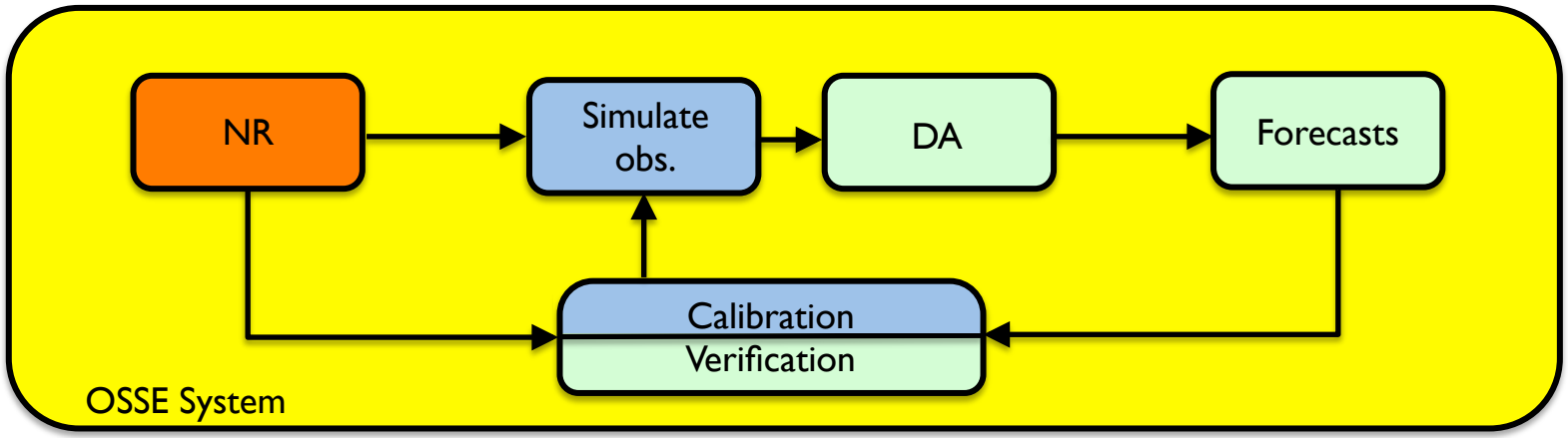
Improving forecasts: The role of OSSEs



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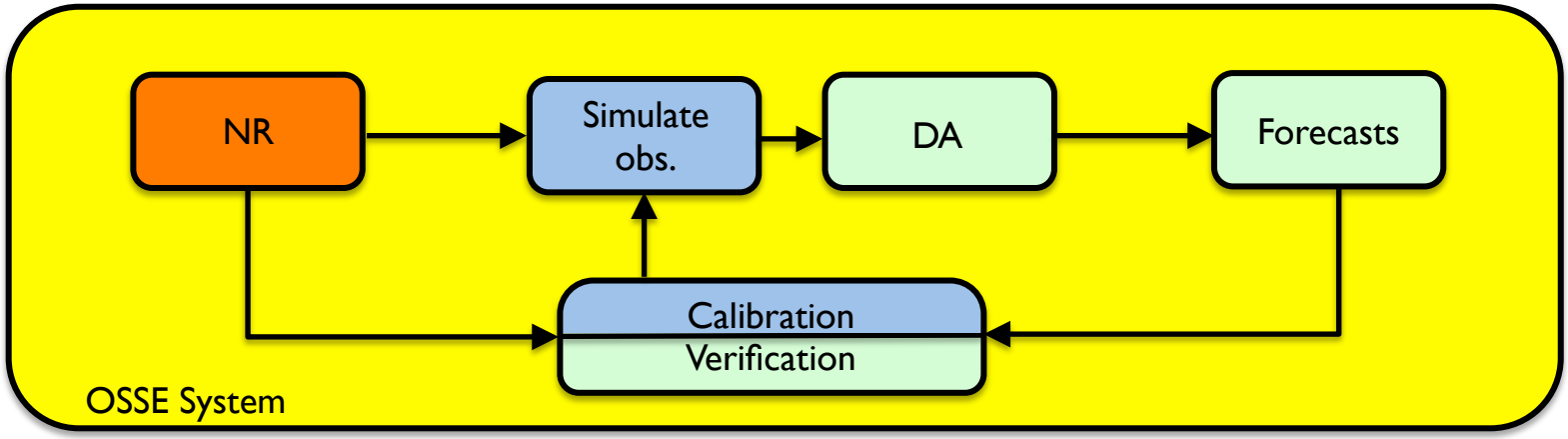
Introduction

- Observing System Simulation Experiments (OSSEs) have been used since the 1950s to
  - Evaluate observing systems in terms of accuracy and coverage (e.g., in planning FGGE)
  - Guide decision makers to allocate resources to mitigate costs and lead time in reality
  - Conduct trade studies of instruments and systems, and
  - Design and test new DA methods

OSSE system components

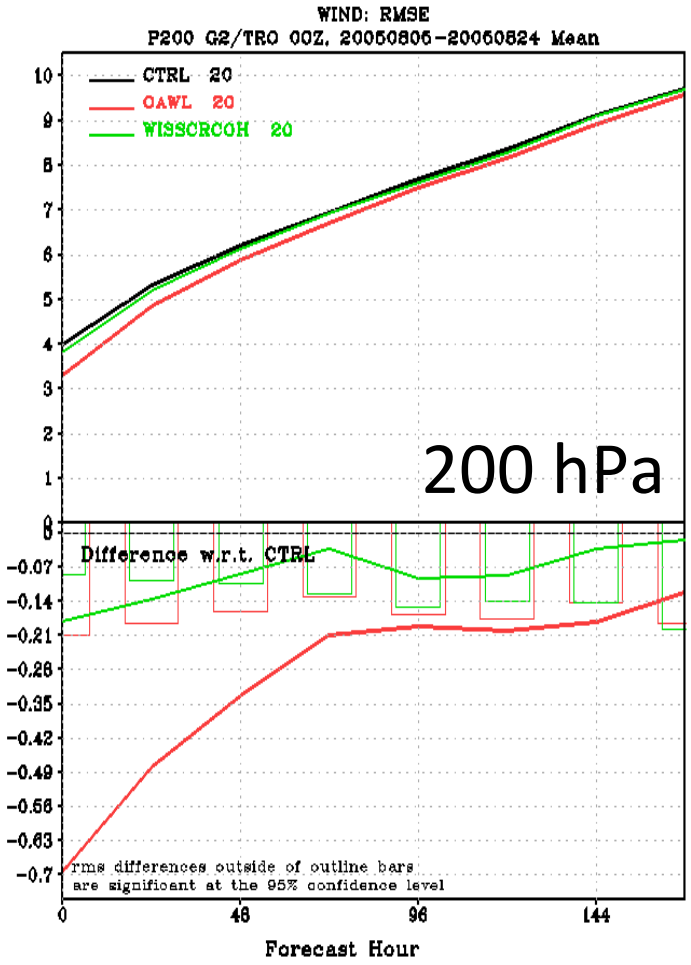


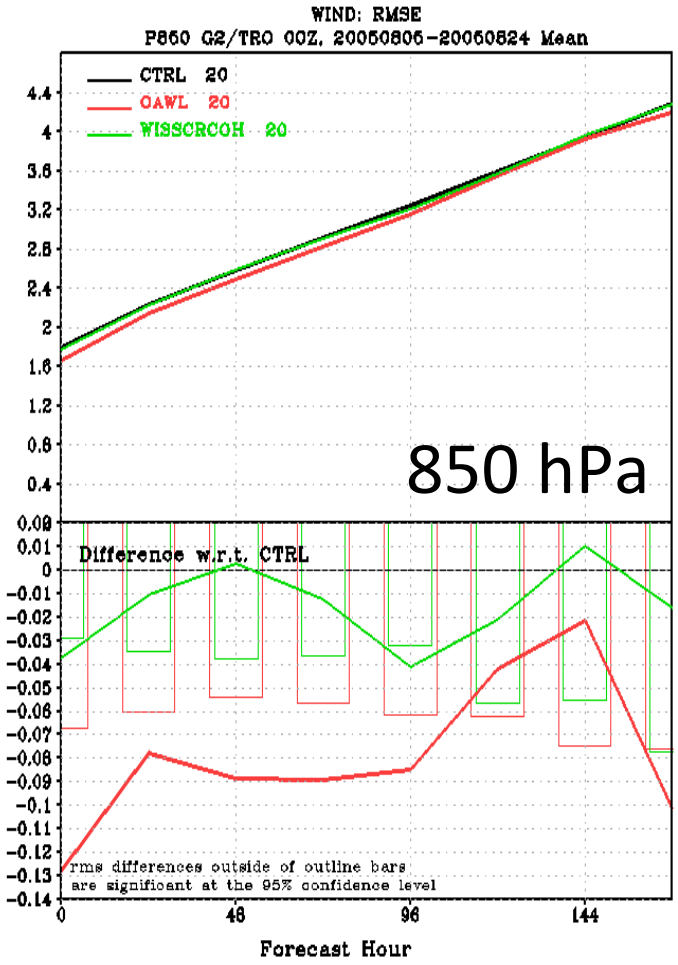
- Each OSSE component must be realistic
  - The nature run (NR)
  - The DA and forecast systems
  - The simulated observations and their errors

Evaluation of alternative lidar technologies

- OSSEs have been used since the 1980s to support the different wind observing systems
- Next 2 slides show sample results for an OSSE study comparing a Control experiment to experiments adding either OAWL or coherent wind lidar observations
- Details:
  - T511 ECMWF NR; embedded 1-km mesh Hurricane NR
  - T382 GFS DA system; 9-km HWRF DA system
  - Sample of 20, 7-day forecasts

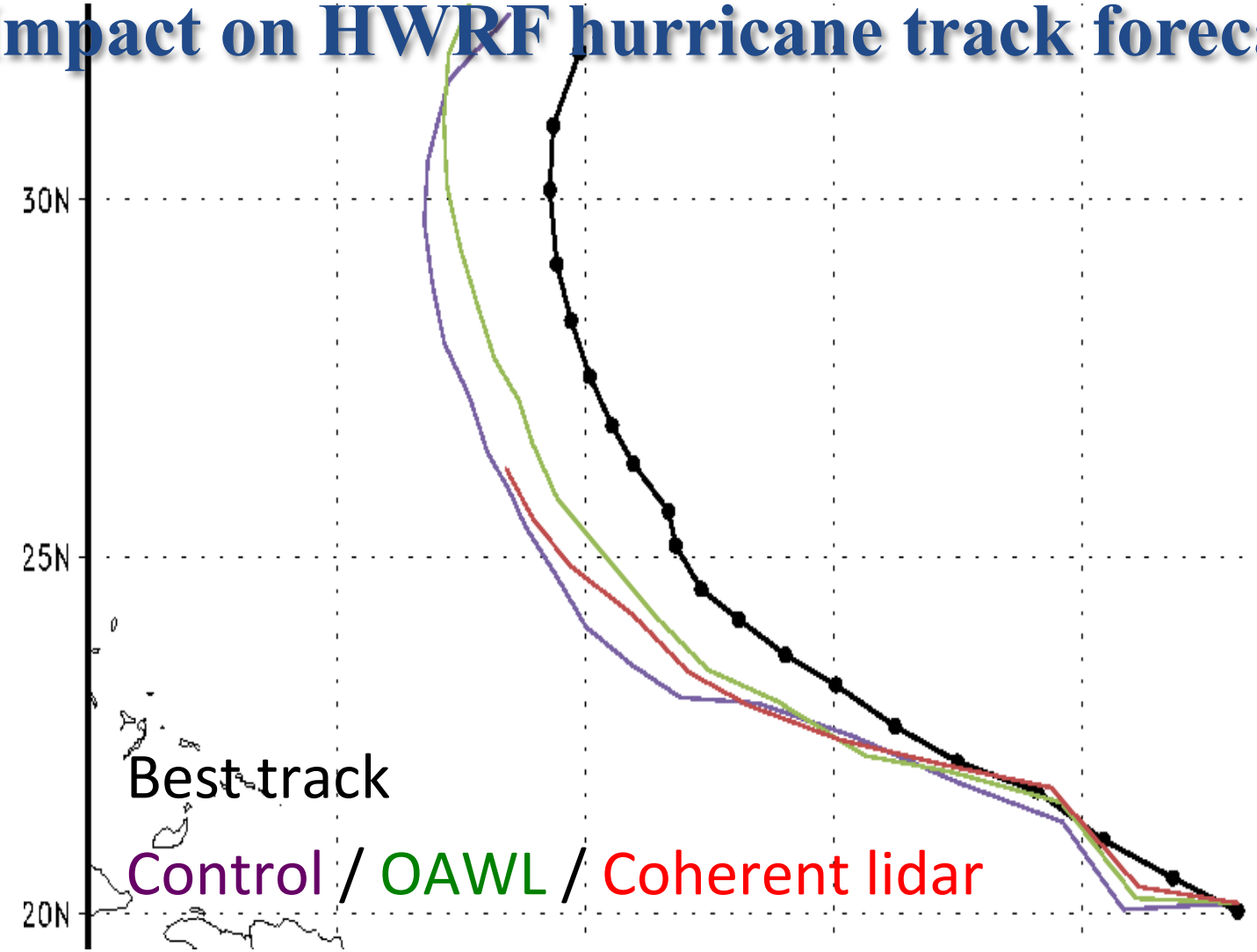
Impact on RMSE wind forecast error in Tropics





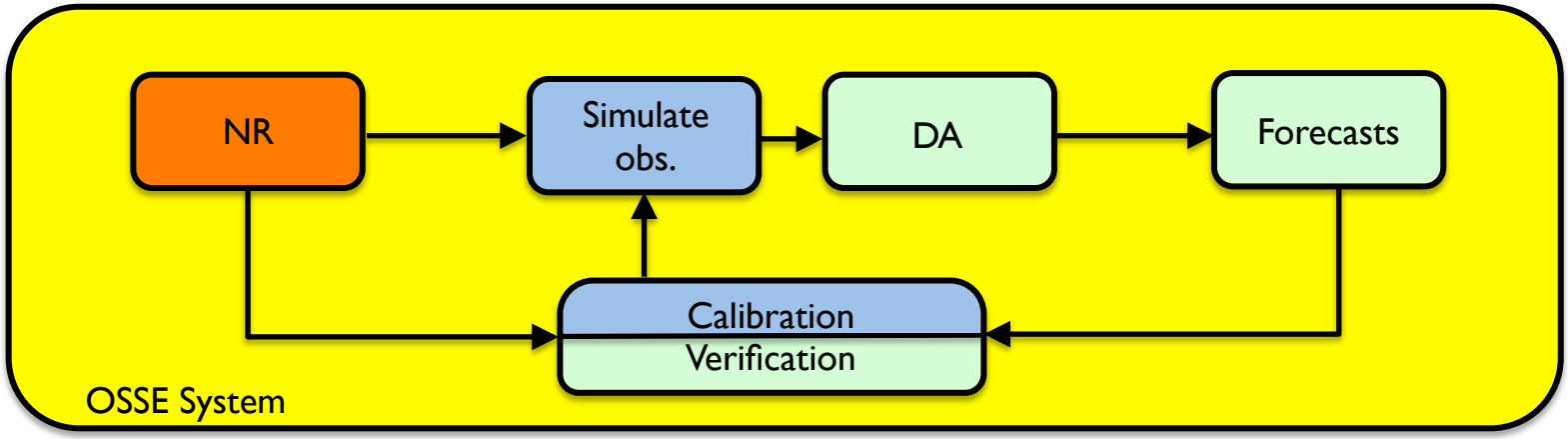
Control / OAWL / Coherent lidar

Impact on HWRF hurricane track forecasts



Track forecasts from August 4 06Z for Nature (black), Control (purple), Control+WISSCR_COH (red) and Control+OAWL (green).

Types of OSSEs



- Full OSSE: multiple forecast during a month or so of DA from a long free-running NR, necessary to demonstrate impacts in a realistic forecast and DA system.
- Quick OSSE: single detailed forecast of an interesting case is used as the NR, can illustrate the potential of a new observation type.

Things to consider

- Simulated observations should be as realistic as possible (coverage, accuracy). But only as realistic as makes sense for the OSSE and the DA system used
  - Consider QC, thinning/super-obbing, the DA system error statistics.
- Different types of OSSEs are appropriate for different purposes
  - Operational impact vs. Demonstrating potential usefulness
  - Full OSSE with realistic obs. errors vs. Quick OSSE with perfect observations
- Advances in operational NWP—increased resolution, coupled systems, use of new obs. types—will challenge our ability to conduct realistic OSSEs
- Errors should be realistic, but in a DA context representativeness error can swamp sensor error
- OSSEs can be useful in many domains
  - Severe Storms, Ecosystems, Air Quality, and other components of the earth system

Four critical questions

1. Will the study be completed soon enough to be useful?
2. What are the limitations of the OSSE system?
   - Do not draw conclusions that go beyond these
3. Is the difference between the NR and forecast models realistic enough?
4. Are the simulated errors realistic enough?

More….

- Article: 10.1175/BAMS-D-15-00200.1
- OSSE checklist: www.aoml.noaa.gov/qosap/osse-checklist/
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