The propagating environments for the initiation of summertime MCSs over the U.S. Great Plains

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- **Motivation**

During summer, large fraction of heavy rainfall-producing MCSs are initiated under the unfavorable large-scale environments, but the understanding on how smaller-scale environments initiate the MCSs is limited

- **Science questions**
- Characterizing the summertime MCSs initiation environments by developing a long-term and high-resolution datasets
- Quantify the relative contributions of different kinds of smaller-scale perturbations to the initiation of summertime MCSs.
- **Methods**
- Self-organizing map analysis; fixed-grid and convection-centered composites

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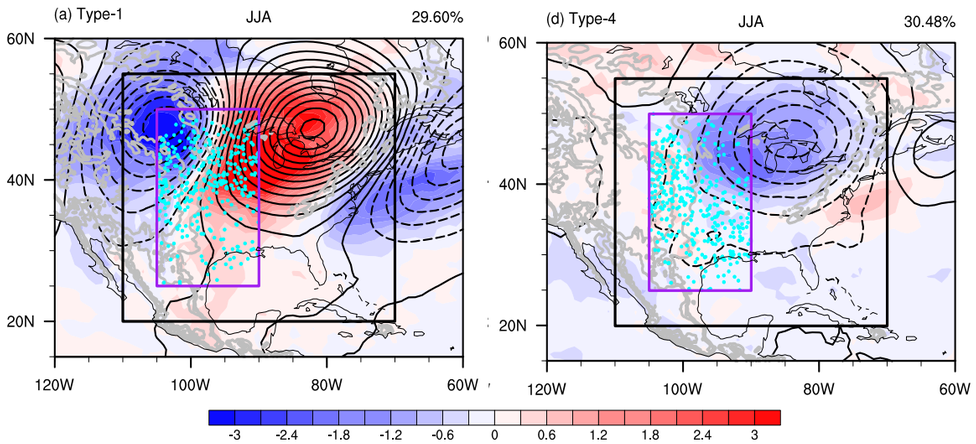
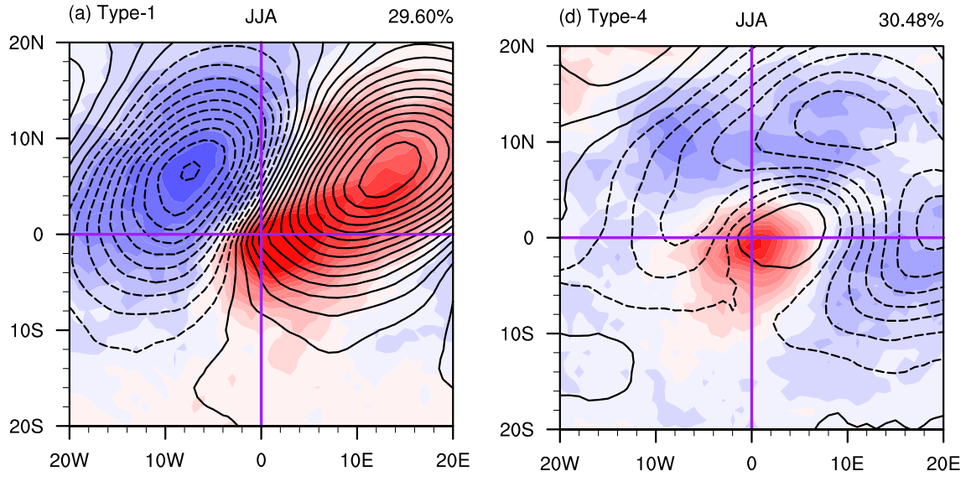
Although the large-scale environments are different between Type-1 and Type-4, the convection-centered environments resembles well.

Shading: θ_e
Contour: Z200

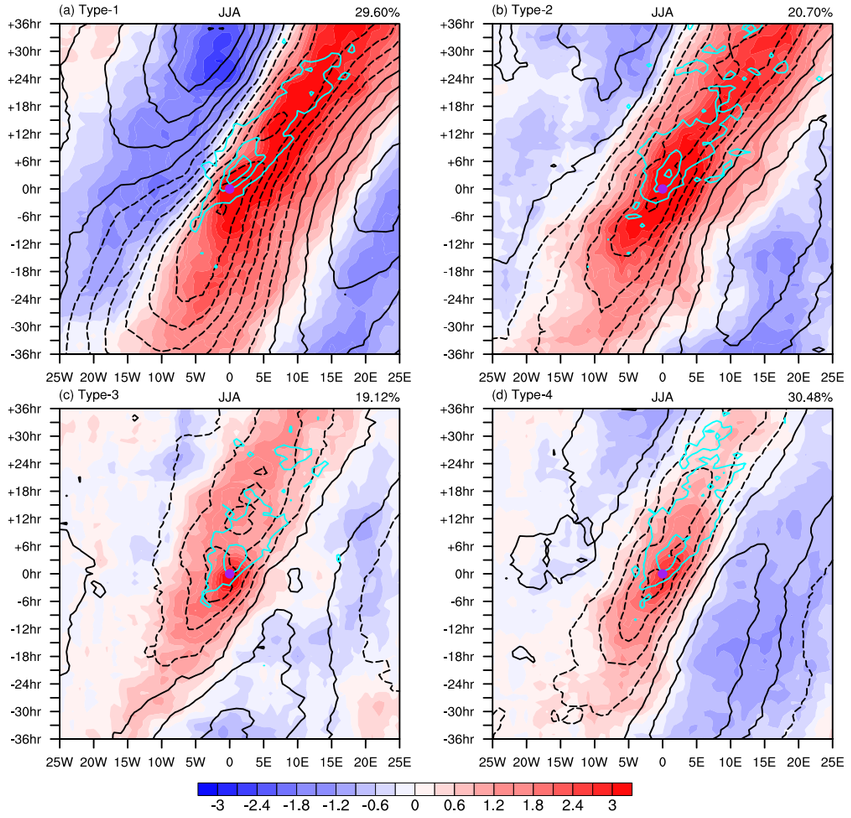
Fixed-grid composites



Convection-centered composites

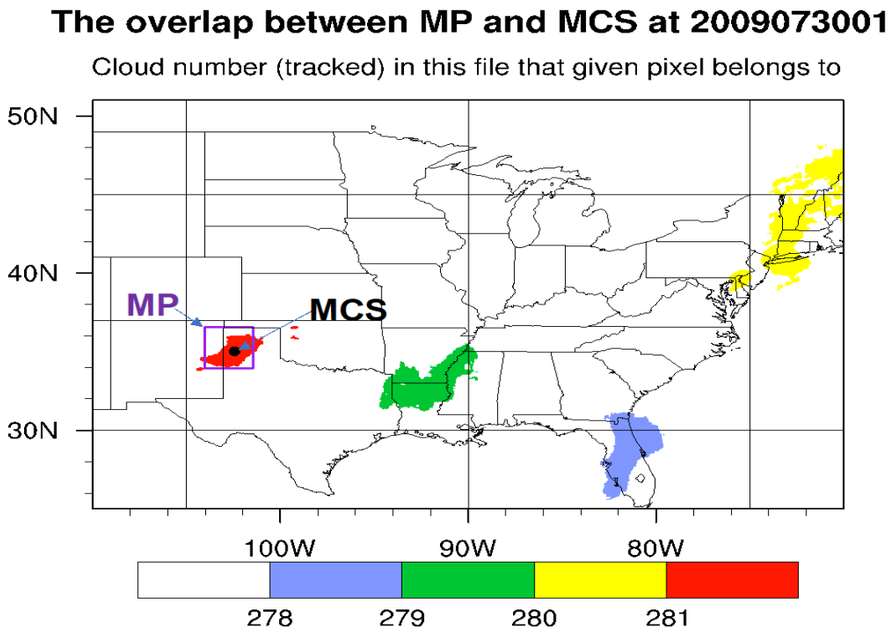


Shading: θ_e **black contour:** PS **cyan contour:** PR

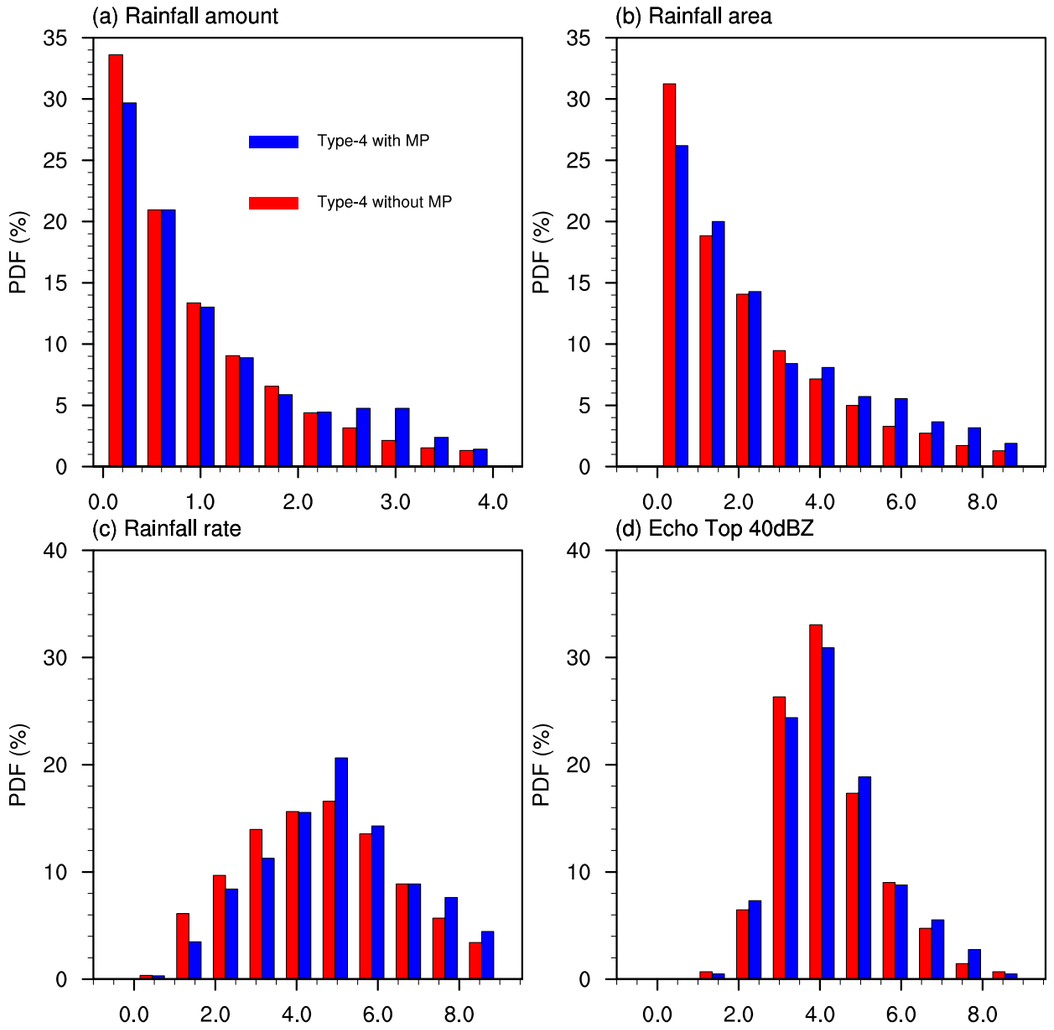


Clear eastward propagating features in all the types

The role of MPs in the initiation of summer MCSs



	Type-1	Type-2	Type-3	Type-4
MCS number	336	235	217	347
MP number	189			
MCS overlap with MP	9 (2.7%)	7 (3.0%)	5 (2.3%)	**34 (10%)**



Research need in the future

- **3-5 years:** track all the types of short-wave trough by using high temporal and horizontal resolution reanalysis (e.g., ERA5) and quantify their roles in the initiation of summertime MCSs; quantify the relative contributions of remote propagating perturbations and local conditions (e.g., soil moisture) in the summer MCSs initiation; conduct high-resolution model simulations to further quantify the roles of different factors in the MCSs initiation

- **5-10 years:** use machine learning method to better understand the summertime MCSs initiation environments; design experiments by using global high-resolution (<10km) climate models, which can directly resolve MCSs, to investigate its future changes.