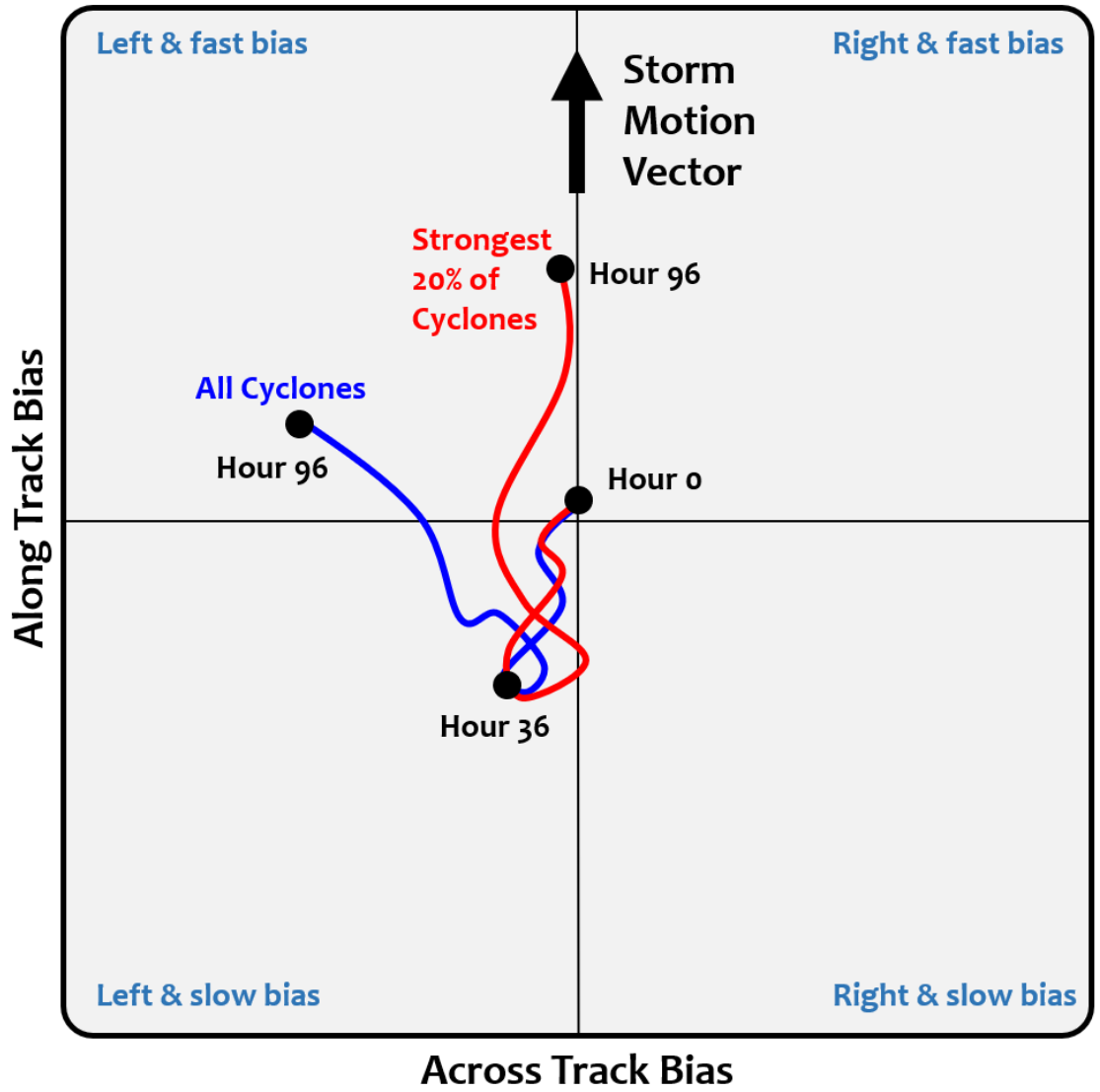
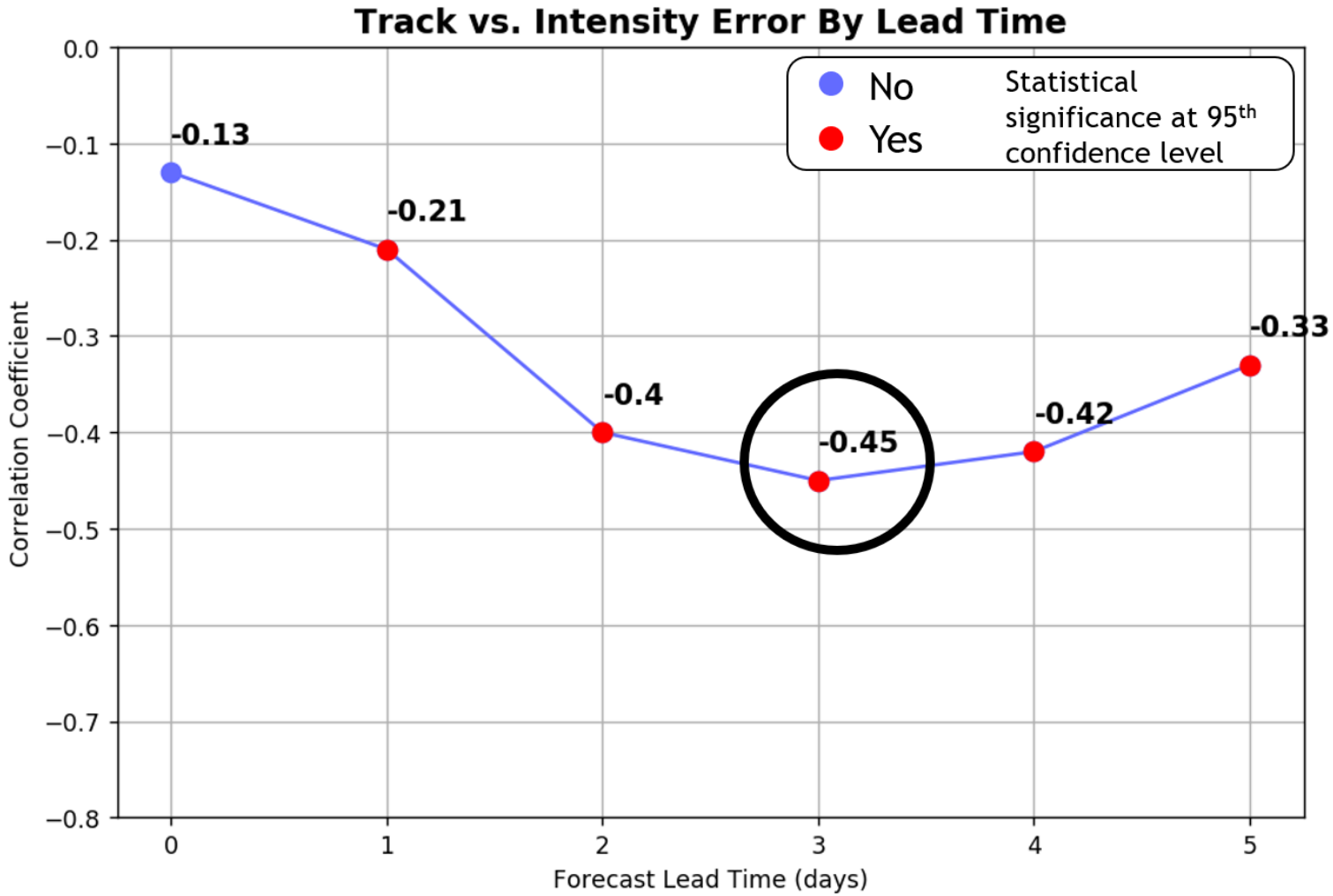
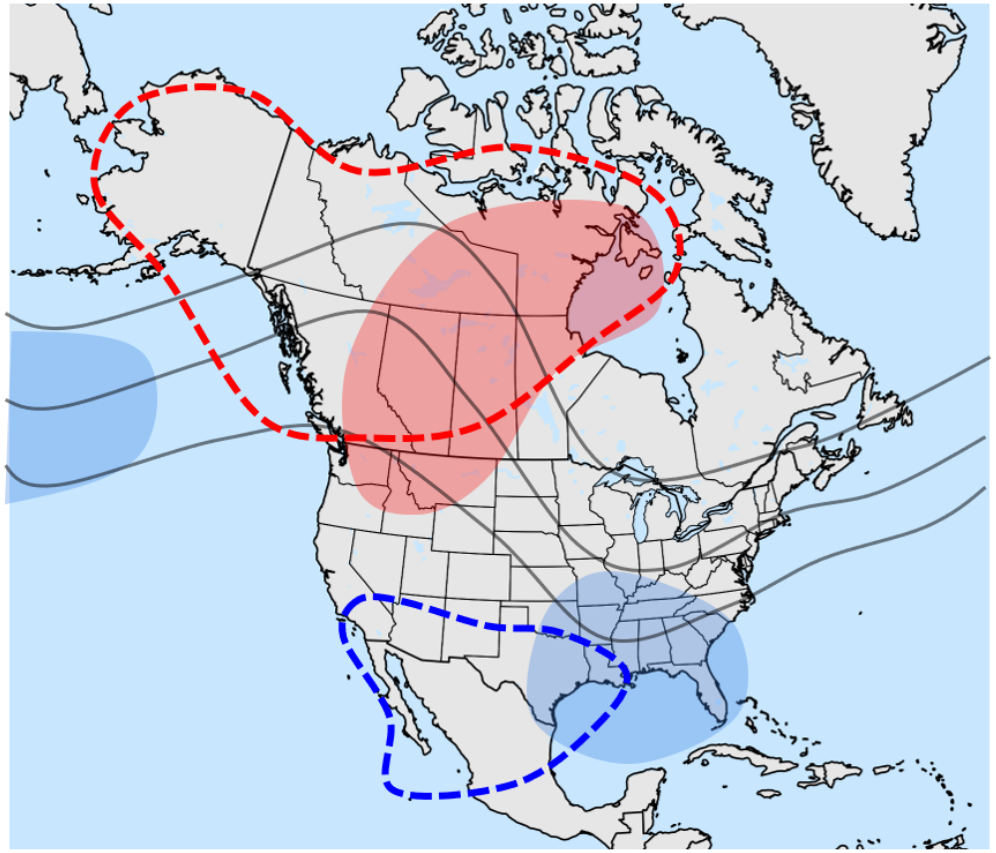


- There is no systematic right-of-track bias for the climatology of cases analyzed in this study.
- A short-term statistically significant slight left and slow bias exists.
- The climatology of all cyclones exhibits a left bias in the medium range, while stronger cyclones exhibit no left bias.



- There is a **negative correlation** between track and intensity errors, peaking at forecast day 3.
- Generally, a **left of track bias** is correlated with a **strong intensity bias**, and a **right of track bias** is correlated with a **weak intensity bias**.



-36 Hour lag time prior to small vs. large across-track ensemble position spread at day 3 lead time

Positive Negative

500-hPa height anomalies associated with **small across-track variability**

500-hPa heights are **higher** in small across-track variability than large across-track variability

Same as above, but **lower**

- Small across-track variability cases, relative to large variability, on average exhibit:
  - **More positive PNA** (vs. slightly positive PNA)
  - **Neutral EPO** (vs. positive EPO)
  - **Neutral NAO** (vs. positive NAO)
  - **Negative AO** (vs. neutral AO)

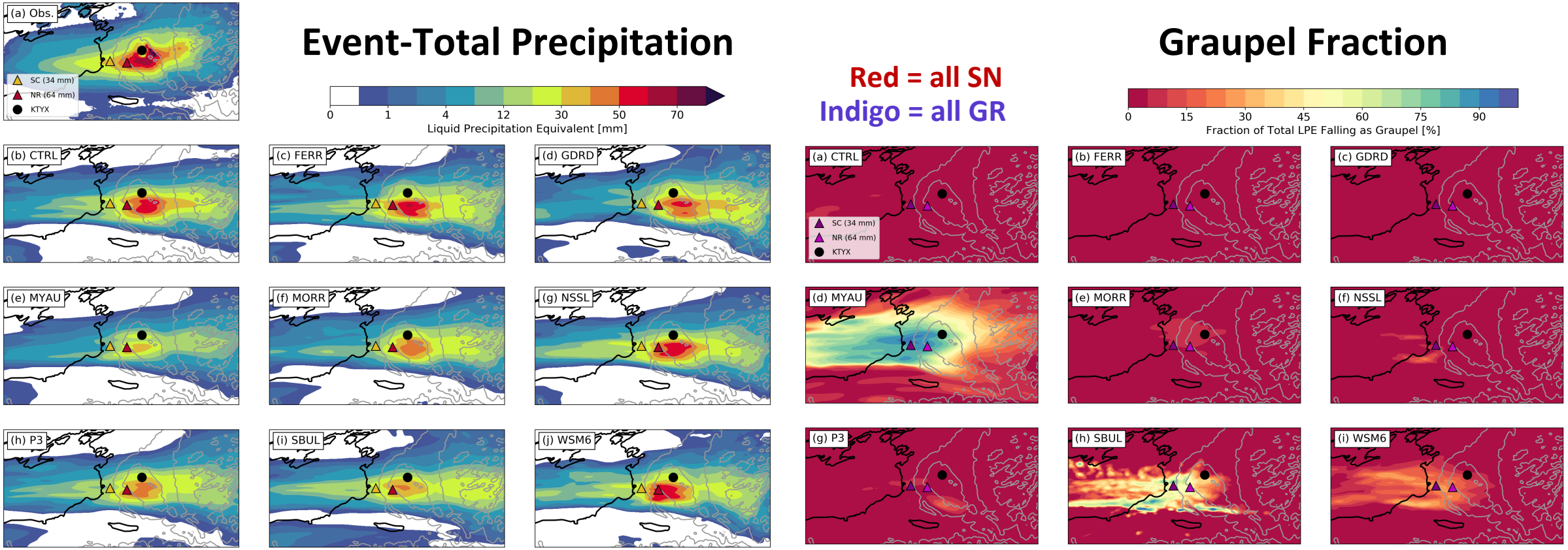
- Sample size is relatively small, so use caution in interpreting these results

Research Overview

- HRRR-based WRF-ARW configuration, not assessing all differences between HREFv2.1 members and NAM Nest
- **All results are specific to OWLeS IOP2b, may not be representative of other LeS cases**

- Does MP or PBL/SL choice contribute more to spread in QPF amounts? Key causes?
  - PBL/SL ensemble has slightly more spread in max QPF amounts than MP ensemble
  - MP mostly affects intensity, PBL affects intensity + LeS band morphology
  - MP differences due to relative amounts of snow and graupel produced
  - PBL differences due to amount of heat/moisture fluxes off Lake Ontario
- Which schemes used in operational models don't perform well in this case?
  - Thompson MP (HRRR) is too snow-dominant while WSM6 (HREF ARW & NSSL) is too graupel-dominant, reality is somewhere in between but closer to Thompson
  - WSM6 has too-intense LeS rates, more QPF windward of Tug Hill
  - MYJ PBL/SL (HREF ARW NSSL, NMMB, NAM Nest) has larger fluxes than MYNN (HRRR), increasing QPF, MYJ LeS band-max intensity too high but QPF may be slightly better than MYNN
- Any other consistent model biases in LeS representation?
  - Model forecast LeS bands are consistently too small in total area across both MP and PBL/SL ensembles (QNSE PBL only exception)
- Position of LeS bands is also likely sensitive to differences in initial and boundary conditions affecting wind flow across Lake Ontario

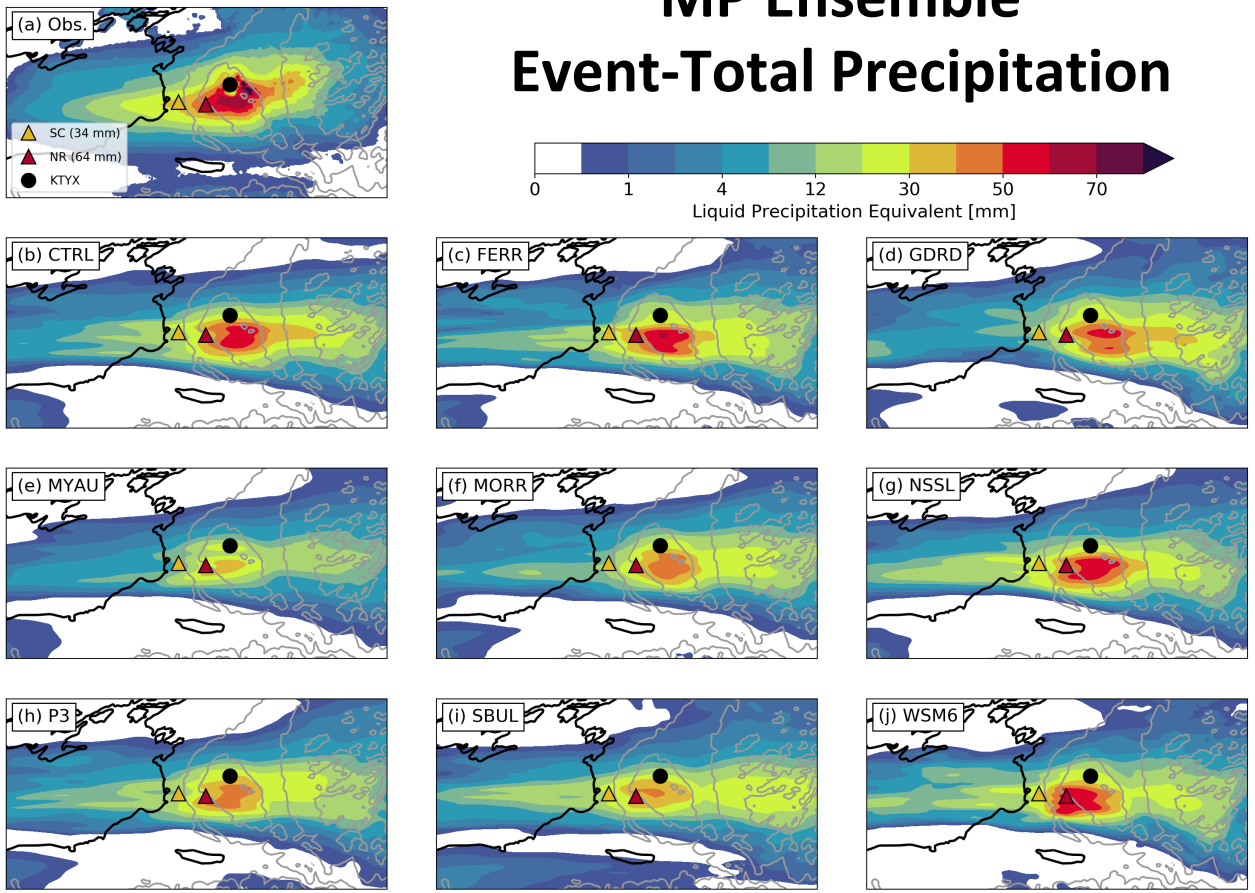
MP Sensitivity – Key Results



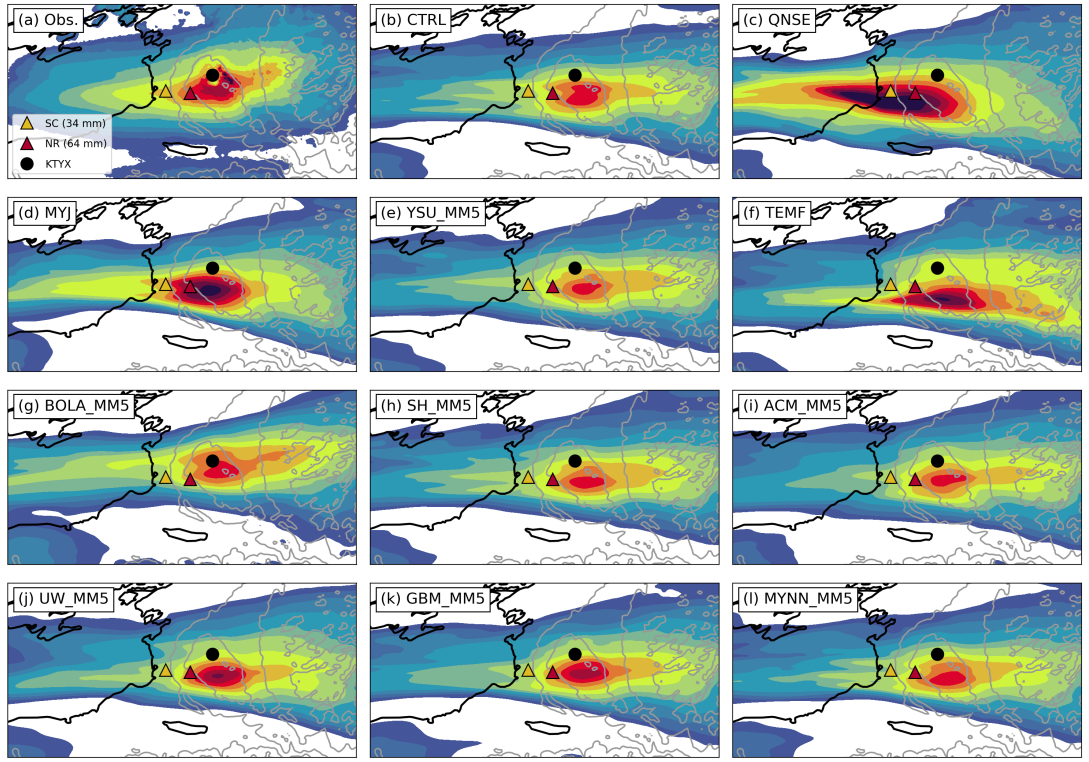
- Primary differences between MP scheme experiments are <u>precipitation intensity</u> and <u>precipitation-type</u>
- Precipitation-type affects whether the heaviest precipitation remains near the coast or extends inland

PBL/SL Sensitivity – Key Results v1

MP Ensemble Event-Total Precipitation



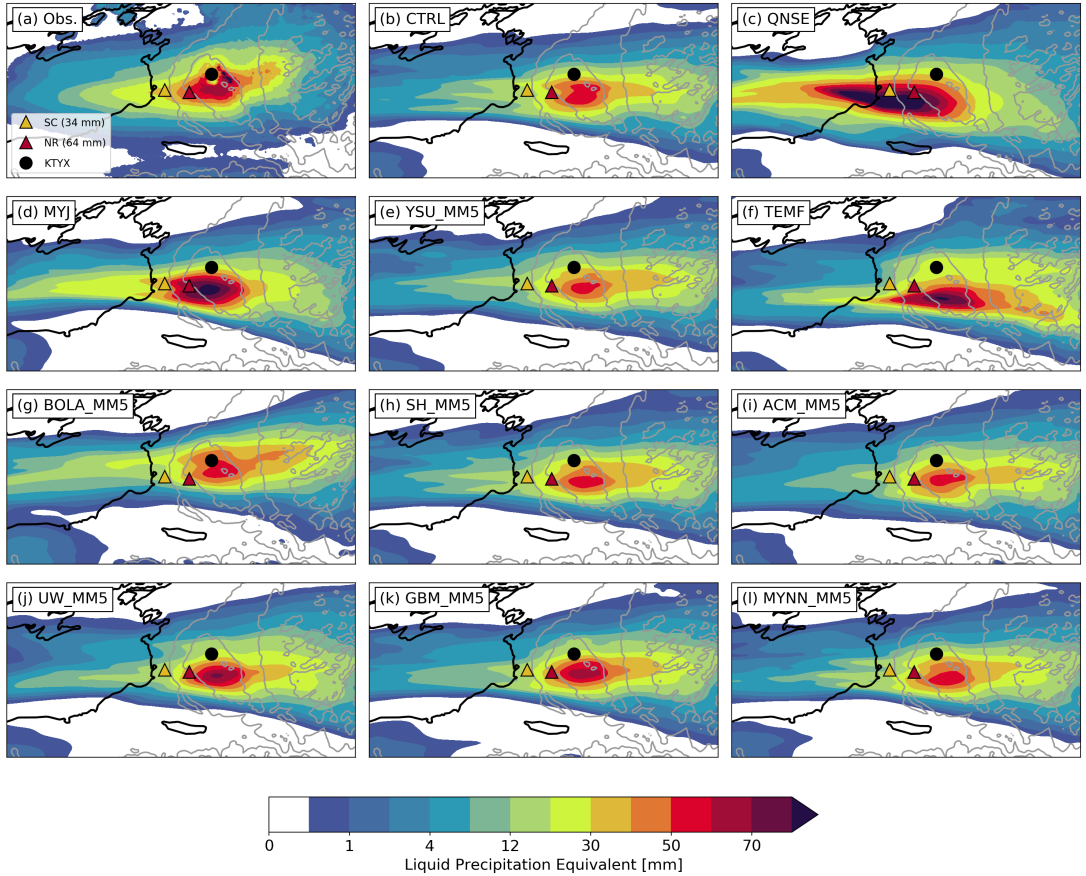
PBL/SL Ensemble Event-Total Precipitation



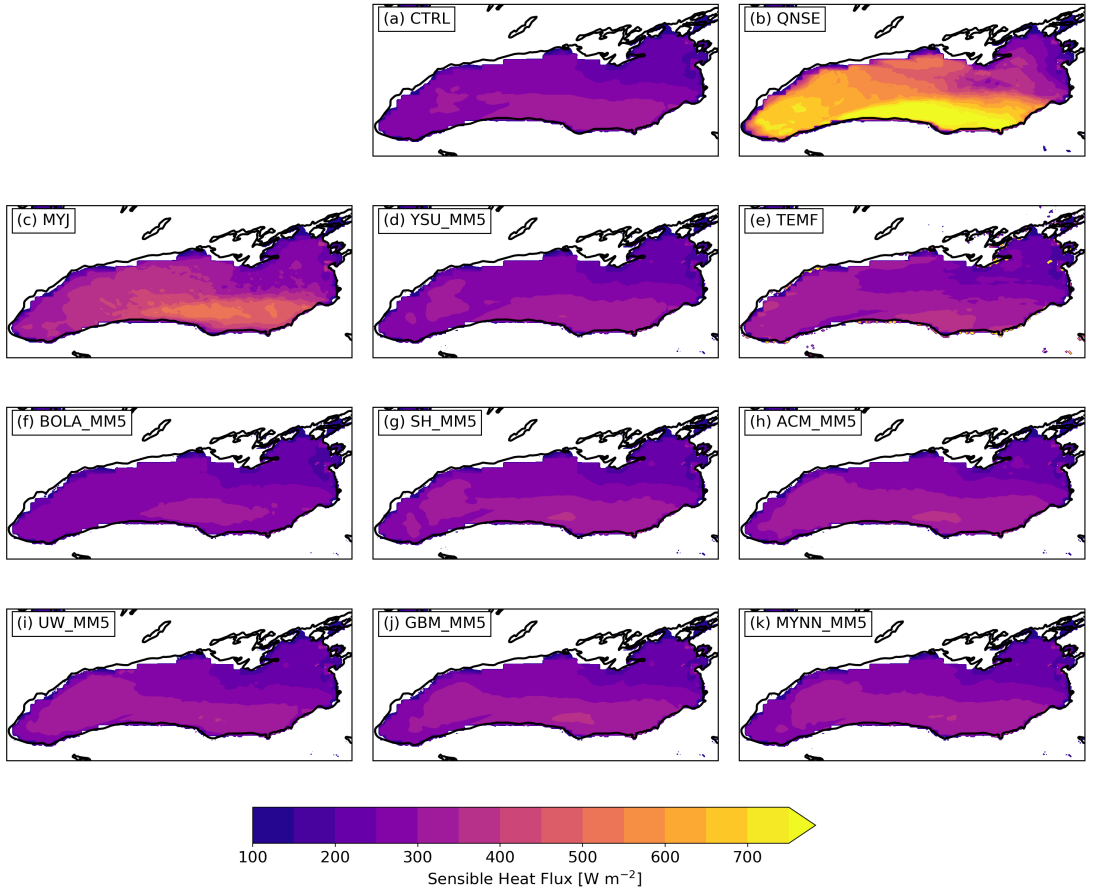
- Primary differences between PBL/SL scheme experiments are LeS band morphology and precipitation intensity due to differences in sensible and latent heat flux off Lake Ontario
- Precipitation-type affects whether the heaviest precipitation remains near the coast or extends inland

PBL/SL Sensitivity – Key Results v2

Event-Total Precipitation



24-h Avg. Sensible Heat Flux



- Primary differences between PBL/SL scheme experiments are LeS band morphology and precipitation intensity due to differences in sensible and latent heat fluxes off Lake Ontario

Summary of Key MP and PBL/SL Results

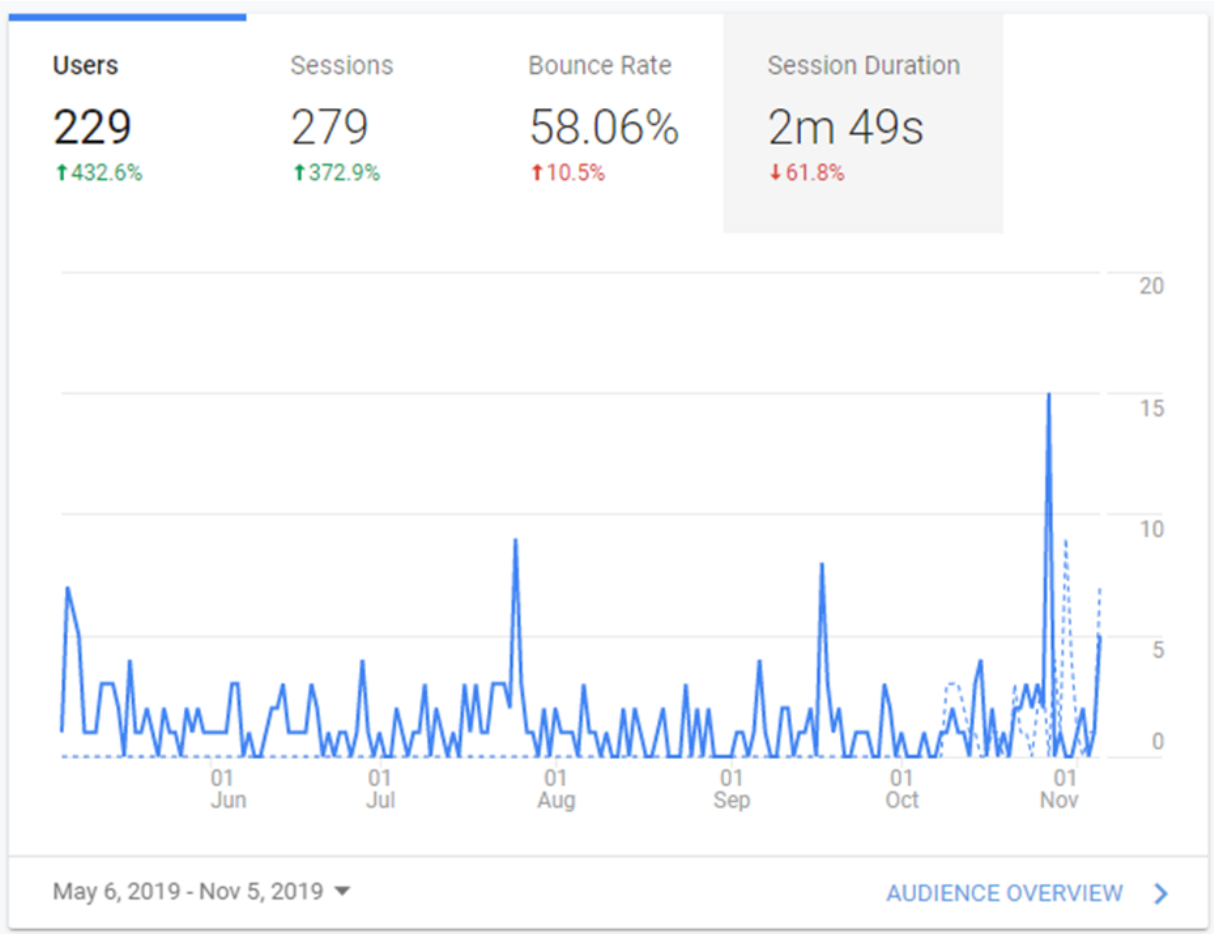
MP Scheme (HREFv2.1 Model)	Band-Max Intensity	Total Band Area	Precipitation Types	QPF relative to CTRL (THOM)	Heat/Moisture Fluxes
THOM (HRRR)	Similar to KTYX obs	Too small	>95% SN, very little GR		
WSM6 (ARW, NSSL)	Too high	Too small	30% GR windward of Tug, SN elsewhere	More QPF windward of Tug, less leeward	

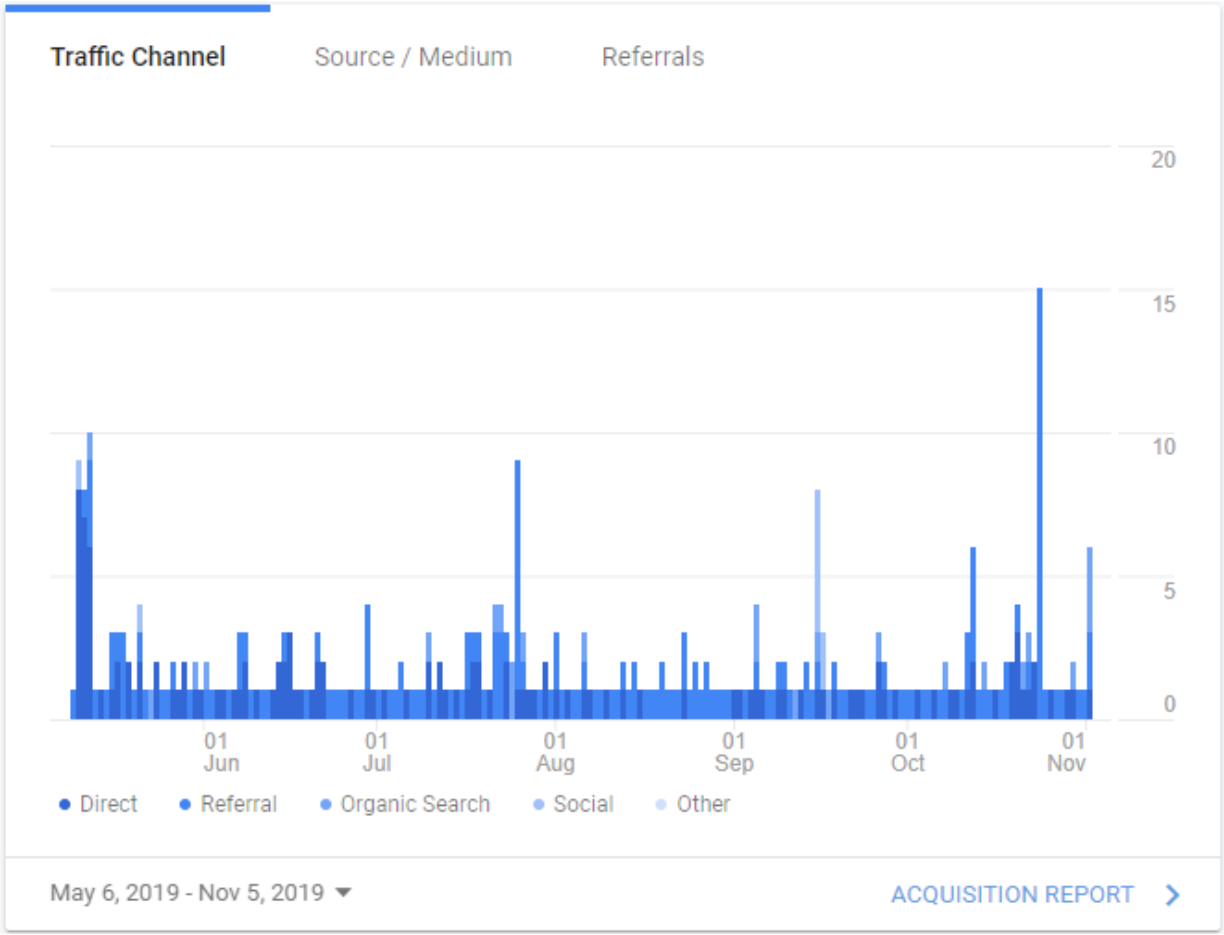
PBL/SL Scheme (HREFv2.1 Model)	Band-Max Intensity	Total Band Area	Precipitation Types	QPF relative to CTRL (MYNN)	Heat/Moisture Fluxes
MYNN/MYNN (HRRR)	Similar to KTYX obs	Too small	>95% SN		
YSU/RevMM5 (ARW)	Similar to KTYX obs	Too small	>95% SN	Similar to MYNN	Similar to MYNN
MYJ/MYJ (NSSL, NMMB, NAM Nest)	Too high	Too small	>95% SN	More QPF windward of Tug, similar elsewhere	Higher than MYNN

CSTAR Google Analytics

Fall 2019 CSTAR meeting

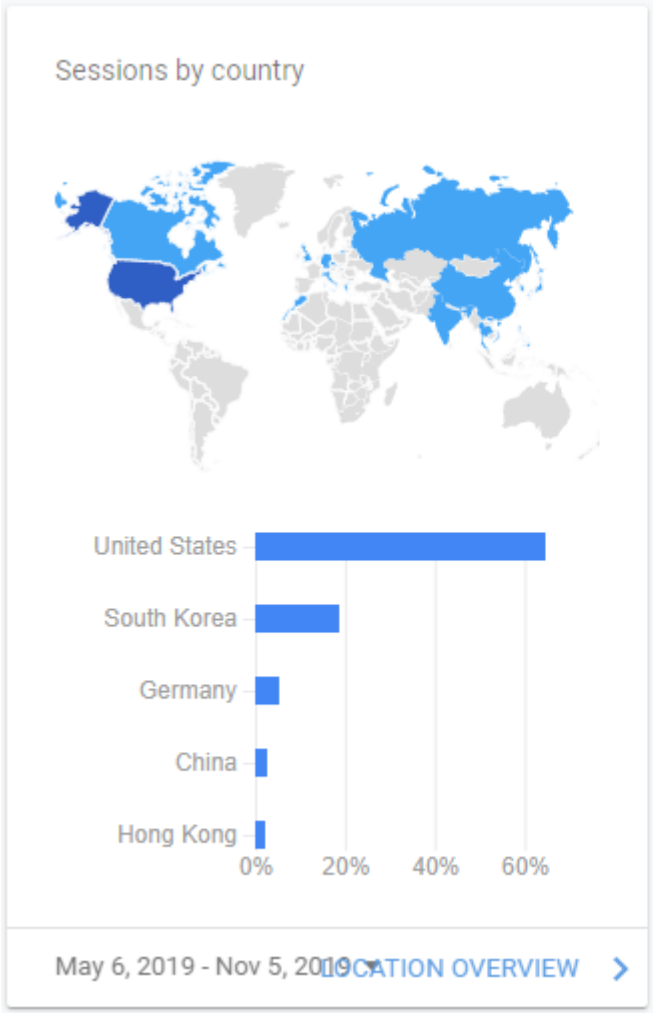
Traffic


Users
229
↑432.6%
Sessions
279
↑372.9%
Bounce Rate
58.06%
↑10.5%
Session Duration
2m 49s
↓61.8%
20
15
10
5
0
01 Jun
01 Jul
01 Aug
01 Sep
01 Oct
01 Nov
May 6, 2019 - Nov 5, 2019
AUDIENCE OVERVIEW


Traffic Channel
Source / Medium
Referrals
20
15
10
5
0
01 Jun
01 Jul
01 Aug
01 Sep
01 Oct
01 Nov
Direct
Referral
Organic Search
Social
Other
May 6, 2019 - Nov 5, 2019
ACQUISITION REPORT

Location

- Session by country
- Users by time of day



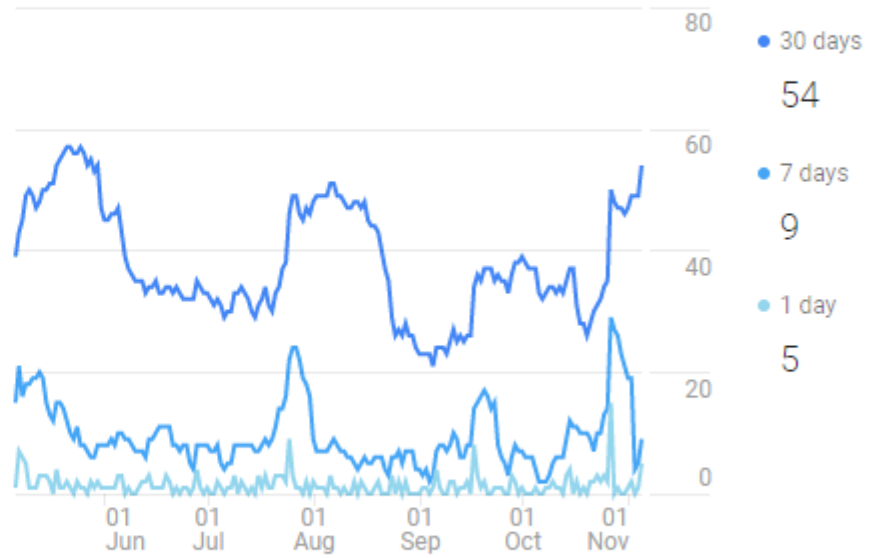
Page Visits and Trends

What pages do your users visit?

Page	Pageviews	Page Value
/web/albany-cstar/home	216	$0.00
/web/albany-cstar/m.s.-theses	123	$0.00
/web/albany-cstar/reports	75	$0.00
/web/albany-cstar	64	$0.00
/web/albany-cstar/web-tools	54	$0.00
/web/albany-cstar/training-modules	41	$0.00
/web/albany-cstar/	39	$0.00
/group/albany-cstar/~...let_folderId=6443670	33	$0.00
/web/albany-cstar/21	32	$0.00
/web/albany-cstar/nrow	30	$0.00

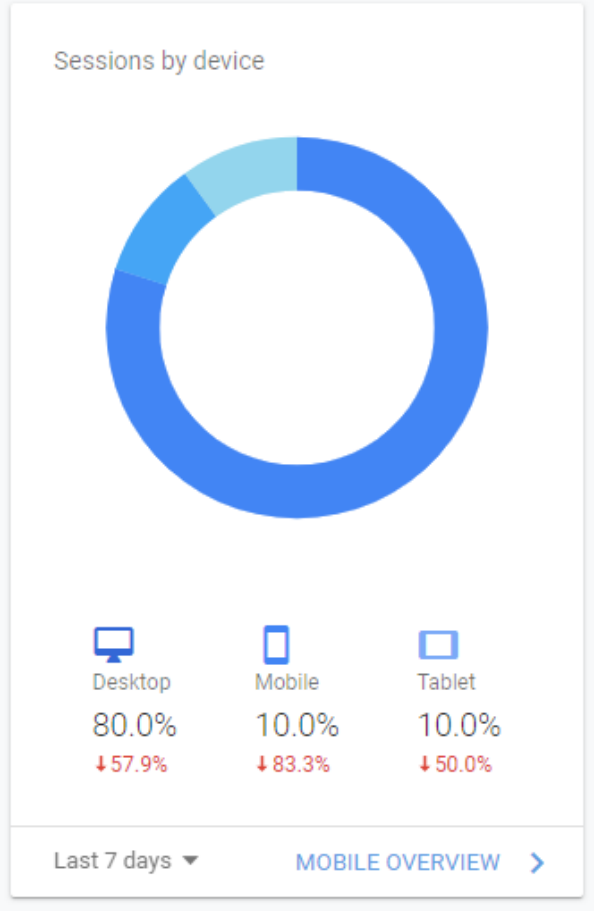
May 6, 2019 - Nov 5, 2019 ▾ PAGES REPORT ›

How are your active users trending over time?



May 6, 2019 - Nov 5, 2019 ▾ ACTIVE USERS REPORT ›

Devices


Sessions by device
Desktop
80.0%
↓57.9%
Mobile
10.0%
↓83.3%
Tablet
10.0%
↓50.0%
Last 7 days
MOBILE OVERVIEW