Dry-wet asymmetricity in changes of future surface water flow: an event-wise analysis

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Abstract

Many researchers have studied the terrestrial water cycle at global and local scales, determining the reasons for its change over time, space, and changing climates. However, event-wise analysis in a higher frequency variability (e.g., daily scale) of surface water flow and the associated complexity in its change remains unexplored. We define magnitude and duration for wet and dry phases of CaMa-Flood simulated discharge (forced by 10 CMIP6 model runoffs) for two future scenarios (SSP126 and SSP585) and compare them with their respective historical scenario to unravel the intricacies accompanied by shifts in discharge under climate change. We found a substantial wet-dry asymmetricity in magnitude and duration shifts, particularly for extreme events. Further, these asymmetric shifts are more prominent for the dry phase than the wet phase for the duration of events, whereas magnitude shifts in the wet phase are more pronounced than the dry phase. There is an intensification of magnitude and duration of moderate events for both dry and wet phases, while for extreme events increase in wet phase magnitude and duration is complemented by a decrease in dry phase changes. Additionally, the discharge shifts are associated with relatively homogenous magnitude-duration shifts for the dry phase than the wet phase, particularly for extreme events. Our research reveals a rather voluminous wet-phase shift than dry-phase shifts but lengthier dry-phase shifts than wet-phase shifts for warmer climates in the future that tend to intensify with additional warming for most regions of the world.

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AGU FALL MEETING

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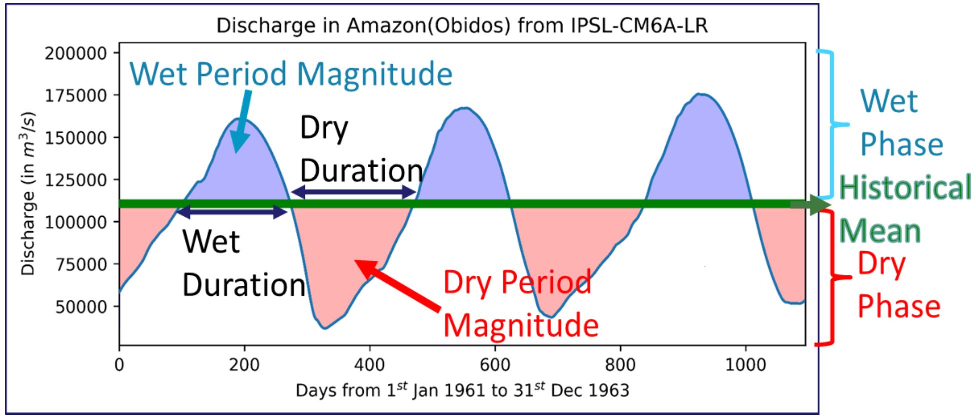
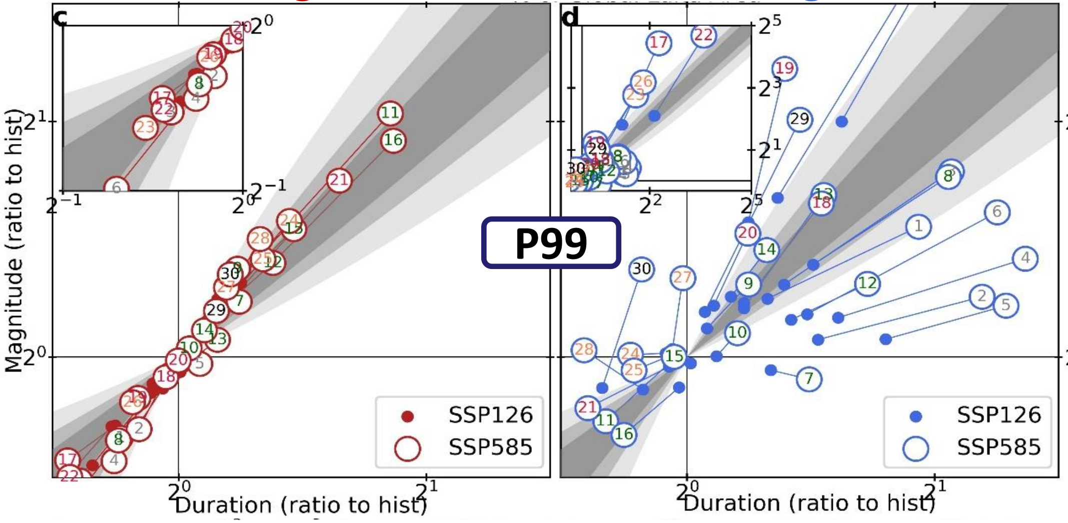
EVENT-WISE ANALYSIS OF DRY AND WET PHASES



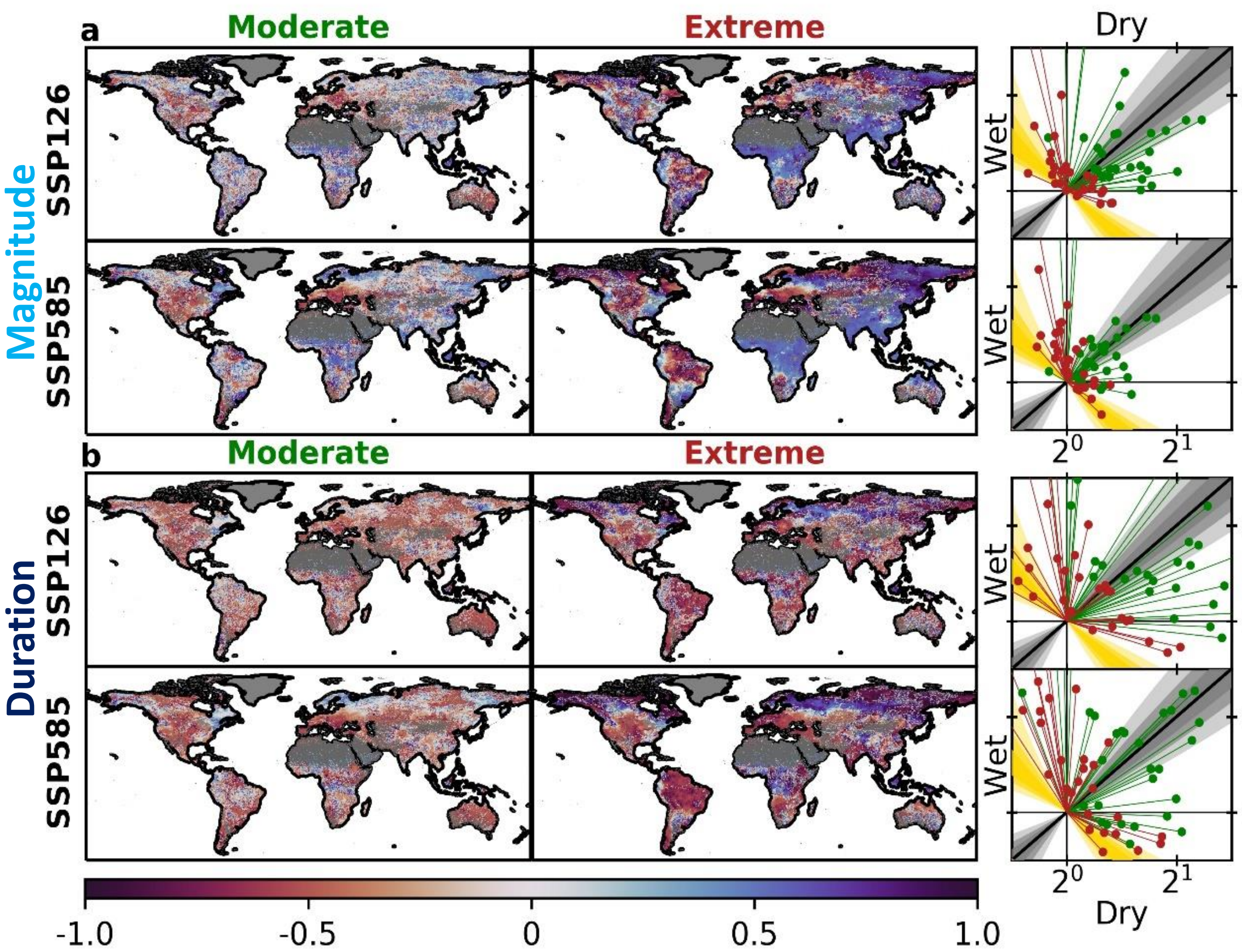
MAGNITUDE-DURATION CHANGES

Dry Phase — **Homogeneous**

Wet Phase — **Heterogeneous**

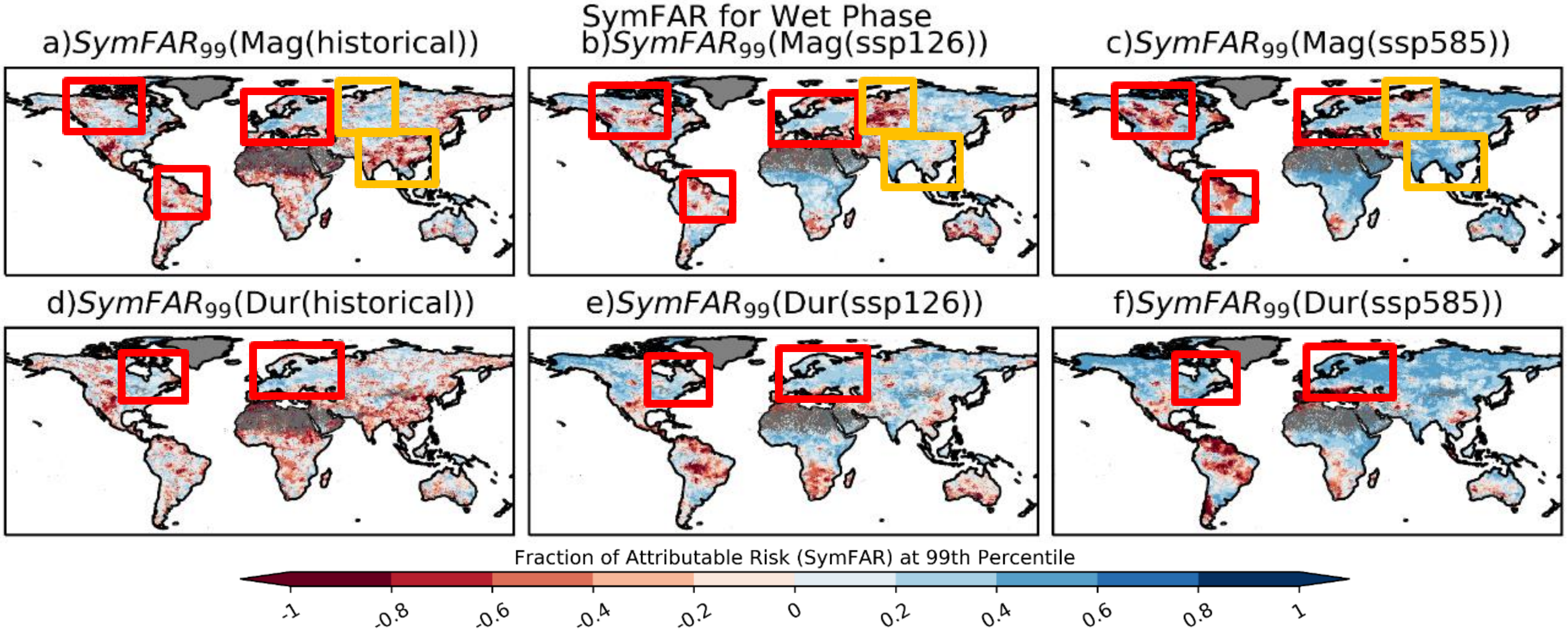


SIGNIFICANT WET-DRY ASYMMETRICITY IN SHIFTS



Intensification of shifts with additional warming from SSP126 to SSP585

HUMAN INDUCED WARMING IS RESPONSIBLE FOR BOTH INCREASE AND DECREASE IN RISK OF EXTREME EVENTS



Tipping points in historical period and reversal of risk with warming

SUMMARY AND CONCLUSIONS

Dry shifts are homogenous for magnitude and duration

Voluminous wet shifts and protracted dry shifts in the future

HIW both increases and decreases the risk of extreme events

Event-wise analysis unravels the complexity of change in streamflow that enables us to formulate better adaptation and mitigation strategies.

The climate change caused by HIW is non-linear in nature with **reversal of risk in certain regions as warming increases.**

Thank you for your time!

For queries, please contact:
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