Summer extreme precipitation over the Mid-Atlantic coastal region and contributions from different precipitation types

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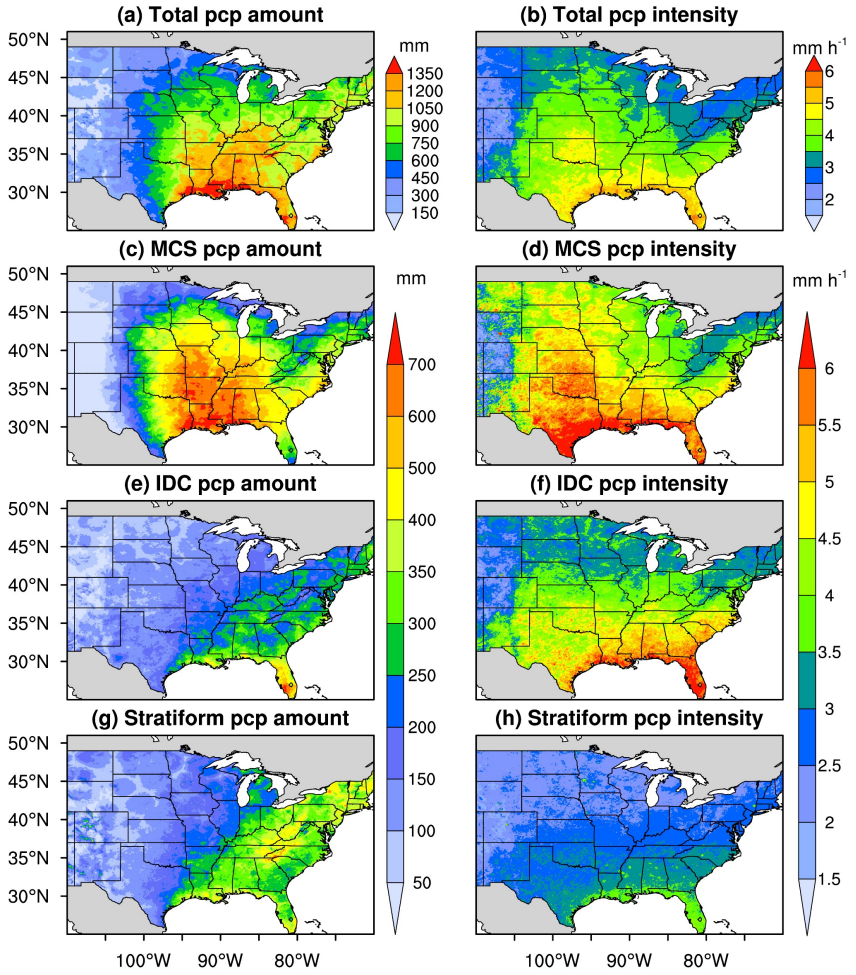
Annual amount Mean intensity



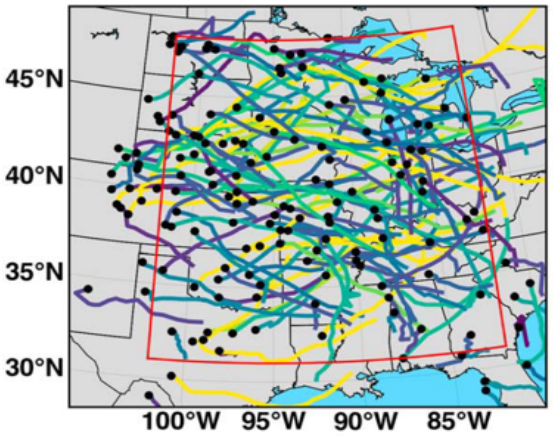
A new precipitation datasets over US

- Hourly
- 4-km
- 2004-2017
- Separate **MCS** (mesoscale convective systems), **IDC** (isolated deep convection), **TC** (tropical cyclones) and **Stratiform** precipitation
- Track each MCS, IDC and TC

Li, J., Z. Feng, Y. Qian, and L. R. Leung, 2020, A high-resolution unified observational database of mesoscale convective systems and isolated deep convection in the United States for 2004 – 2017, *Earth System Science Data*, in review.

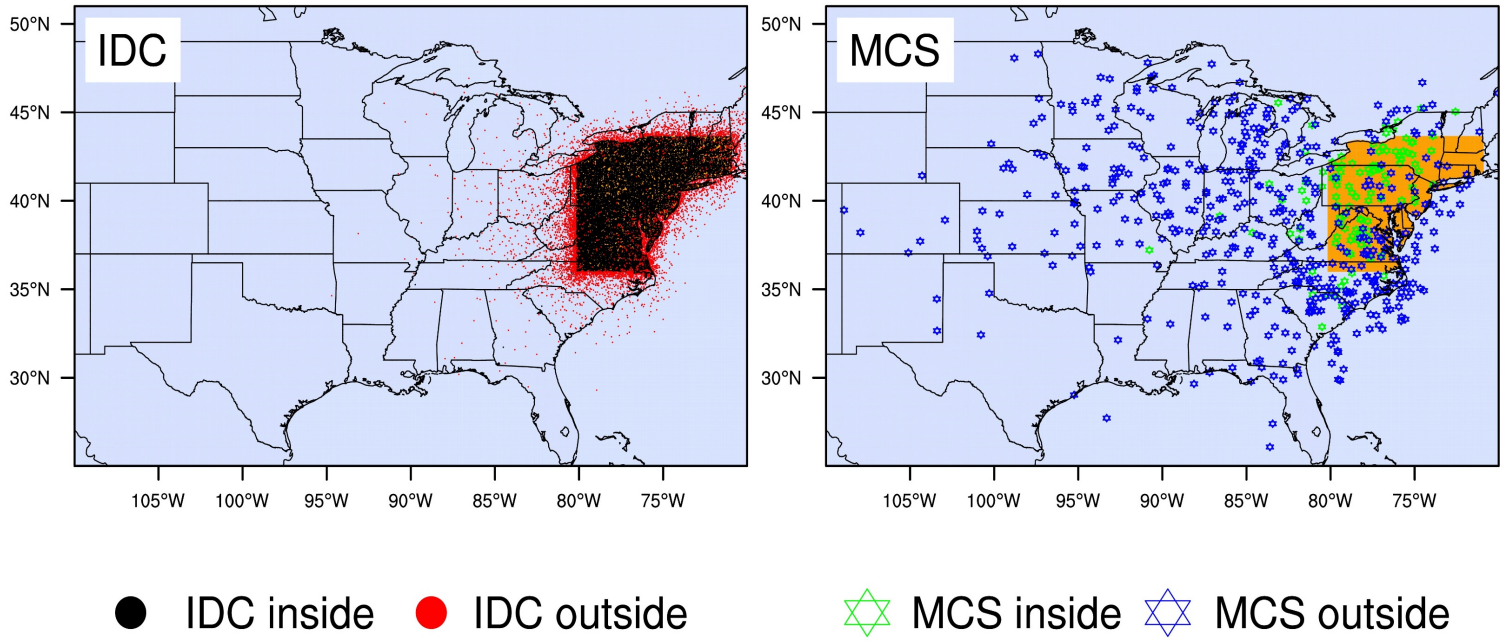
Tracking each MCS, IDC and TC: FLEXible object TRaKeR (FLEXTRKR)

(Feng et al., 2018, Li et al., 2020)



Satellite data:
Cold cloud system
Radar reflectivity:
Convective cells and precipitation feature

MCS/IDC initiated locations for JJA of 2004 – 2017

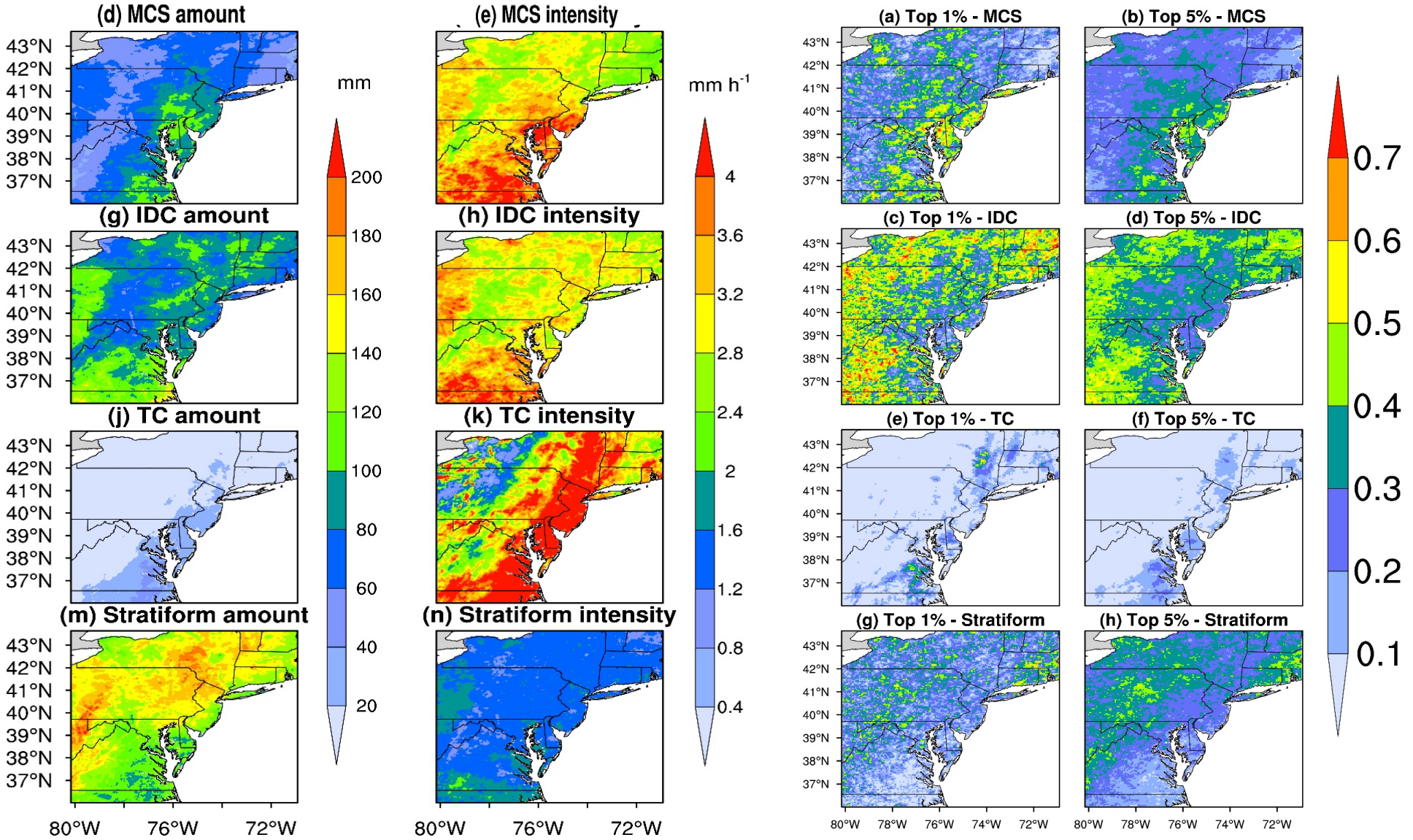


Number of MCS/IDC inside/outside	Inside Mid-Atlantic	Outside Mid-Atlantic
IDC	1538/yr	470/yr
MCS	8/yr	34/yr

Note: An MCS/IDC event defined as inside the Mid-Atlantic region, if it stays in the Mid-Atlantic region for more than half of its lifetime.

Four types of precipitation for summer of 2004-2017 in the Mid-Atlantic region

Column 1 (JJA amount), 2 (intensity), 3 (relative contributions to 1%), and 4 (to 5% extreme precipitation)



Average	Top 1%	Top 5%
MCS	29.0%	27.5%
IDC	41.7%	37.9%
TC	5.4%	5.3%
ST	24.0%	29.3%

Li, J., Y. Qian, L. R. Leung, and Z. Feng, 2020, Summer mean and extreme precipitation over the Mid-Atlantic region: climatological characteristics and contributions from different precipitation types, to be submitted to JGR-atmosphere.

Research challenges for coastal system land-atmosphere-ocean interactions

1. **Extreme and compounding storm events, flooding, and sea/lake level rise ⟺ land use change, pollution, urban, population growth, and energy sector**
2. **Model uncertainty and sensitivity propagate across land-atmosphere-ocean interfaces**

Gaps:

1. **Model representation: integrated model interactively connecting land-atmosphere-ocean/lakes-human dimension**
2. **Observational data**
3. **HPC computing**
4. **Metrics quantifying the land-atmosphere-ocean interaction:**
   - **land-atmosphere coupling strength**
   - **atmosphere-ocean/lakes coupling strength**
   - **land-ocean/lakes coupling strength**