



# 3.11 Development of NCEP Global Aerosol Forecasting System: An overview and its applications for improving weather and air quality forecasts



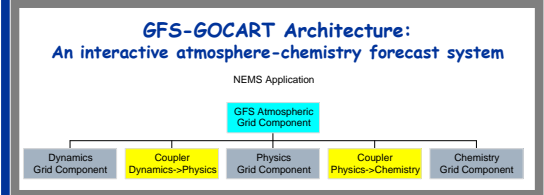
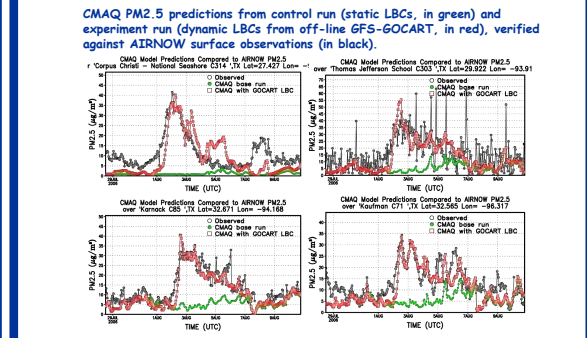
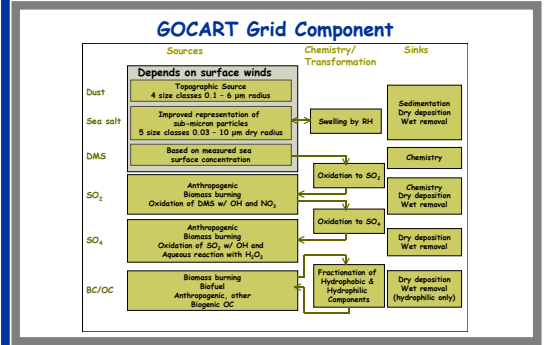
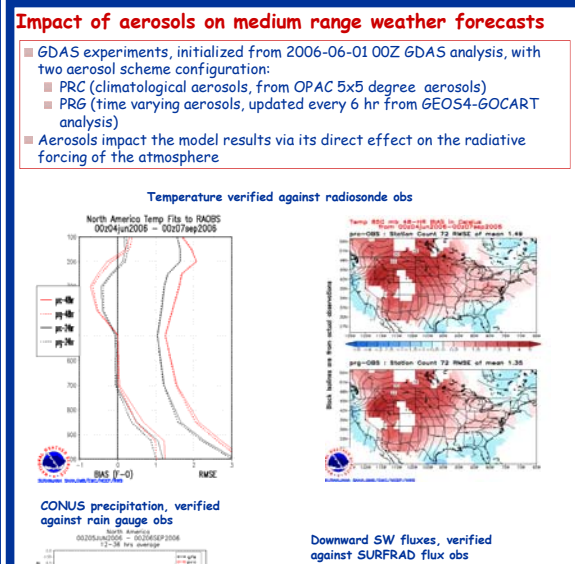
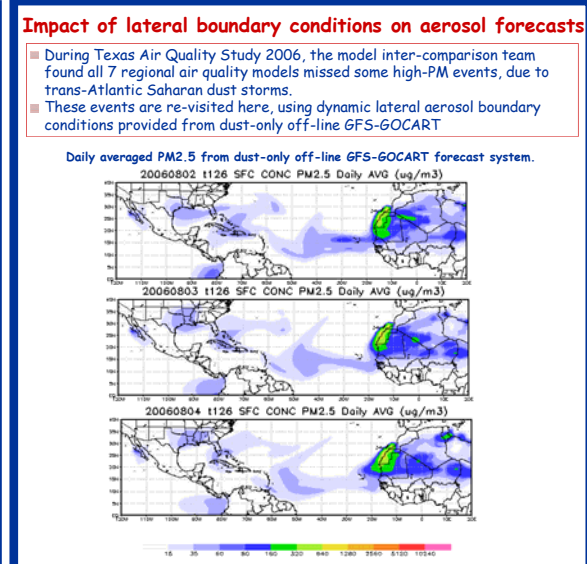
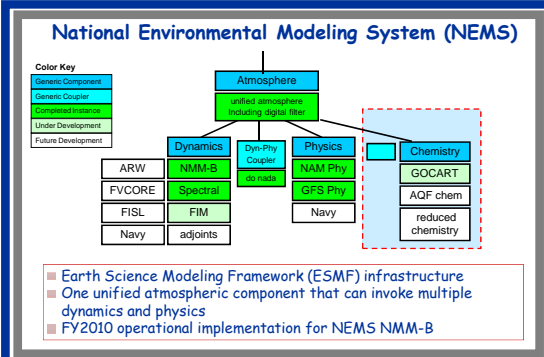
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- Goal:**
- Improving weather and air quality forecasts by incorporating prognostic aerosols in GFS and assimilating global aerosol information in GSI via NCEP-NASA/GSFC-Howard University collaborations
- Multiple, complementary approaches:**
- On-line system including GOCART:
    - NEMS GFS/GOCART: new capability being developed
    - GEOS-5/GOCART: NASA/GMAO real-time system
    - GFS~GEOS-5/GOCART (GEOS-5 dynamics + GFS physics): Research system for sensitivity analysis
  - Off-line GOCART CTM:
    - Driven by GFS meteorology

- Rationale**
- Potential for improving forecast accuracy
    - Aerosols affect surface radiation both directly (via scattering and absorption) and indirectly (through cloud-radiation interaction)
    - Dust-laden Saharan air layer reduces occurrence of deep convection and suppresses tropical cyclone activities
  - Aerosol (lateral and upper) boundary conditions are needed for planned National aerosols air quality predictions
    - Key mechanism for utilizing satellite observations
    - Impacts on climate, human health, ecosystem, and visibility

- Proposed Enhancement**
- NOAA medium range weather forecasts**
- Climatology-based aerosol distributions are used in GFS and background aerosol conditions are assumed in GSI
  - Global aerosol products will improve the representation of aerosol distributions and variations within the GFS/GSI system
- NOAA air quality forecasts**
- Default static boundary conditions are used for the developmental aerosol air quality predictions
  - Global aerosol products will provide improved aerosol lateral boundary conditions for the AQF system and, consequently, improve AQF aerosol forecasts

- Summary**
- NCEP is developing NEMS as next-generation weather forecast system
  - NEMS R & D efforts continue in interactive atmosphere-chemistry modeling system: NMM-B + Chem and GFS-GOCART
  - Impact study 1: GFS/GSI experiments with different aerosol representations (climatological versus prognostic aerosols) are conducted. Changes in model forecasts arises from the direct radiative effects. Overall appears to be a neutral to slight improvement.
  - Impact study 2: Dust simulations from off-line GFS-GOCART system are used as lateral aerosol BCs for AQF (experimental configuration). Verification with AIRNOW PM observations shows great enhancement.



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