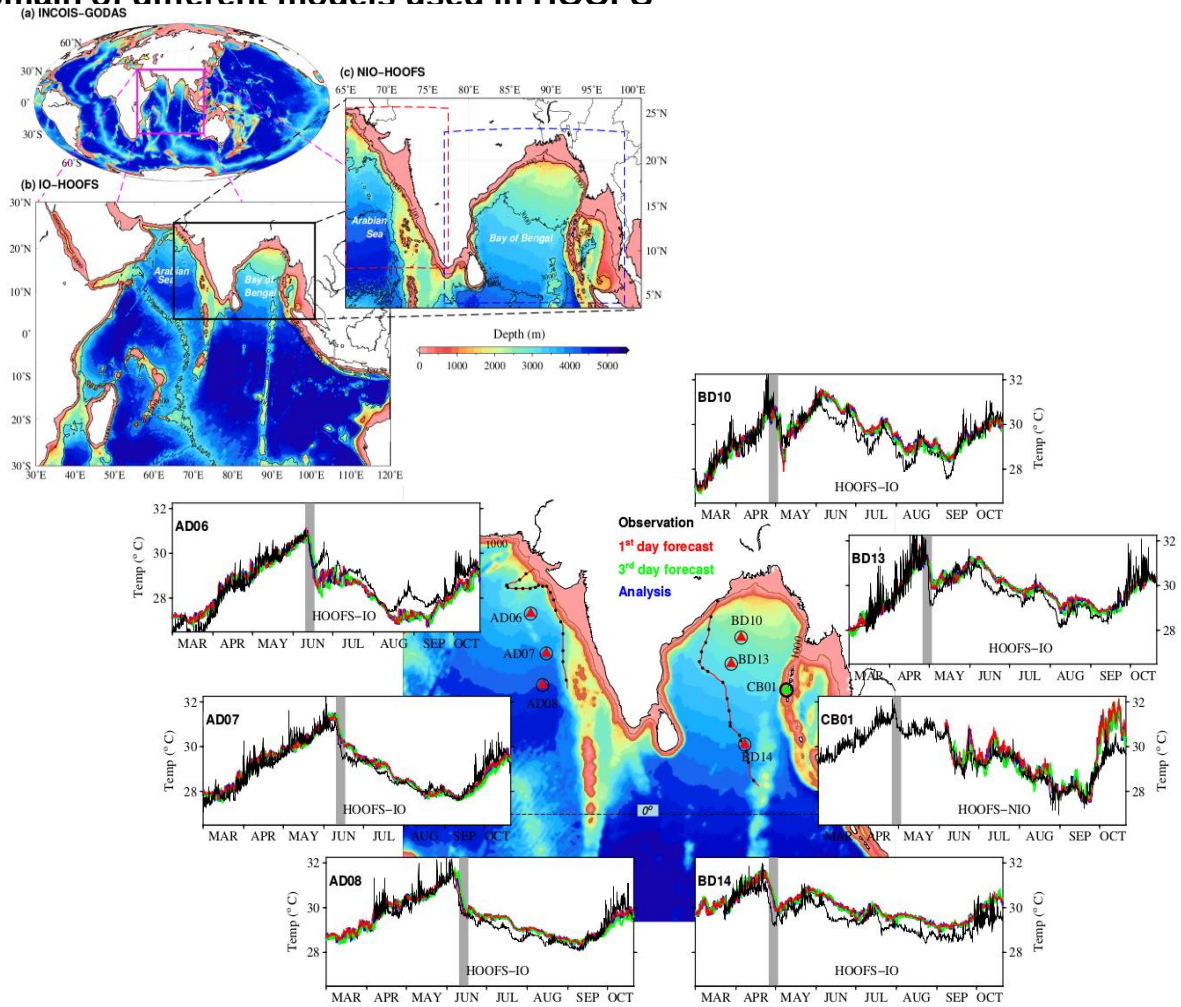

Data Assimilation System
Atmospheric Model
Ocean Model
Verification
Validation
Observation System
Forecaster
Tools
Model Outputs
Experience
Education
Literature
Research
Forecasts/
Warnings/
Advisories

High-resolution Operational Ocean Forecast and reanalysis System for the Indian Ocean

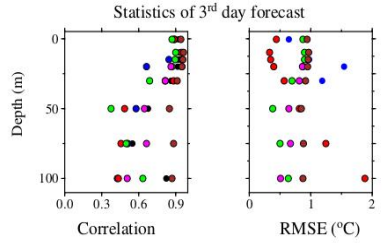
Different components of HOOFS



Domain of different models used in HOOFS

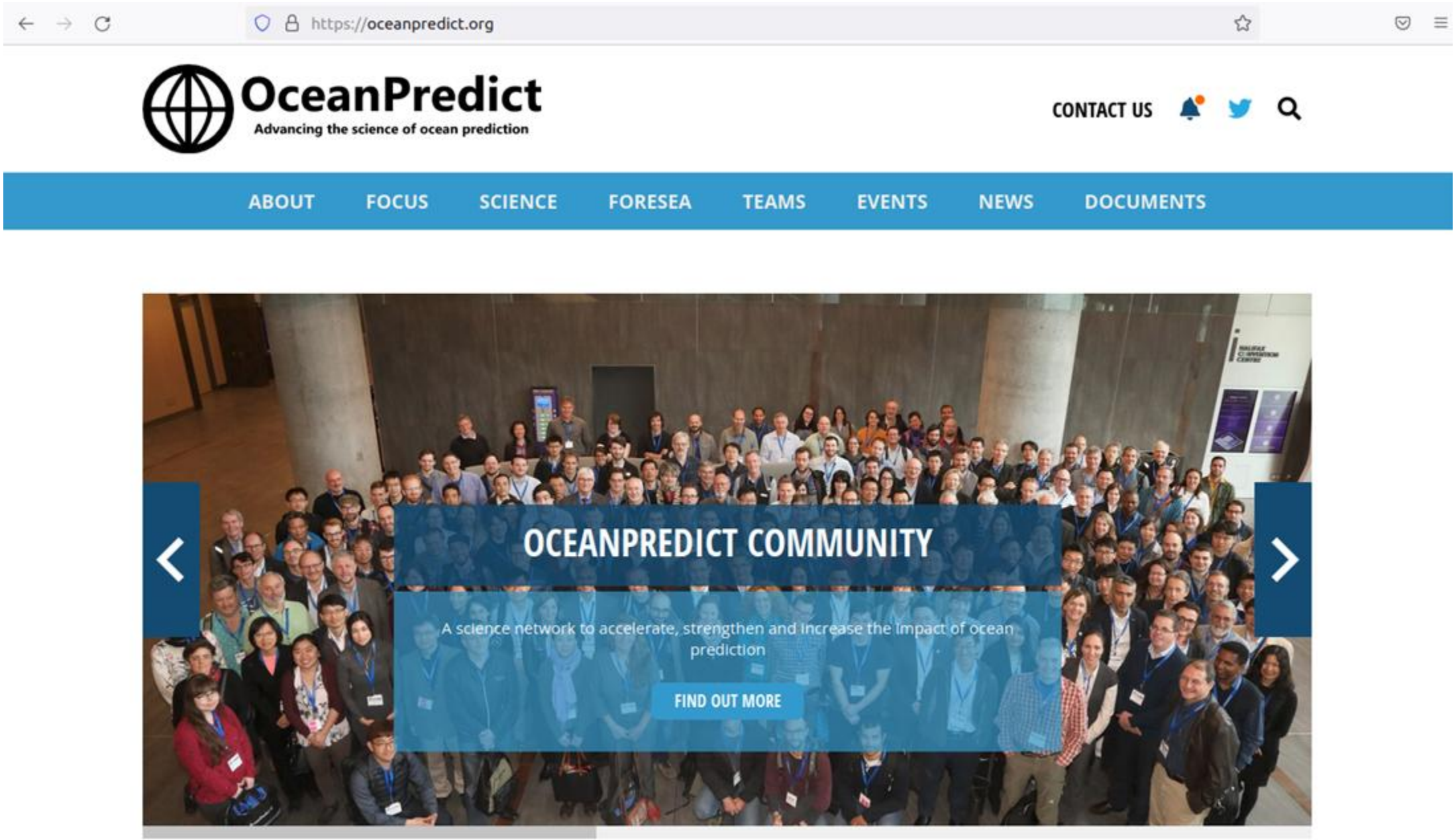


Correlation



RMSE

Francis et al., BAMS (2020)



https://oceanpredict.org/