DOE RGMA 2020 PI Meeting

Convection and Surface-Atmosphere Interactions

Breakout Session

October 13, 2020

Convection and Surface-Atmosphere Interactions Breakout

Breakout Session Logistics

- **Session time: Tuesday, October 13th from 1:30-5:00 pm ET**
  - Break from 3:30-4:00 pm ET
- **Session topics:**
  1. Whitepaper Overview
  2. Data and Analysis: 8 Talks
  3. Model Development, Sensitivity, and Evaluation: 9 Talks
- **~5 minutes talks, followed 1-2 minutes of short questions** (speakers request next slide)
- **Longer presentations available from several speakers on the Google drive**
- **Each topic will be followed by 20 minutes of open whitepaper discussion**
  - Please mute your microphone when not speaking
  - If needed, please use the Zoom “raise hand” feature
  - Please share ideas in discussion and add them to Breakout Discussion Google doc

Advancing Understanding of Variability, Predictability, and Change Across Spatiotemporal Scales

A Whitepaper Synthesizing Current and Future Earth System Science Research

Chapters:

- Convection and Surface-Atmosphere Interactions
- Synoptic to Intraseasonal Scale Interactions
- Extremes and Impacts
- Multi-year Earth System Variability, Predictability and Prediction
- Ecosystem Responses and Feedbacks
- High Latitude Processes and Feedbacks
- Cloud/Cloud-Aerosol Interactions and Feedbacks
- Coastal Processes: Land-Atmosphere-Ocean Interactions
- ML/AI
- CMEC

Chapter updates to include:

1. Update description of challenges and current research in RGMA

2. Update research gaps and future directions
   - Short term (3-5 years) research goals
     - E3SM Experiments
     - Use of CMIP data
     - Use of ML/AI
     - Metrics for CMEC
   - Long term (10 years) research goals
     - Intercomparisons
     - E3SM Experiments
     - Use of ML/AI
     - Cross-cutting Ideas

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Whitepaper Chapter Overview

Grand Challenge Question: How do cloud microphysics, atmospheric dynamics, surface fluxes and their multiscale interactions influence the predictability of mesoscale convection and its impact on surface conditions and land-atmosphere interactions from synoptic to interannual time scales?

Science Questions:

- How do cloud microphysical processes influence the macro-physical properties and lifecycle of mesoscale convection?
- How do the spatial and temporal variability of surface fluxes influence mesoscale convection and its predictability during the warm season?
- How do mesoscale convection and atmospheric circulation interact locally and remotely to limit the predictability of precipitation from synoptic to interannual time scales?
- How does the frequency, intensity, and timing of precipitation from mesoscale convection impact the surface water balance and its influence on surface temperature and runoff?

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Whitepaper Chapter Overview

Short Term (3- 5 years) Research Goals:

- Improve the availability and synergistic use of a variety of measurements from field campaigns to in-situ and remote sensing platforms of microphysical processes, latent heating, dynamics, and thermodynamics environment to understand convective microphysics feedbacks on cloud-scale and large-scale dynamics.
- Leverage Atmospheric Radiation Measurement (ARM) and other BER investments in observation (e.g., data from Next Generation Ecosystem Experiments) with data-fusion techniques to improve estimates of surface fluxes of energy and water in order to better constrain observation and modeling of surface-atmosphere interactions and their roles in the development and evolution of mesoscale convective systems over land and ocean through local and non-local processes including feedbacks.
- Improve understanding of the key microphysical, surface, dynamic and thermodynamic processes that influence the development of MCSs during spring and summer and differentiate the predictability of different types of MCSs in the two seasons.

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Whitepaper Chapter Overview

Long Term (10 years) Research Goals:

- Develop a modeling hierarchy, including single-column models, limited area models, and multiscale and uniform/variable resolution global models for the atmosphere coupled to land-surface models with simple-to-complex representations of processes to improve understanding of model biases in the simulation of MCSs and land-atmosphere coupling, and to test hypotheses of convection-surface and convection-circulation interactions.
- Improve the characterization of MCSs, including their three-dimensional structure, across a variety of different climate regimes, and hence understanding of the roles of MCSs in the global and regional water and energy cycles.
- Elucidate the roles of different MCS characteristics (e.g., size, intensity, and propagation speed) and land-surface conditions in the development of convective events that are most conducive to extreme precipitation and flooding.
- Develop a better understanding of the major mechanisms that control how MCSs respond to warming and the implications for the global and regional water cycles and hydrologic extremes.