

After (during and before) the Storm: Comparing SSH Data Systems

[Speaker
Zoom
video]

Rajasaurus_Baris



Climatematch
Academy



Research Question & Hypothesis

[Speaker
Zoom
video]

Is there correlation between ECCO data and TG data before, during and after severe storm impact events?

Hypothesis 1: There is a linear relationship between ECCO and TG data during severe storm impact events

Hypothesis 2: There is no linear relationship between ECCO data and TG data during severe storm impact events

STEPS:

- Identify current network of TGs in our regions of interest (ROI)
- Compare ECCO and TG data recorded:
 - one month of data, one month *prior* to the beginning of extreme weather events
 - during the extreme weather events
 - one month of data, one month *after* the end of the extreme weather events
- Determine the correlation/linear relationship between the ECCO and TG data

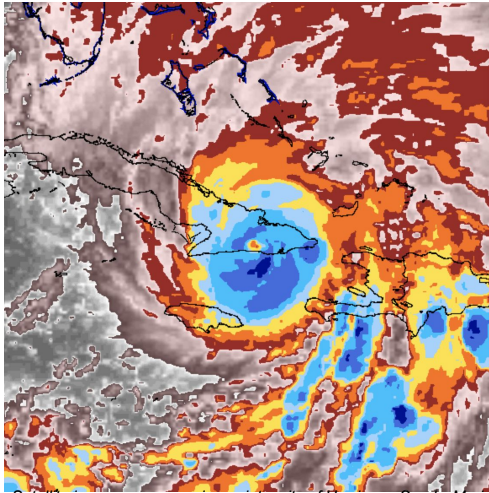


Selected Storms

[Speaker
Zoom
video]

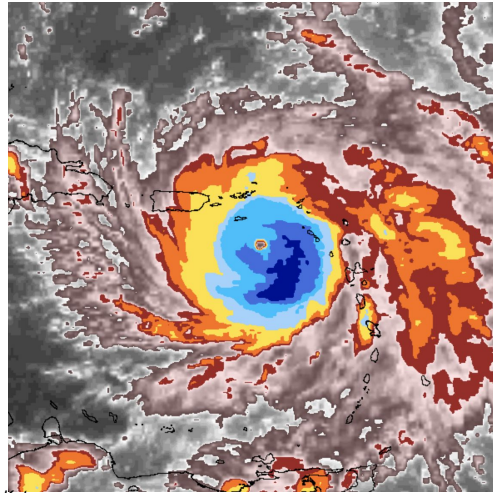
Hurricane Sandy New Jersey

Full Moon-Spring Tide
Landfall 30/10/2012 00Z



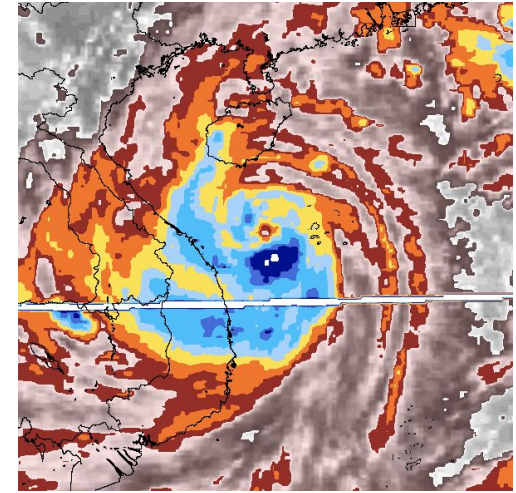
Hurricane Maria, PR and Caribbean

- New Moon-Spring Tide
- Landfall 20/9/2017 10Z



Typhoon Ketsana, Philippines and Vietnam

- Half moon waxing-Neap Tide
- Landfall 26/09/2009, 29/09/2009



Satellite imagery near maximum intensity of Hurricane Sandy, Maria, and Typhoon Ketsana

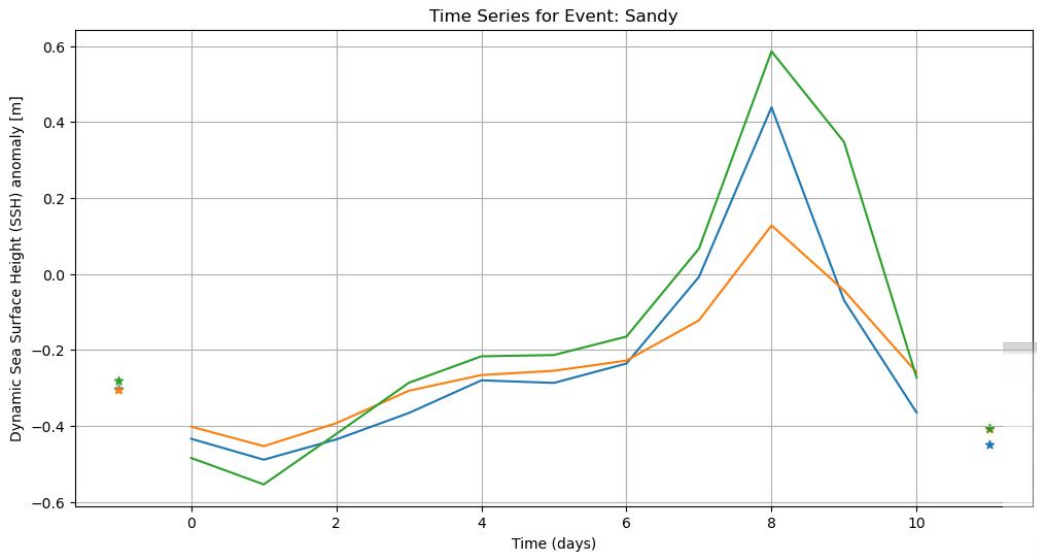
from Knapp, K. R., H. J. Diamond, J. P. Kossin, M. C. Kruk, C. J. Schreck, 2018: International Best Track Archive for Climate Stewardship (IBTrACS) Project, Version 4. [2012296N14283]. NOAA National Centers for Environmental Information.

[doi:10.25921/82hv-9e16](https://doi.org/10.25921/82hv-9e16) [27/7/2023]

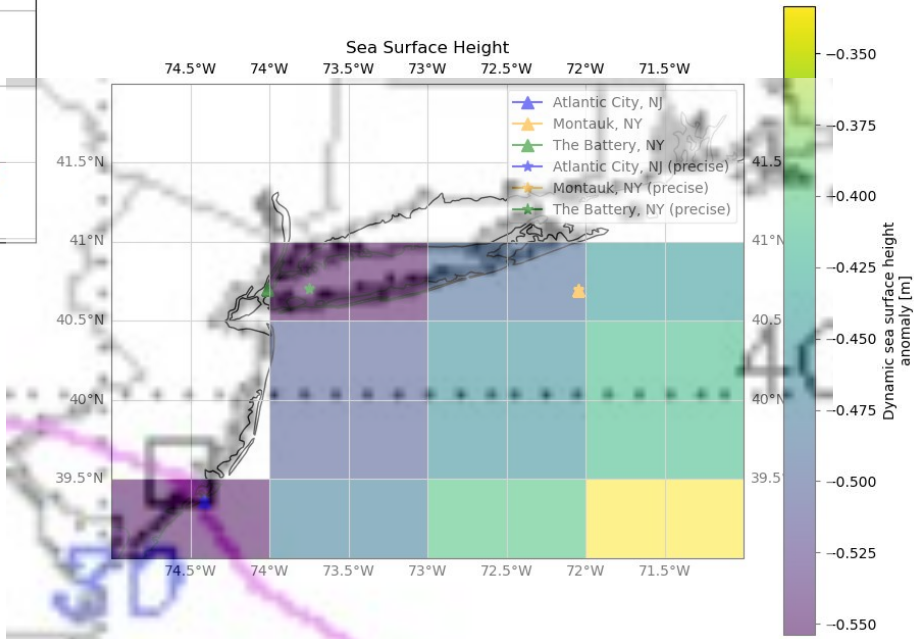


Hurricane Sandy

[Speaker
Zoom
video]

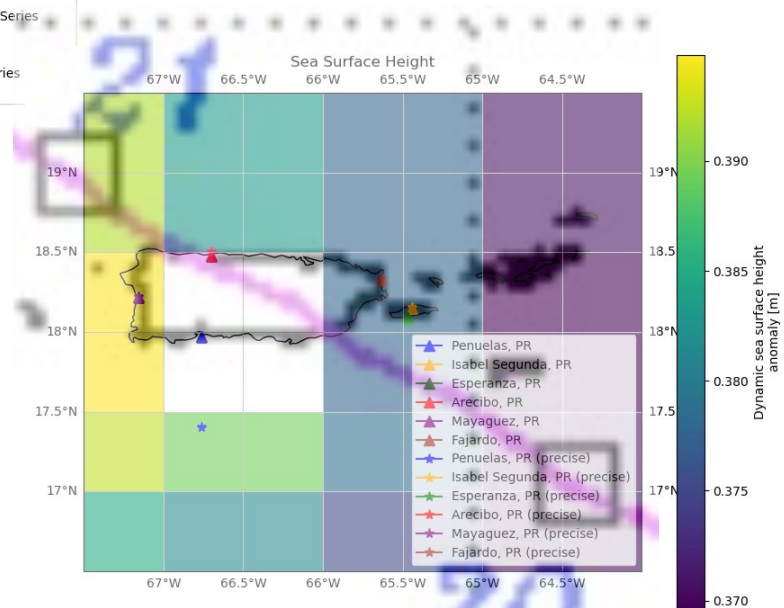
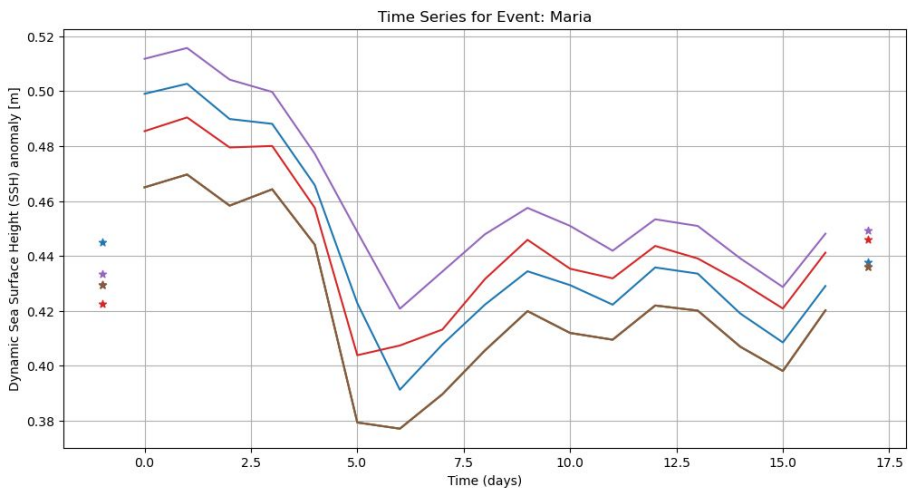


- ★ Atlantic City, NJ - bl1
- Atlantic City, NJ - Time Series
- ★ Atlantic City, NJ - bl2
- ★ Montauk, NY - bl1
- Montauk, NY - Time Series
- ★ Montauk, NY - bl2
- ★ The Battery, NY - bl1
- The Battery, NY - Time Series
- ★ The Battery, NY - bl2



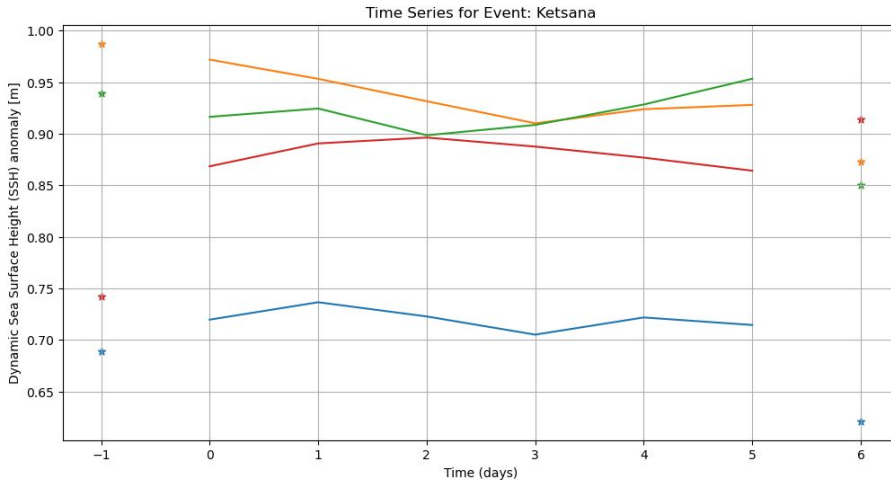
Hurricane Maria

[Speaker
Zoom
video]

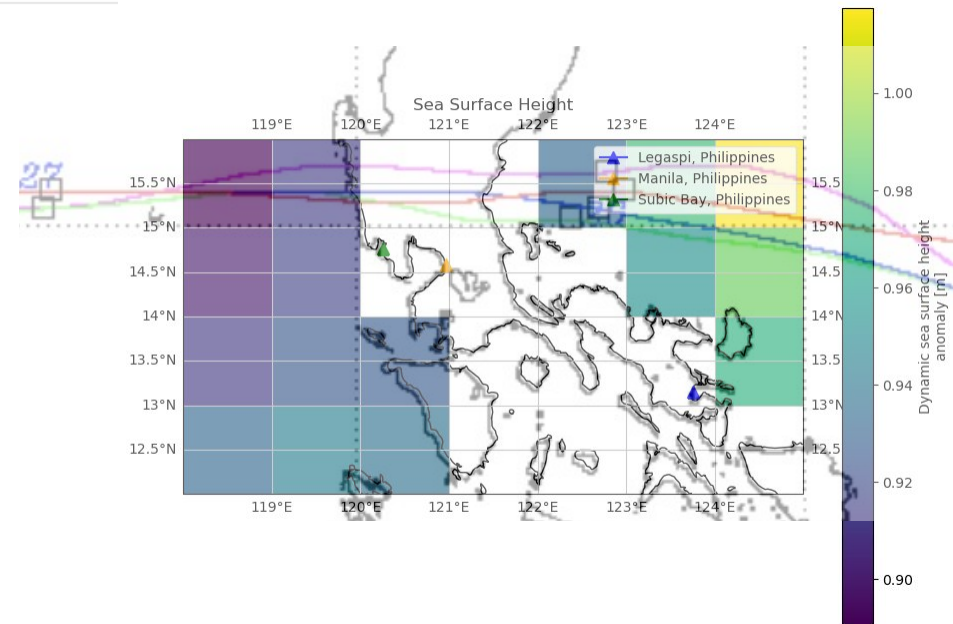


Typhoon Ketsana

[Speaker
Zoom
video]



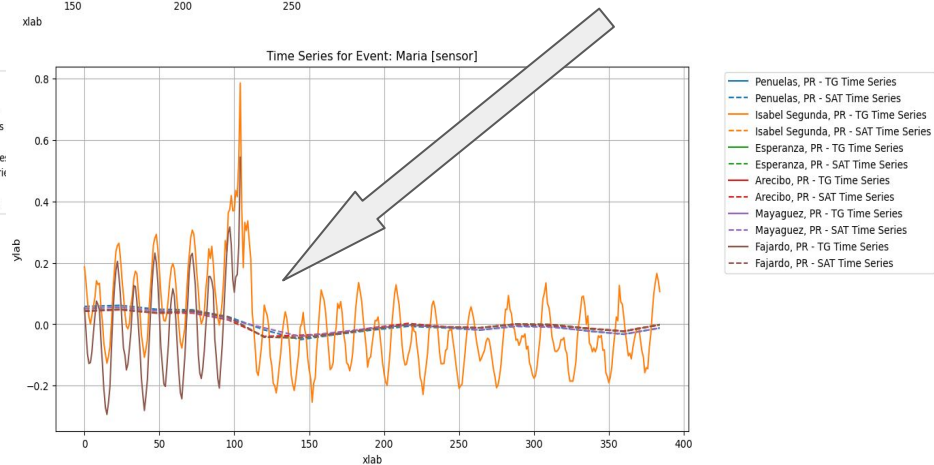
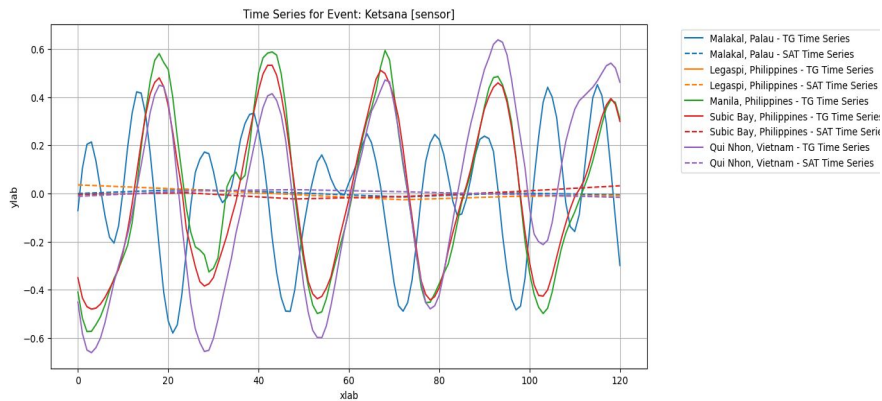
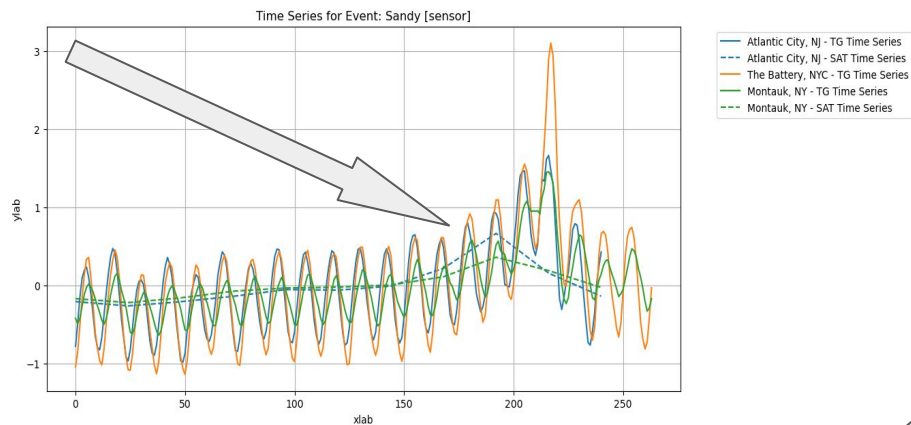
- ★ Malakal, Palau - bl1
- Malakal, Palau - Time Series
- ★ Malakal, Palau - bl2
- ★ Legaspi, Philippines - bl1
- Legaspi, Philippines - Time Series
- ★ Legaspi, Philippines - bl2
- ★ Subic Bay, Philippines - bl1
- Subic Bay, Philippines - Time Series
- ★ Subic Bay, Philippines - bl2
- ★ Qui Nhon, Vietnam - bl1
- Qui Nhon, Vietnam - Time Series
- ★ Qui Nhon, Vietnam - bl2



Normalized time series

ECCO & TG

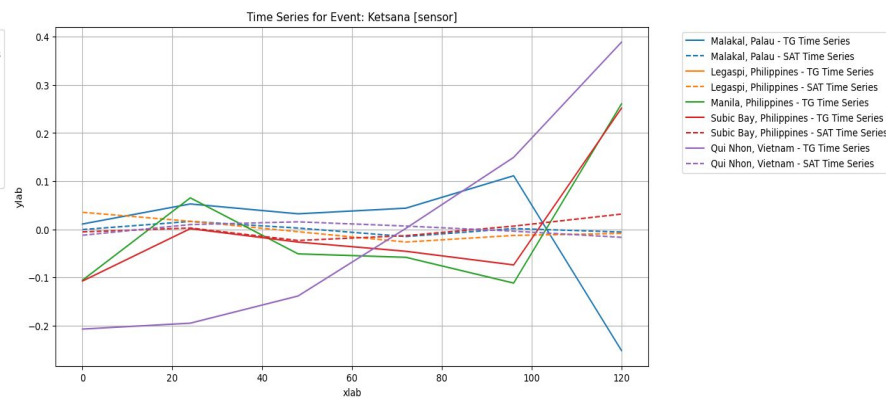
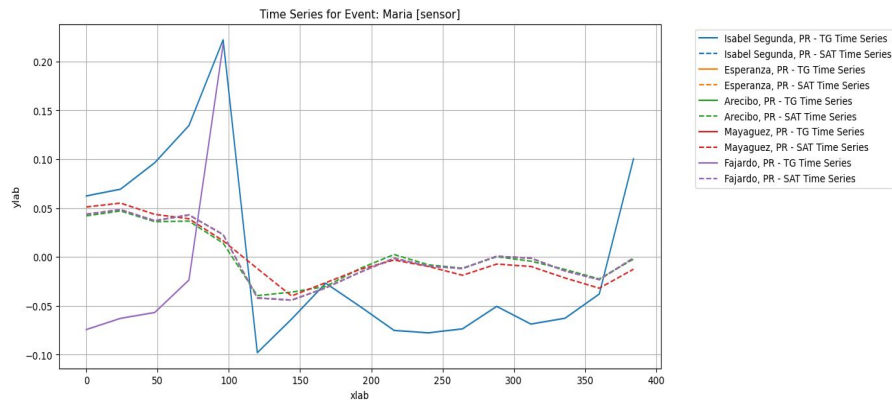
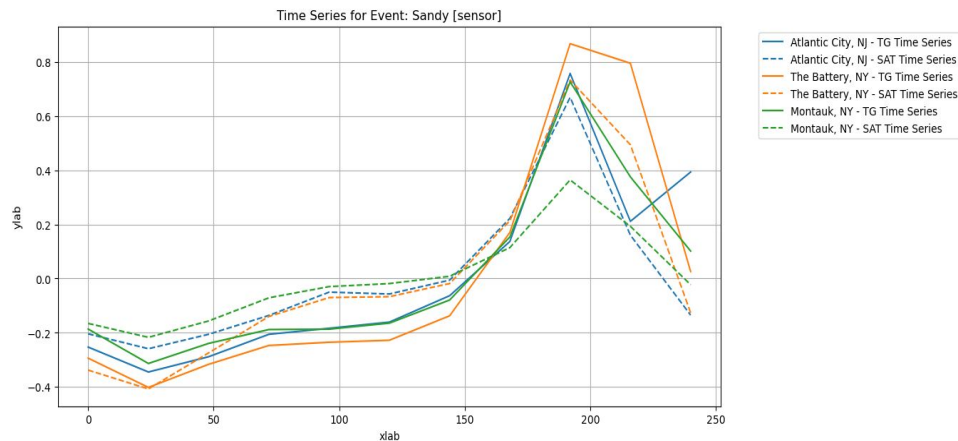
[Speaker
Zoom
video]



Normalized time series

ECCO & TG (resampled)

[Speaker
Zoom
video]

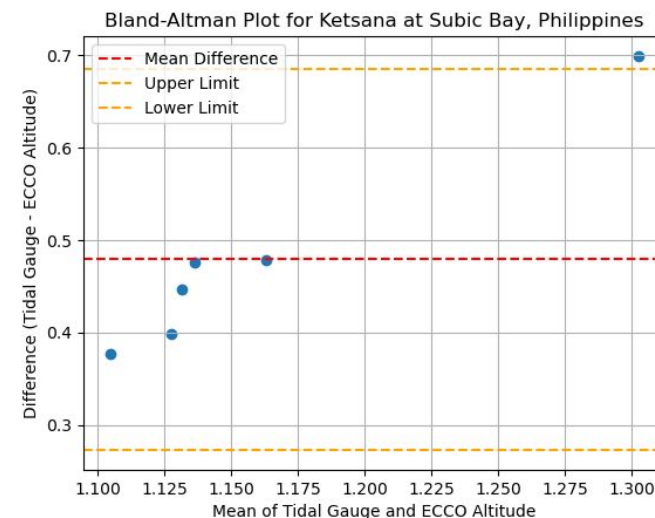


Correlation Analysis

● Methods

- Pearson correlation (assesses linear relationship)
- Bland-Altman analysis for testing the agreement of two observation procedure

	Event	Location	Pearsons Statistic	Pvalue	Min TG	Max TG	Min SAT	Max SAT	Percent_usable
0	Sandy	Atlantic City, NJ	-0.830777	0.001537	-0.344750	0.757125	-0.011458	0.011458	100.0
1	Sandy	The Battery, NY	-0.742462	0.008869	-0.401583	0.866917	-0.014469	0.014469	100.0
2	Sandy	Montauk, NY	-0.753133	0.007456	-0.313288	0.725920	-0.010682	0.010682	100.0
3	Maria	Isabel Segunda, PR	-0.461112	0.062467	-0.097939	0.222228	-0.001560	0.001560	100.0
4	Maria	Esperanza, PR	TOO SHORT	TOO SHORT	NaN	NaN	-0.001560	0.001560	0.0
5	Maria	Arecibo, PR	TOO SHORT	TOO SHORT	NaN	NaN	-0.001668	0.001668	0.0
6	Maria	Mayaguez, PR	TOO SHORT	TOO SHORT	NaN	NaN	-0.001315	0.001315	0.0
7	Maria	Fajardo, PR	0.800279	0.103875	-0.074278	0.217527	-0.000390	0.000390	100.0
8	Ketsana	Malakal, Palau	-0.471233	0.345471	-0.251410	0.111299	-0.001758	0.001758	100.0
9	Ketsana	Legaspi, Philippines	TOO SHORT	TOO SHORT	NaN	NaN	-0.001937	0.001937	0.0
10	Ketsana	Manila, Philippines	TOO SHORT	TOO SHORT	-0.111479	0.260396	NaN	NaN	0.0
11	Ketsana	Subic Bay, Philippines	0.642657	0.168726	-0.107208	0.251458	-0.000841	0.000841	100.0
12	Ketsana	Qui Nhon, Vietnam	0.94912	0.003817	-0.206937	0.388438	-0.002310	0.002310	100.0



Conclusions

[Speaker
Zoom
video]

- The visualizations of the data resampled to the same time steps **appear** to show a linear relationship (e.g; TG data increases over the same time steps as the ECCO data from that same location). Statistical analysis of correlation values, however, do not agree. We **think** this is due to a methodological error in the analysis which we would hope to address with more time.
- Bland-Altman analyses show that for higher sea level values, the level of disagreement between TG and ECCO data increases. This suggests that extreme events like storms contribute to greater differences in the measured values of sea level between data systems.

There are pros and cons to analyzing storm events with both data sources.

- Tidal gauges
 - Benefit: Unmatched temporal resolution (as fine as just several minutes) can be especially useful for picking up small changes in RSL due to tides without any interpolation
 - Downfall: Major storms can damage tidal gauges and render them useless during important times
- Satellite (ECCO)
 - Benefit: Not susceptible to damage in the middle of an event
 - Downfall: Cannot necessarily capture short time scales which take tides into account

Lots of room for future work

- Due to limited project time, we were restricted to data we could quickly access
- The ECCO data that we could access offers daily data
 - This means either coarsening or interpolation is required to fairly correlate tidal gauge with satellite data
 - More time could allow us to access satellite data at a finer temporal resolution

