

Wind Lidar in NASA's Weather Forecast Area

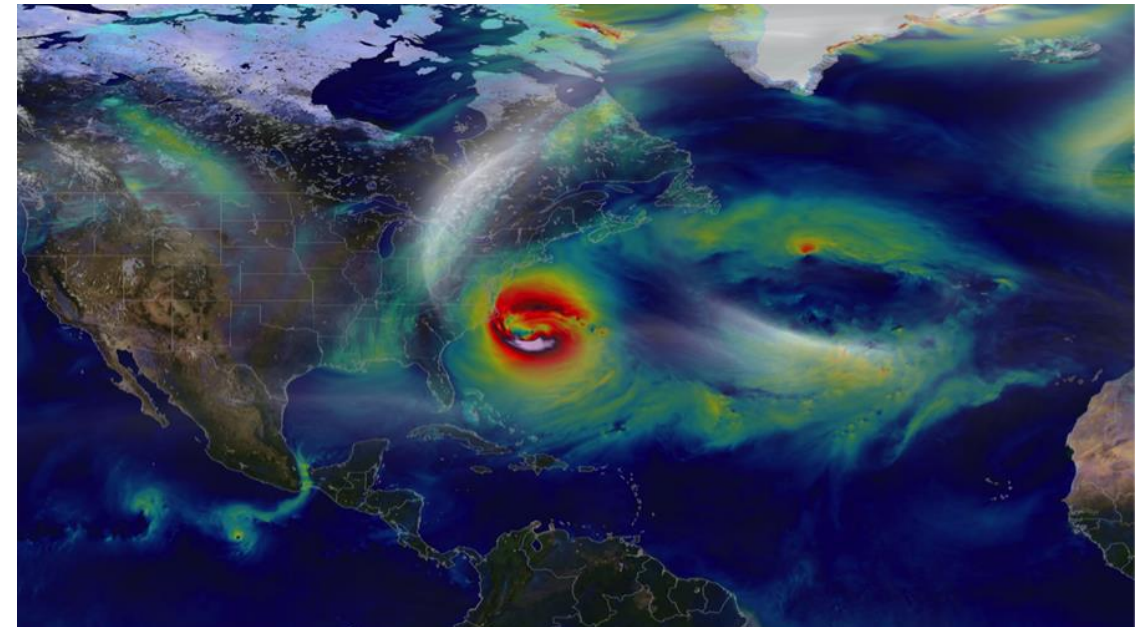
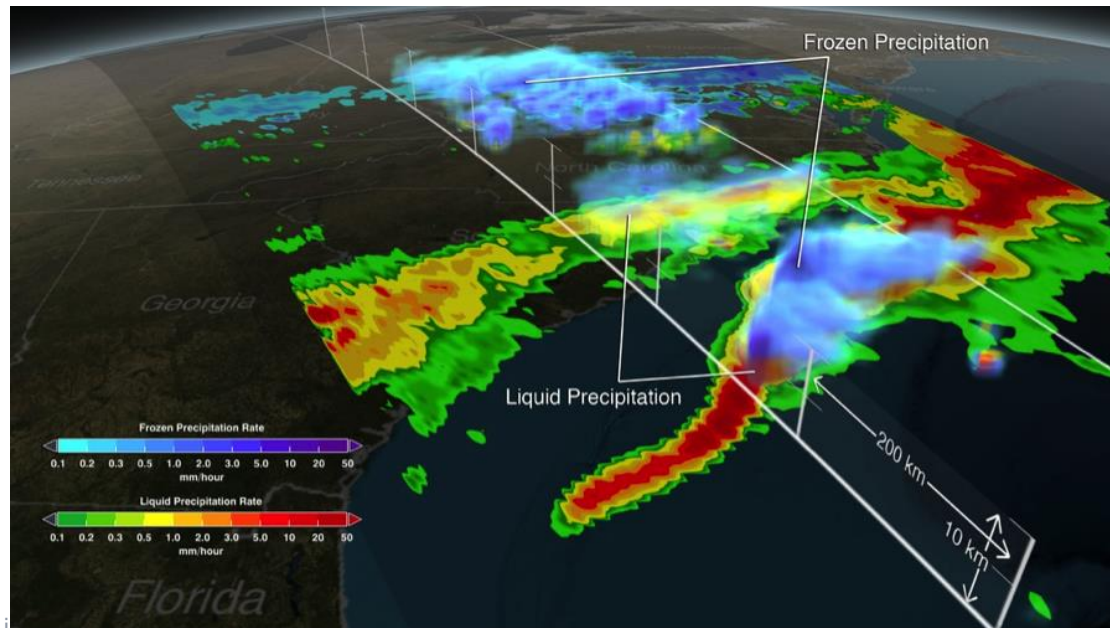
Tsengdar Lee

Presented at Working Group on Space-based Lidar Winds
NOAA ESRL

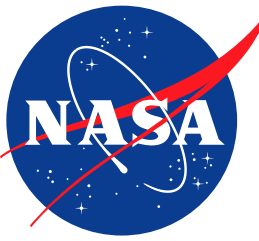
February 7, 2018

NASA's Weather Programs

- Atmospheric Dynamics
- Precipitation Science
- Sounders Science
- Joint Center for Satellite Data Assimilation
- Short-term Prediction Research and Transition Center
- Heavily leverage Modeling and Analysis Program



Topics in 2015 Weather Focus Area Workshop



Weather Prediction and Predictability:

- Expand range of NWP up to 4 weeks.
- Improved prediction of extreme weather.

Convection and Precipitation:

- Interaction between convective and larger scale circulations.
- Mesoscale organization, internal structure and dynamics, life cycle of convection.
- Rate of intensification.
- Processes and interactions which control precipitation.

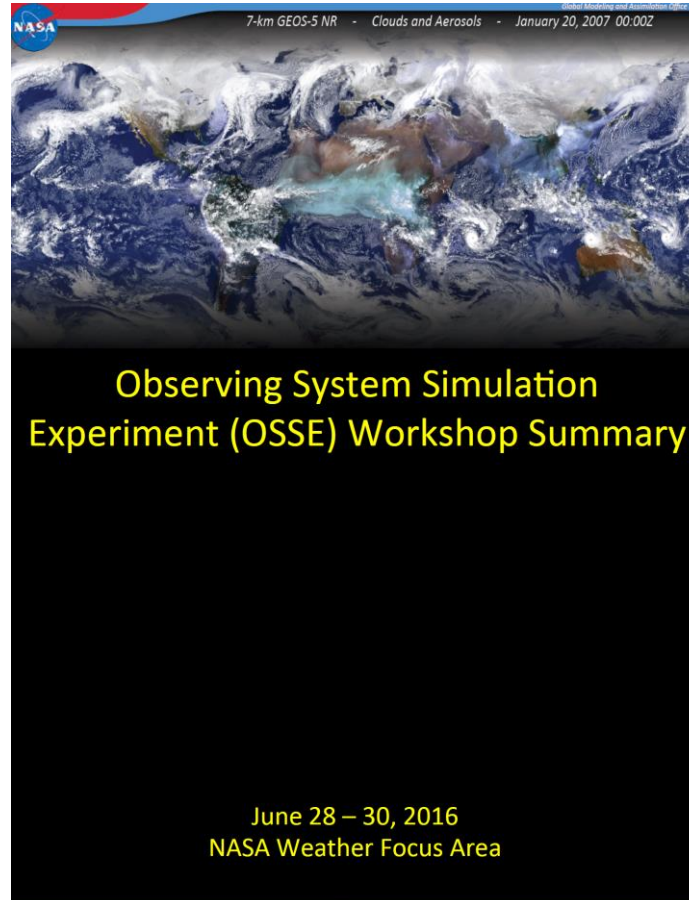
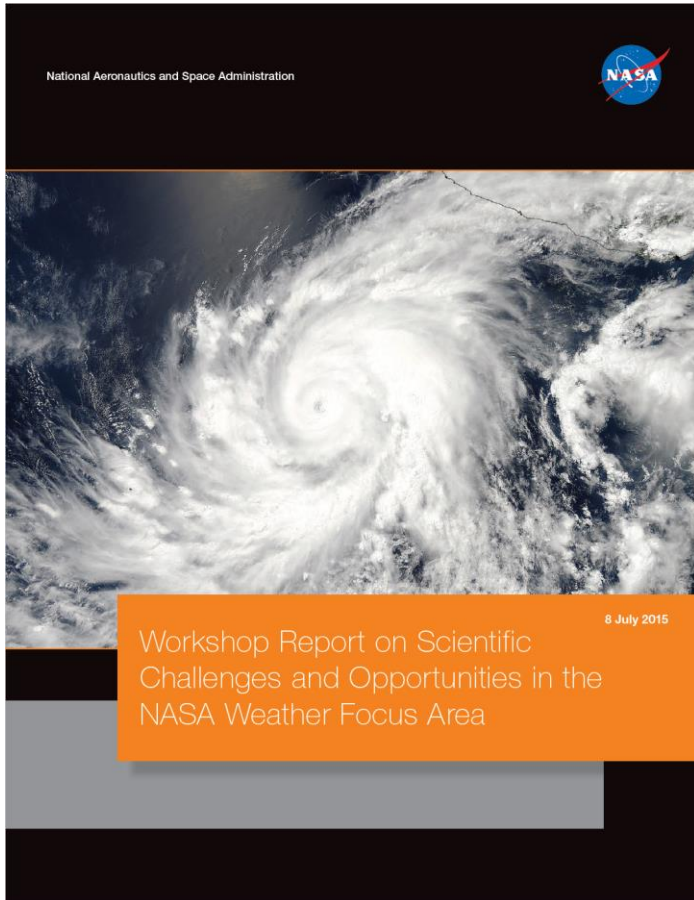
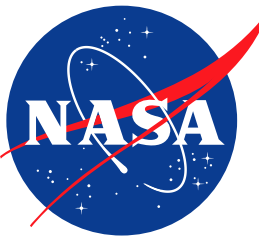
PBL/Land surface/Ocean surface:

- Moist convective process interaction with BL and surface.
- Mechanisms controlling BL clouds.
- Unify parameterization of moist and dry turbulence, convection and clear air turbulence.

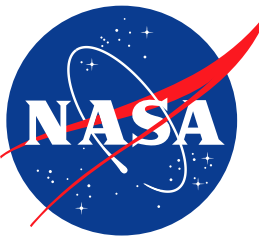
Clouds and Radiation:

- Processes determining cloud microphysical properties, connection to aerosols and precip.
- Spatio-temporal structure of cloud systems.

Some Notable WFA Activities Since 2015



- Published WFA Workshop report
- Two OSSE Workshops
- One MISTiC OSSE study (Steven Pawson talk at 16:05 today)
- One AMV OSSE study
- Convective Storm ROSES call
- CPEX campaign
- Participated in the NGGPS working groups
- Continue to invest in precipitation science
- Invested in Joint Effort for Data assimilation Integration (JEDI) at JCSDA



Decadal Survey Recommendations

Science questions

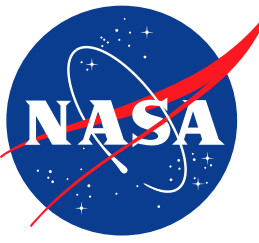
- (W-1)** What planetary boundary layer (PBL) processes are integral to the air-surface (land, ocean and sea ice) exchanges of energy, momentum and mass, and how do these impact weather forecasts and air quality simulations?
- (W-2)** How can environmental predictions of weather and air quality be extended to forecast Earth System conditions at lead times of 1 week to 2 months?
- (W-4)** Why do convective storms, heavy precipitation, and clouds occur exactly when and where they do?
- (W-5)** What processes determine the spatio-temporal structure of important air pollutants and their concomitant adverse impact on human health, agriculture, and ecosystems?
- (W-3)** Influence of Earth surface variations on weather and air quality

Atmospheric Wind Observations

3D winds in troposphere/PBL for transport of pollutants/carbon/aerosol and water vapor, wind energy, cloud dynamics and convection, and large-scale circulation

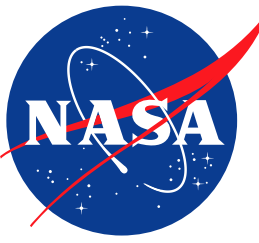
Active sensing (lidar, radar, scatterometer); or **passive imagery** or **radiometry-based atmos. Motion vectors** (AMVs) tracking; or lidar**

** Could potentially be addressed by a multi-function lidar designed to address two or more of the Targeted Observables



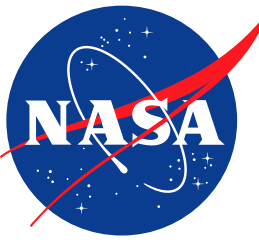
Status in Implementing Decadal Survey Recommendations

- Still early in developing the implementation plan.
- NASA HQ started weekly meetings. Senior managers are focusing on the first 6 chapters.
- R&A staffs have been asked to review the other chapters to find nuggets of information that did not get into the first 5 chapters.
- WFA also started discussions with other focus areas to find synergies among the focus areas.
- May take 12 – 18 months.
- NASA HQ received many phone calls and emails from the community asking for guidance
- In general, NASA HQ is not ready to provide guidance at time time.



Tsengdar Lee's Opinion

- Be patient! There is a lot of noise in the system and that's not good to anybody.
- It's better to think of science question and not just missions (it's more than technology).
- Think about how to address multiple DS recommendations when possible.
- Put a comprehensive plan together including observations, framework, R&A elements, big data analytics, global model and data assimilation system, regional model, supercomputer requirements, applications, and partnerships
- Specific to winds: Concepts should include AMV (both polar and geostationary), lidar (both satellite and suborbital) and need to be anchored with science questions
- DS put Weather and Air Quality together. Is there something we can do to cover the air quality community's interest?



Questions?