



Development toward global aerosol DA system at NCEP

Jun Wang, Jeff Mcqueen (NOAA/NWS/NCEP/EMC)

Sarah Lu (SUNY at Albany)

Shobha Kondragunta, Qiang Zhao (NESDIS)

Arlindo da Silva (GSFC)

EMC GSI-EnKF group

Aerosol data assimilation development in NCEP

- NCEP started the efforts to develop global aerosol forecasting and assimilation capabilities in 2010.
- NCEP aerosol data assimilation project was suspended in May 2012 due to budgetary constraints.
- NGAC, with the potential benefits to improve weather/climate forecasts, was implemented in Sept 2012.

NCEP Strategic Plan 2015-2019

MODELS

Implement a new unified global coupled data assimilation and modeling suite.

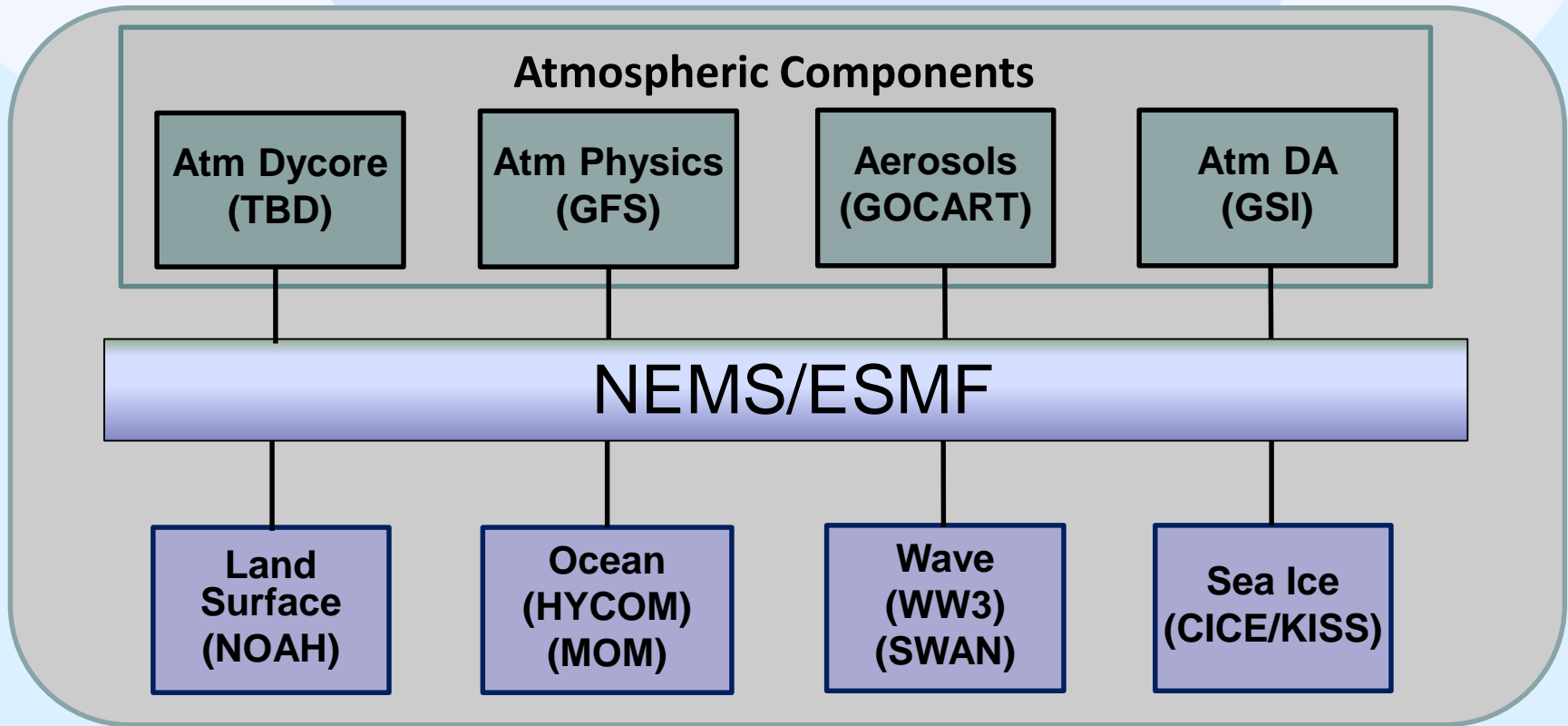
4.13

4.13.1 Couple the atmosphere to the ionosphere, ocean, sea ice, waves, land, and chemistry.

4.13.2 Develop scale-aware physics to enable unified approach to modeling.

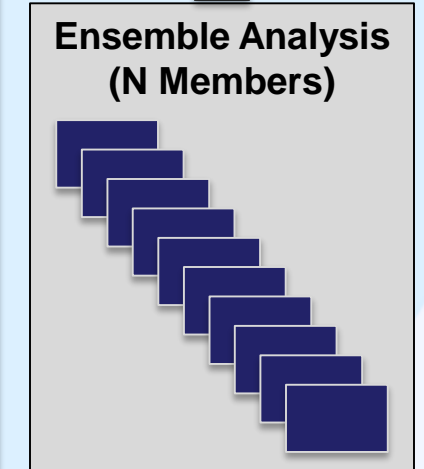
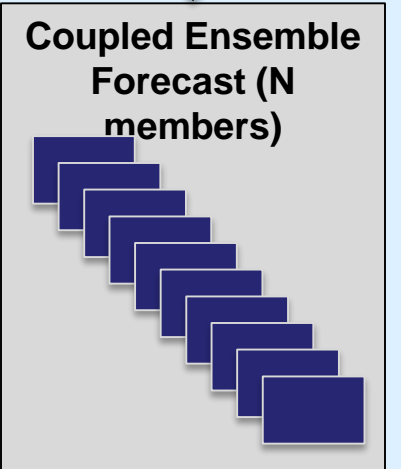
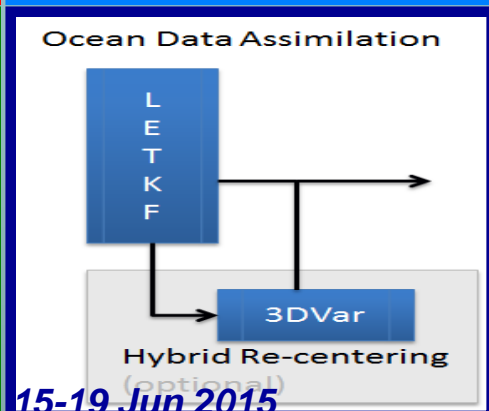
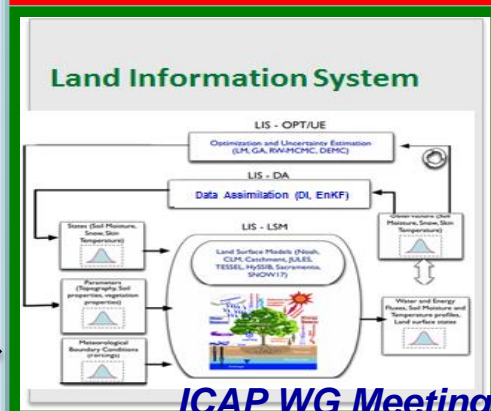
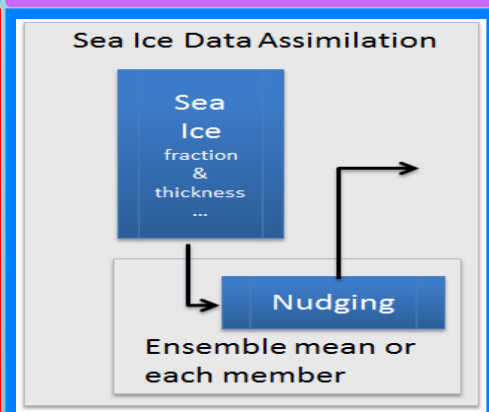
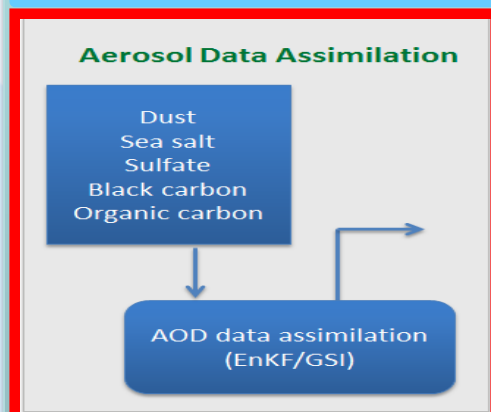
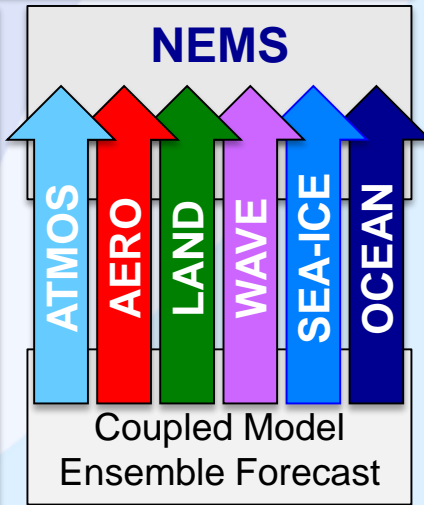
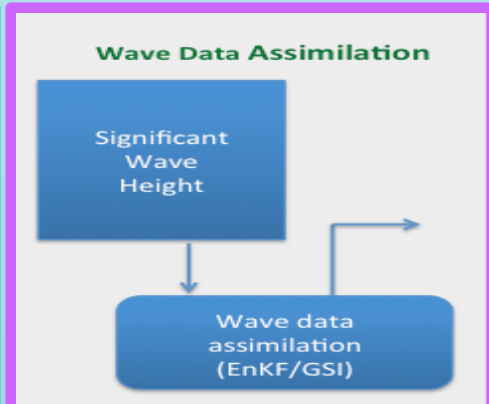
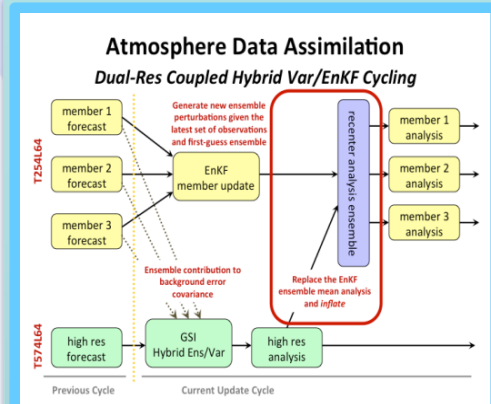
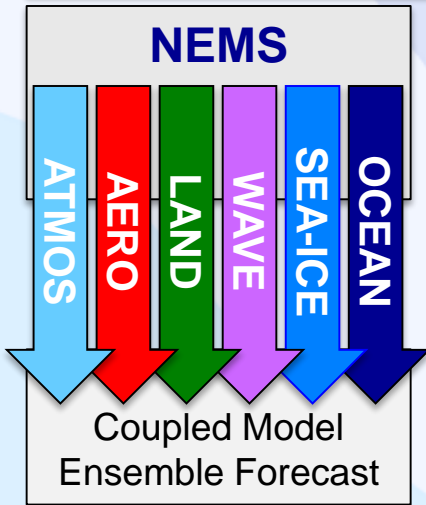
4.13.3 Implement Next Generation Global Prediction System dynamic core.

NGGPS Prediction Model Components



- NGGPS implementation plan development includes an aerosol team
- Development of dust/aerosol capabilities is underway by universities and federal labs

NCEP Coupled Hybrid-EnKF Data Assimilation System



INPUT

OUTPUT

NGGPS Dust/Aerosol Development in Progress

Prognostic aerosols (GOCART) in candidate dynamic core

- Implementation and Testing of Regional and Global Dust Forecasting (Ginoux, GFDL)
- Using Advanced Photochemical and Aerosol Modules to Verify the Applicability of GOCART Aerosol Modules within Global Weather Prediction Models (Grell, ESRL)

Aerosols and weather/precipitation

- Investigation of Aerosol Effects on Weather Forecast using NCEP Global Forecast System (Lu, SUNYA)
- Evaluating the Impact of Cloud-Aerosol-Precipitation Interaction (CAPI) Schemes on Rainfall Forecast in the NGGPS (Li, U Md)

Upgraded to modal aerosol model

- Improving Cloud Microphysics and Their Interactions with Aerosols in the NCEP Global Models (Lu, SUNYA)

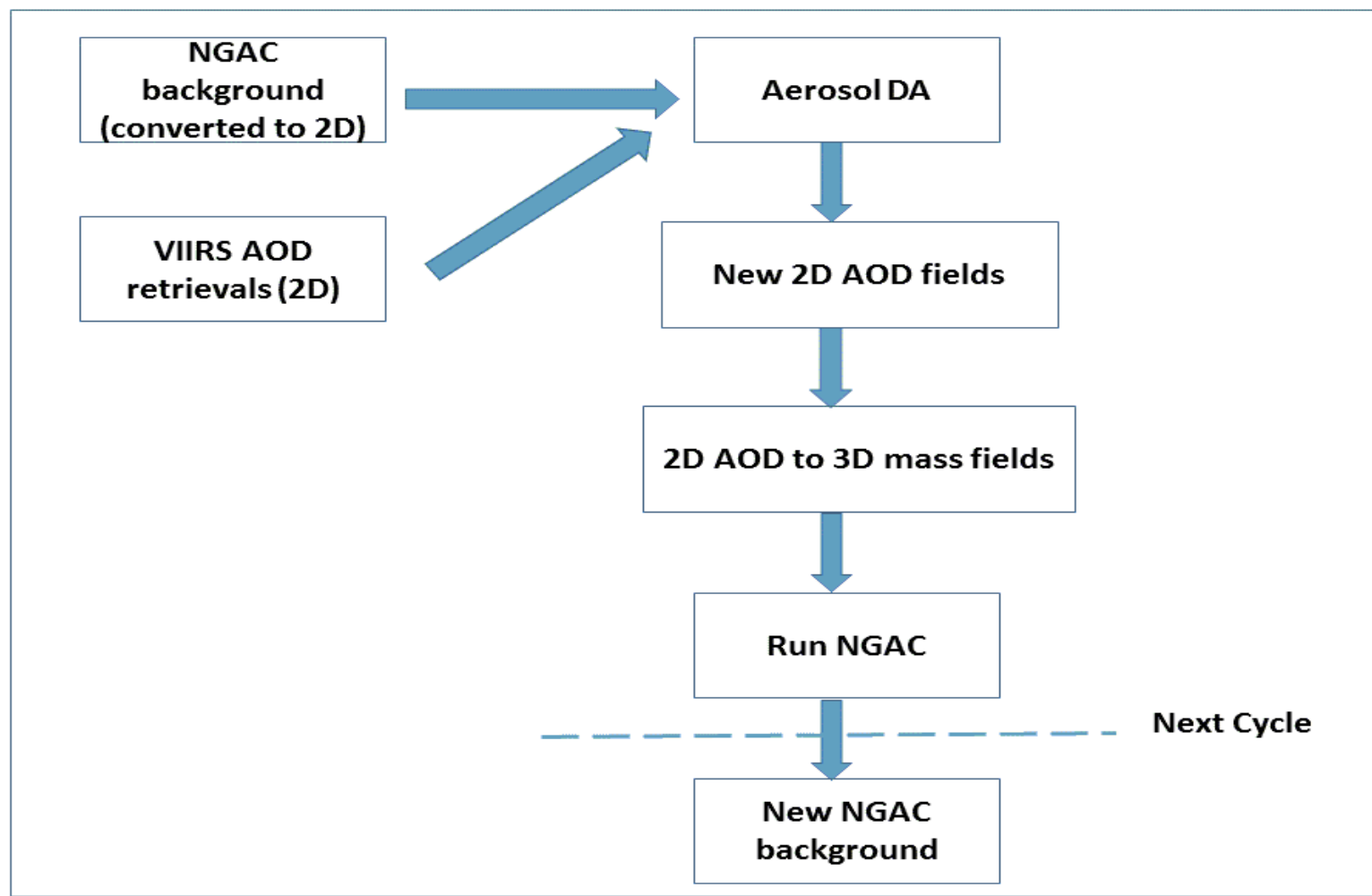
Aerosol data assimilation development in NCEP

- NGAC aerosol data assimilation using VIIRS AOD is funded by JCSDA from 2015-2016
- NCEP Aerosol data assimilation is build upon the NCEP(w/SUNYA) – GSFC - STAR collaborations. We will leverage expertise in NOAA laboratories (e.g. OAR ERSL) and research communities (e.g. NCAR) under NGGPS program.

NGAC data assimilation implementation plan

- The global aerosol analysis system at NCEP will be implemented with **incremental** updates
 - The first phase is based on GSI framework using VIIRS AOD as input observations and the NGAC output as first guess
 - The system will be extended to use multi-sensor and multi-platform aerosol observations and evolve to an EnKF system
- The primary outcomes include:
 - **Improved operational global real-time aerosol forecasts.** JPSS aerosol information will be assimilated in the NWS operational data assimilation system for the first time.
 - **A prototype global coupled system with aerosol modeling and data assimilation capabilities.**

NGAC Data Assimilation flow chart



Milestone and deliverables

- **Activity 1: VIIRS Quality Assurance and Bias Correction**
 - Conduct VIIRS AOD error analysis
 - Establish VIIRS data screening procedure
 - Prototype data assimilation grade VIIRS AOD product

- **Activity 2: Global Aerosol Analysis**
 - Estimate VIIRS observation errors
 - Determine NGAC background errors and conduct base-line NGAC experiments in non-assimilation runs
 - Modify GSI to include AOD as analysis variable and adopt GSFC' local Displacement technique
 - Conduct AOD assimilation experiments using VIIRS as observation inputs and NGAC as first guess and conduct benchmark study
 - Prototype global aerosol data assimilation system

- **Activity 3: Synergistic activities**
 - GDAS run scripts are modified to use NGAC as prediction model (NWS R2O project) and VIIRS Cal/Val activities (JPSS program)
 - GAC upgraded to multi-species prediction system (EMC base funding activities)
 - Evaluation of retro-NGAC forecasts (CPO MAPP-CTB project)

Future plan

- Aerosol data assimilation will be evolving into an EnKF system.
- The observations will be extended to include multi-sensor and multi-platform aerosol observations.



Thank You