Impacts of Anthropogenic Climate Change and Urbanization on Derechos – Contrasting Results between Two Case Studies

Poster # 016 on Thursday

2024 EESM PI Meeting

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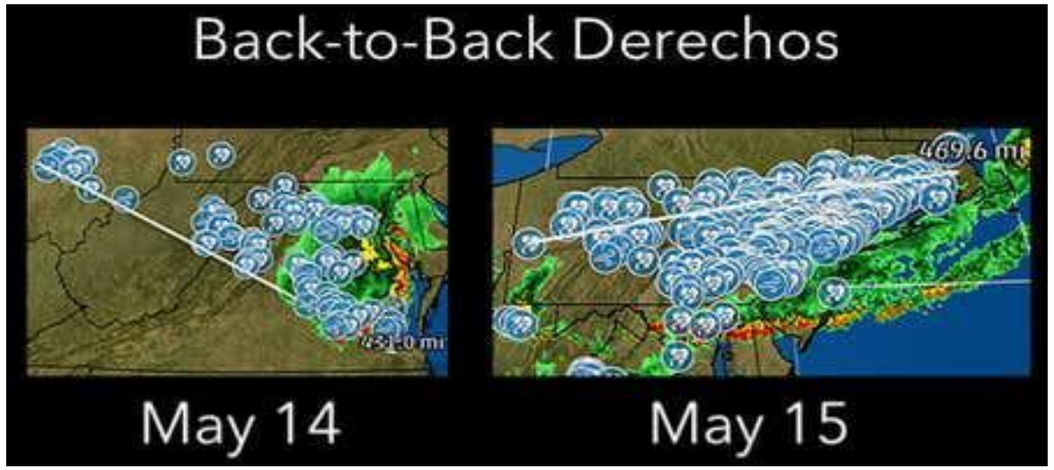
Objective

To improve understanding of how present-day derechos would be changed under future warming and urbanization environments

Methods

- **Conduct WRF simulations at 1-km grid spacing for two present-day Derecho cases**

  2018 Northeast Derecho (May 14 and 15, two back-to-back derechos; damaging tornados and large hail). The first to hit the New York metropolitan area in several year.



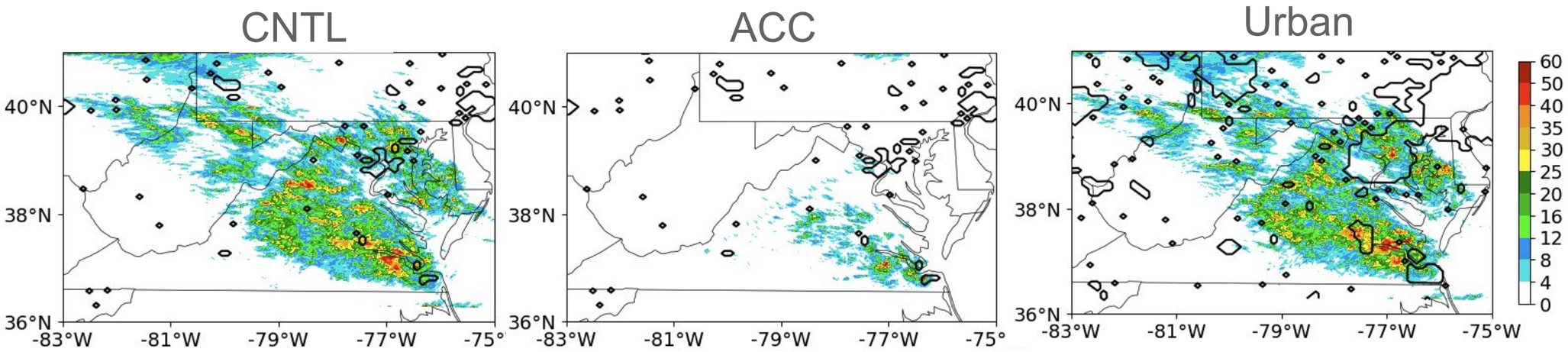
@DildineWT

OP

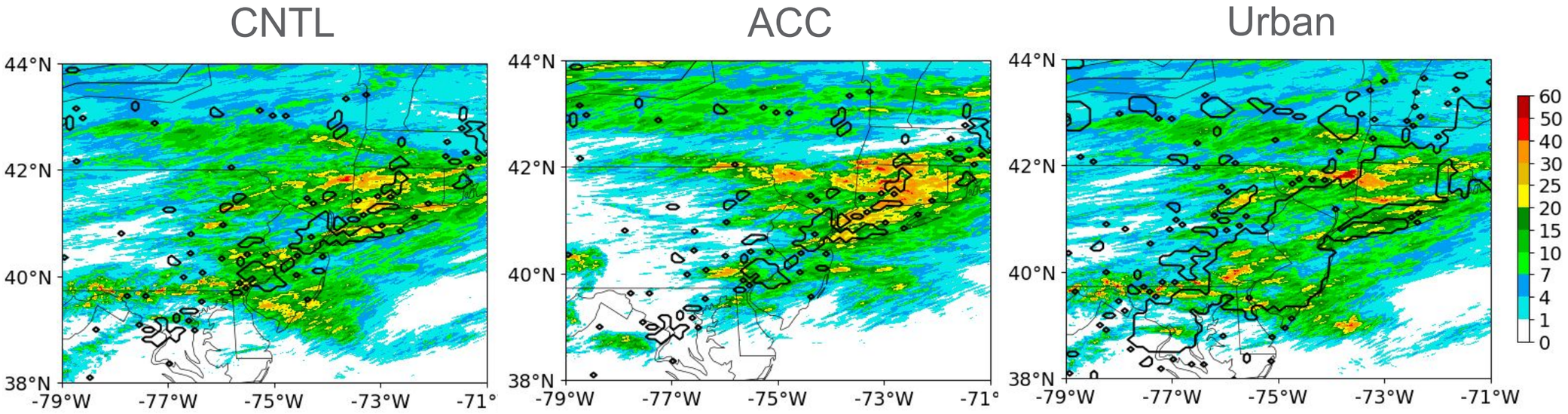
- **Carry out sensitivity simulations to investigate climate change effect (PGW approach with ensemble mean difference between 2071-2100 and 1981-2010 from 11 CMIP6 models) and urbanization effect (increase urban areas by 6 times)**

Main results: Maximum precipitation rate

May 14 derecho



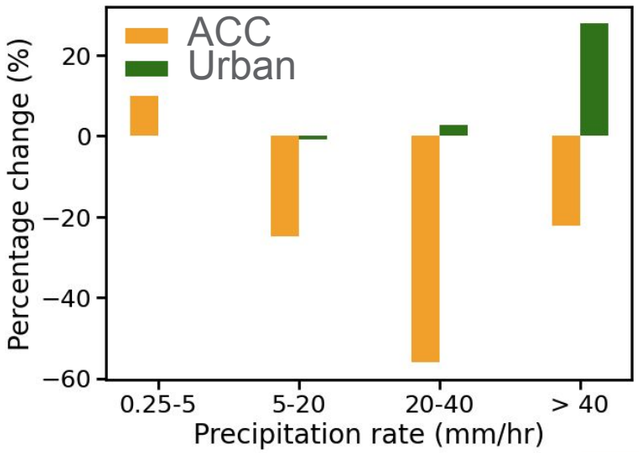
May 15 derecho



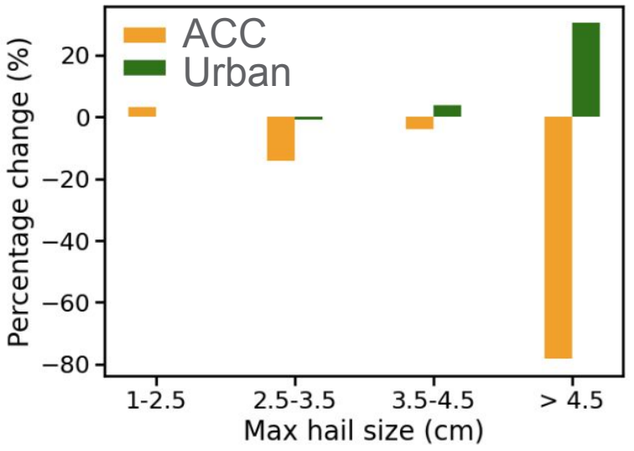
Main results: percentage change of PDFs of precipitation, hail and near surface winds

May 14 derecho

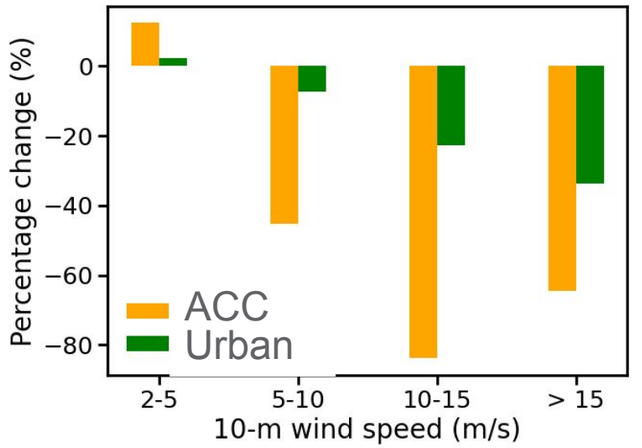
Hourly precipitation rates



Max hail sizes

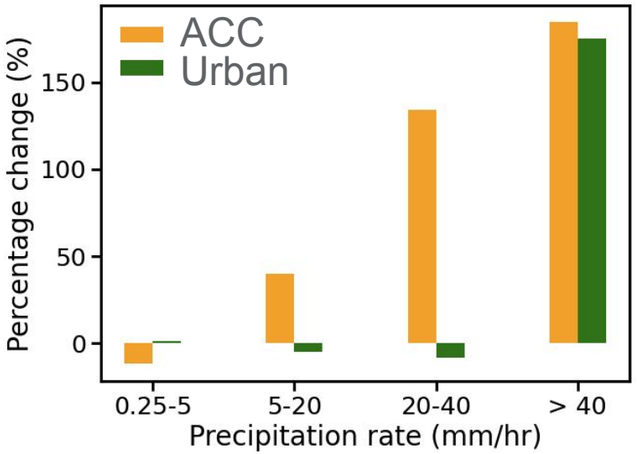


10-m wind speed

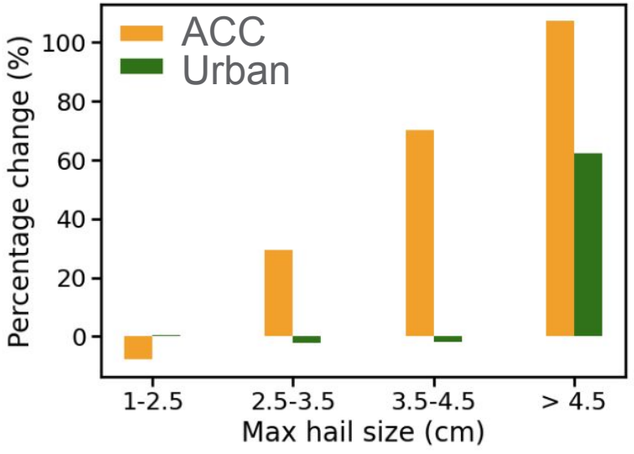


May 15 derecho

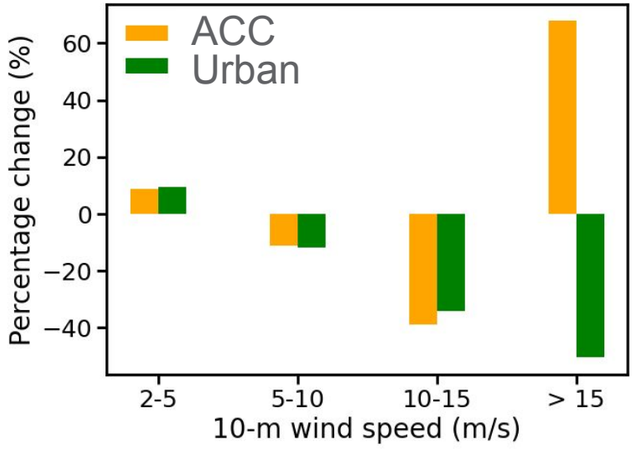
Hourly precipitation rates



Max hail sizes



10-m wind speed



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Summary

- Anthropogenic climate change (ACC) and urbanization effects on severe convective storms are case-dependent – **can be in a contrasting effect between different cases**
- **ACC impacts are opposite** between May 15 and May 14 derechos: strengthened in the former but drastically weakened in the latter, resulting from drastically different large-scale responses.
- **Urbanization effects** on on wind speeds, heavy precipitation, and significant severe hail (SSH) **are consistent for both cases**: enhanced heavy precipitation and SSH, but weakened near-surface wind speeds.
- **Urbanization effects are stronger** in May 15 but the effects are much weaker in May 14 case because a smaller part of the storm passes over the urban area.

Welcome to the poster session for more details.
Poster # 016 on Thursday

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Thank you