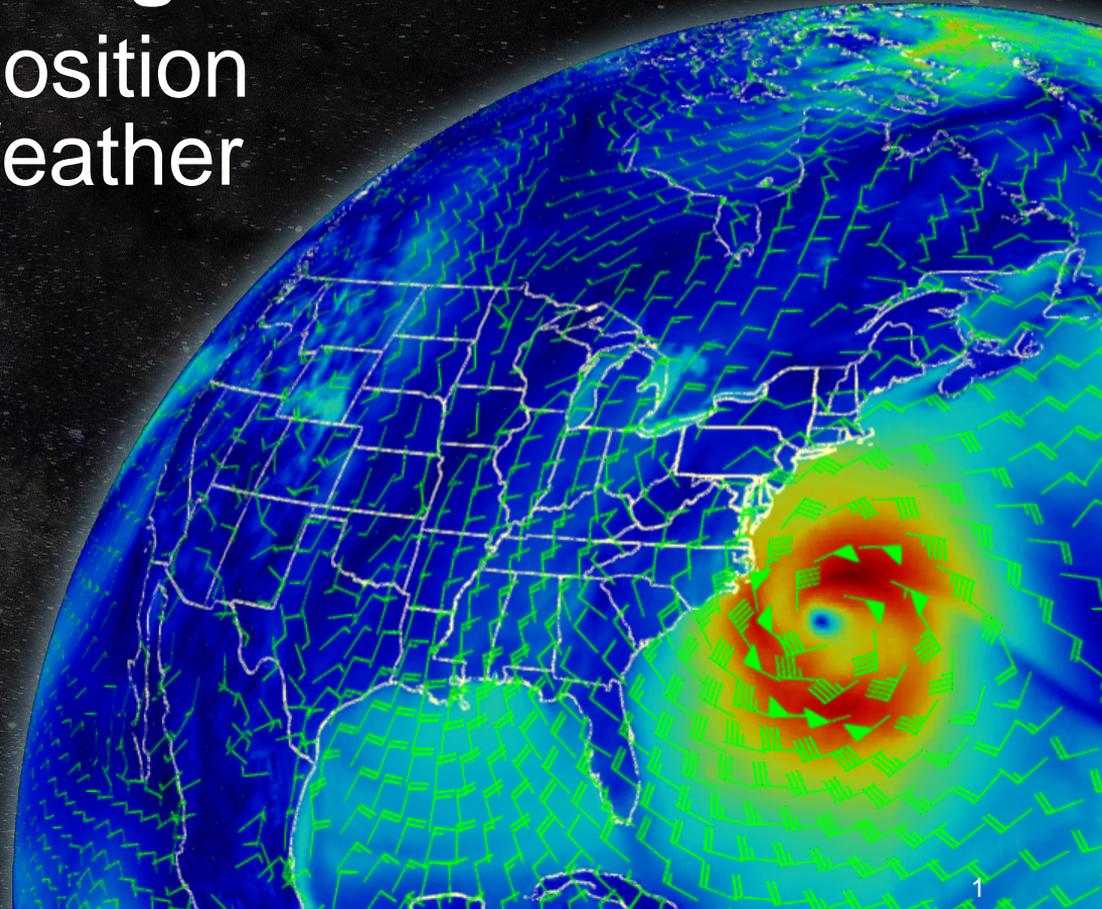


Earth-System Modeling: The Impact of Composition and Chemistry on Weather Forecasting

Georg Grell
NOAA/ESRL/GSD



GSD Science Review
3-5 Nov 2015



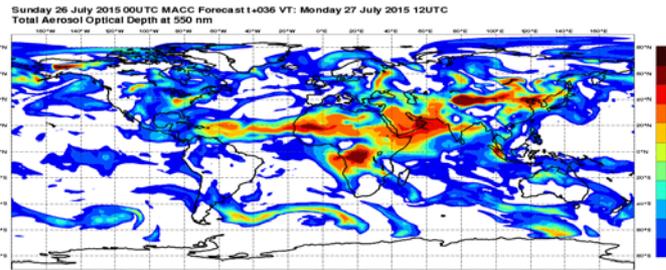
Current State-of-the-Art Effort: ECMWF

Principal goal of ECMWF for forthcoming decade: physical and chemical weather - One of the four aims:

“We will deliver operationally global analysis and forecasts of atmospheric composition.”

Prof. Alan Thorpe, ECMWF Director-General, 2012

Monitoring Atmospheric Composition and Climate (MACC), Now MACC-III



The **N**ext **G**eneration **G**lobal

Prediction **S**ystem (**NGGPS**)

Great accessibility of

expertise at **ESRL** to

accomplish this for **NGGPS**

forecasting at **ESRL** (short,

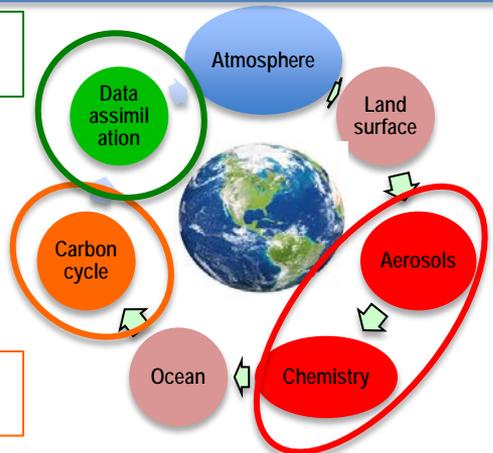
medium, and seasonal)

ESRL/PSD

ESRL/GMD

ESRL/GSD

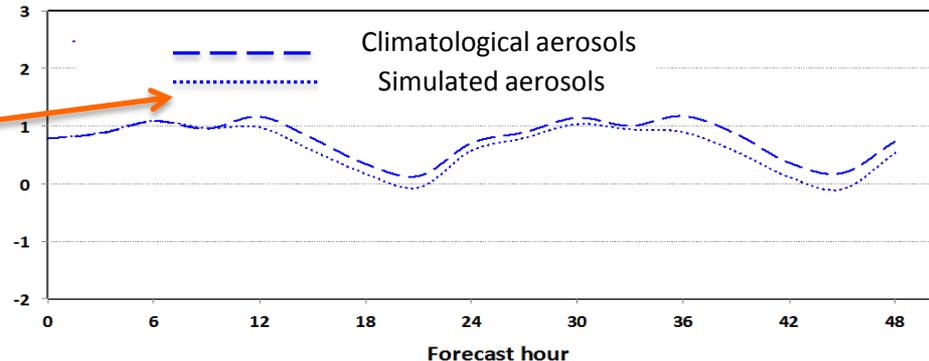
ESRL/CSD



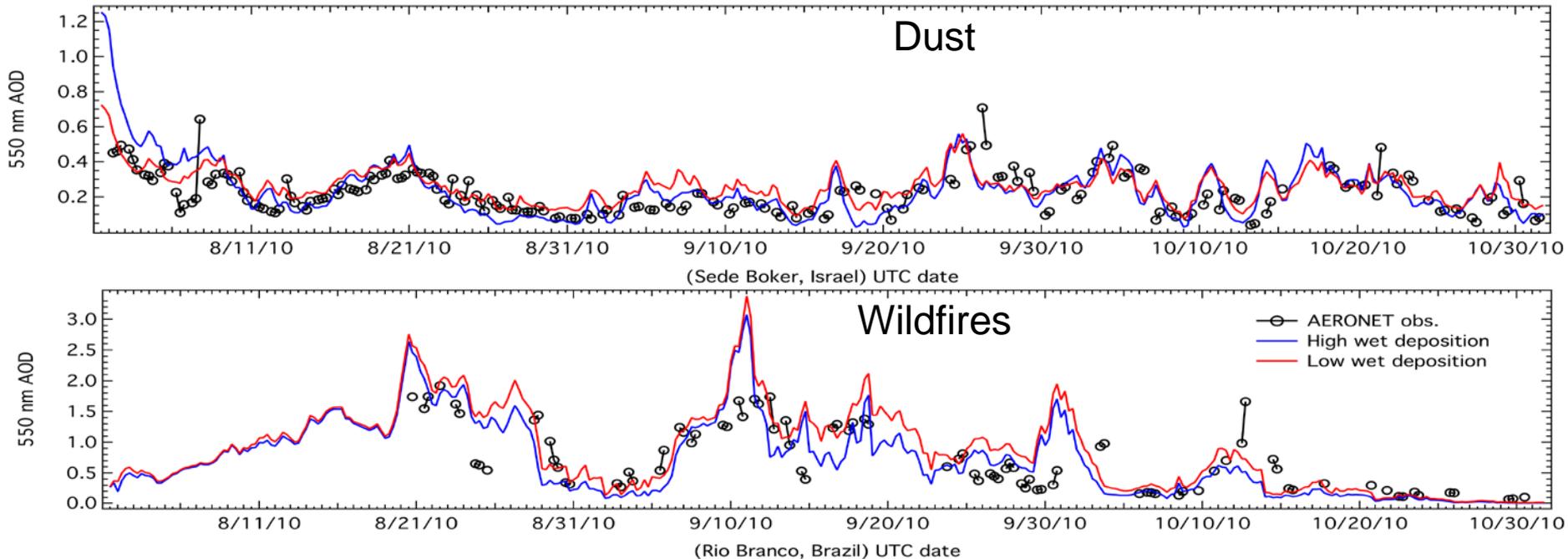
Use experience gained with the Weather Research and Forecasting model coupled with Chemistry (**WRF-Chem**)

- **WRF-chem** estimated 2000 users world wide, community effort lead by ESRL
- Original **WRF-Chem** paper (2005) cited 500 times according to ResearcherID
- Perform convection permitting simulations in areas with strong aerosol signals
- Use best and computationally affordable setup for NGGPS

Surface Temperature biases from ECMWF modeling systems, when aerosol impacts are included over Brazil



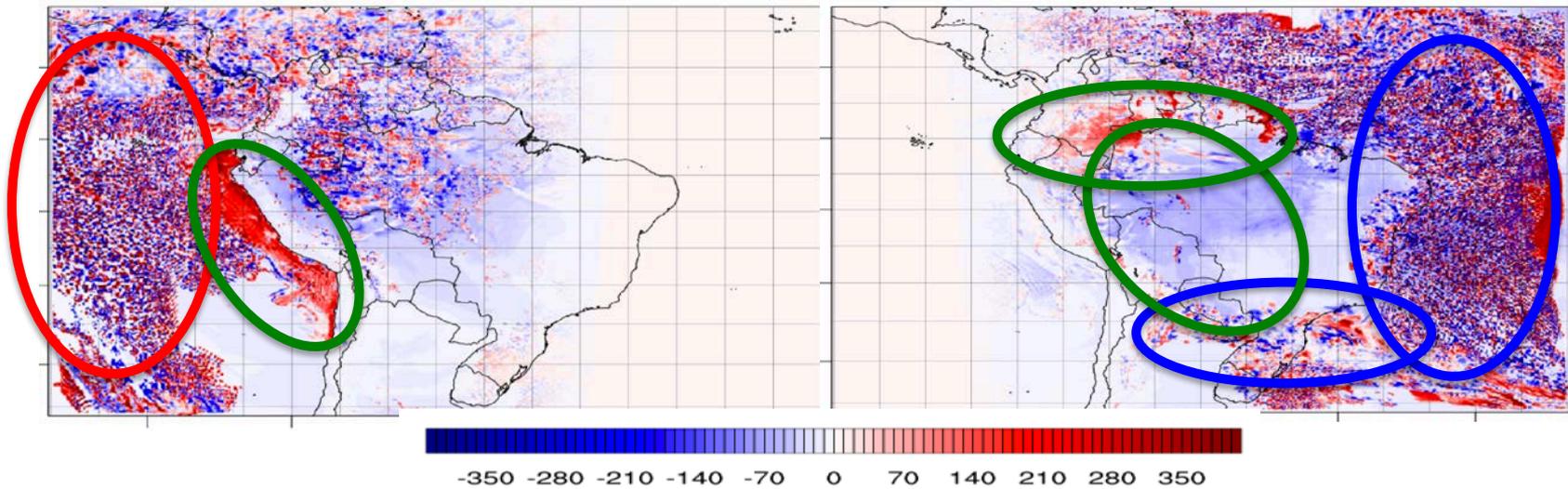
Aerosol impacts on NWP: Can this be done with the simple GOCART modules? First evaluation of aerosol predictions compared to AERONET observations: 2 stations near dust and wildfire locations



Future: Use chosen chemistry suites for next generation NGGPS core

Using WRF-Chem with highest degree of complexity in chemistry suites for aerosol direct and indirect effect:

~~Apparent systematic and random short wave radiation differences 20 runs 72hr forecasts~~
Random changes in cloud cover, aerosol loading, sea level, non layered concentrations, usually less than 10% variation reaching the ground



In areas of strong sources (wildfires, dust) there is a significant impact of aerosol on NWP!