A Review of Recent Observing System Experiments

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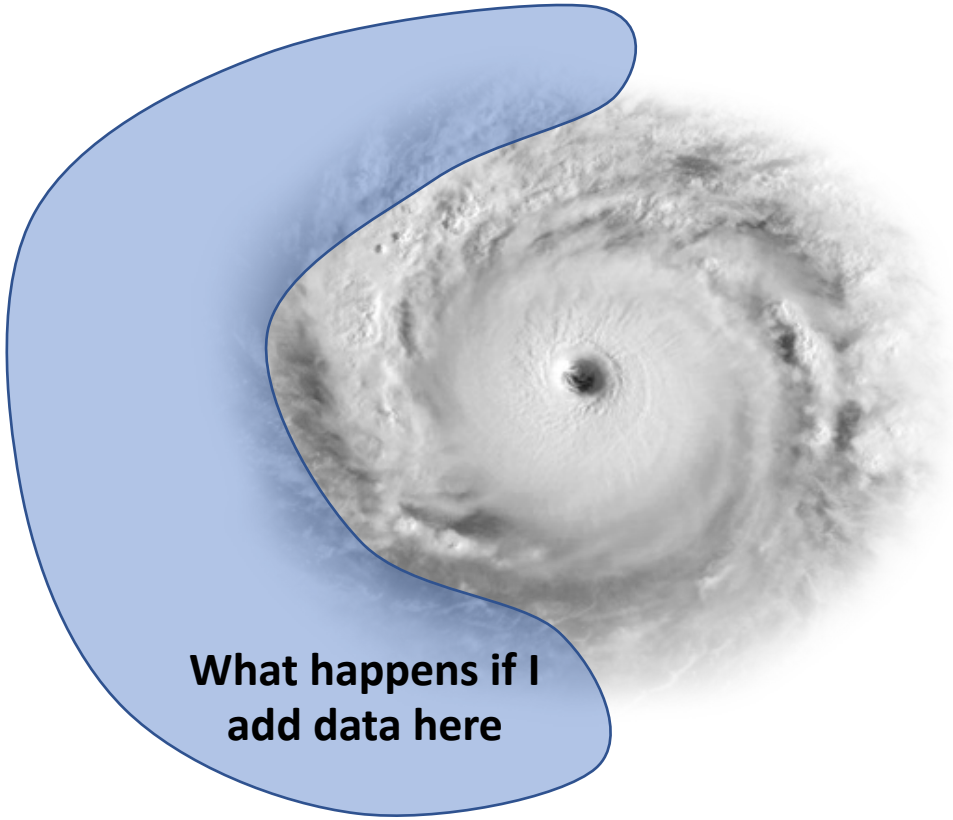
Intro to OSEs

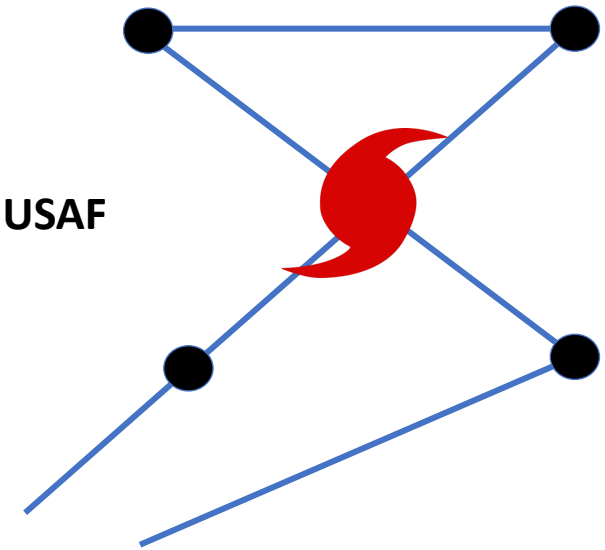
With a model that performs well (e.g., HWRF), one can effectively evaluate observing-system experiments **(OSEs)**

?



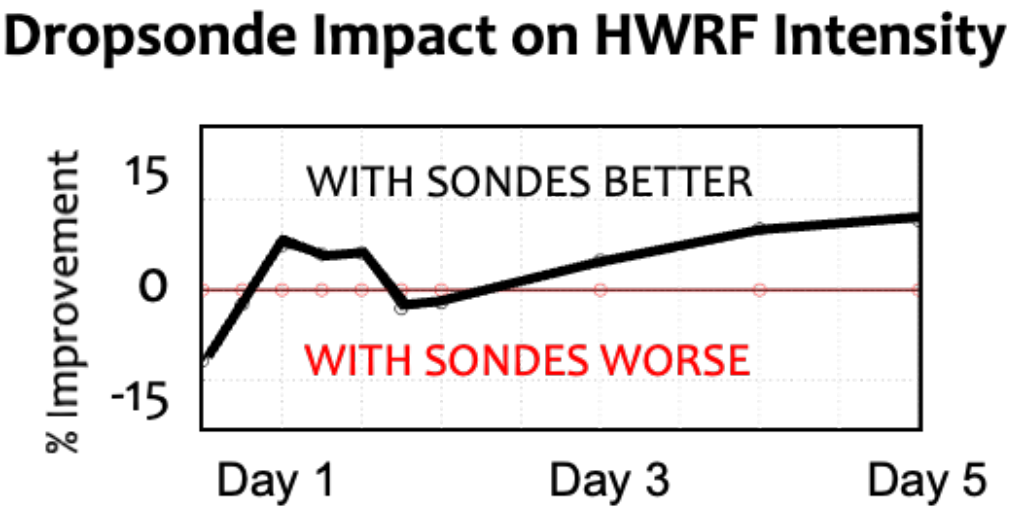
Recent OSE Work

Example: “End-point” dropsondes added to C-130 missions in 2018



Typical USAF pattern

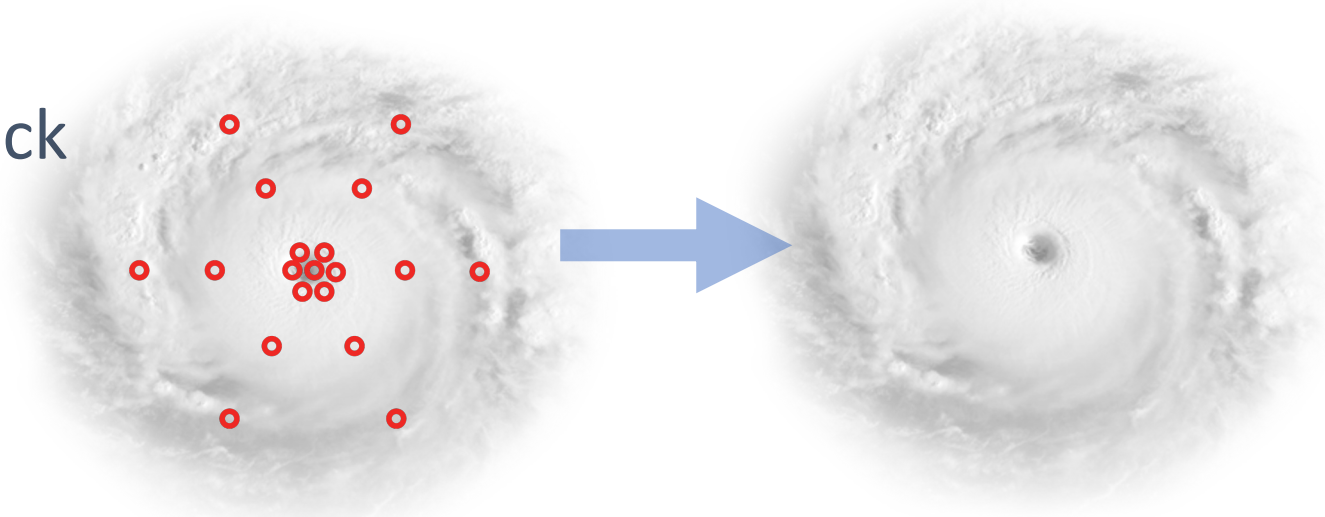
Add dropsondes at turn points



Ongoing OSE Work

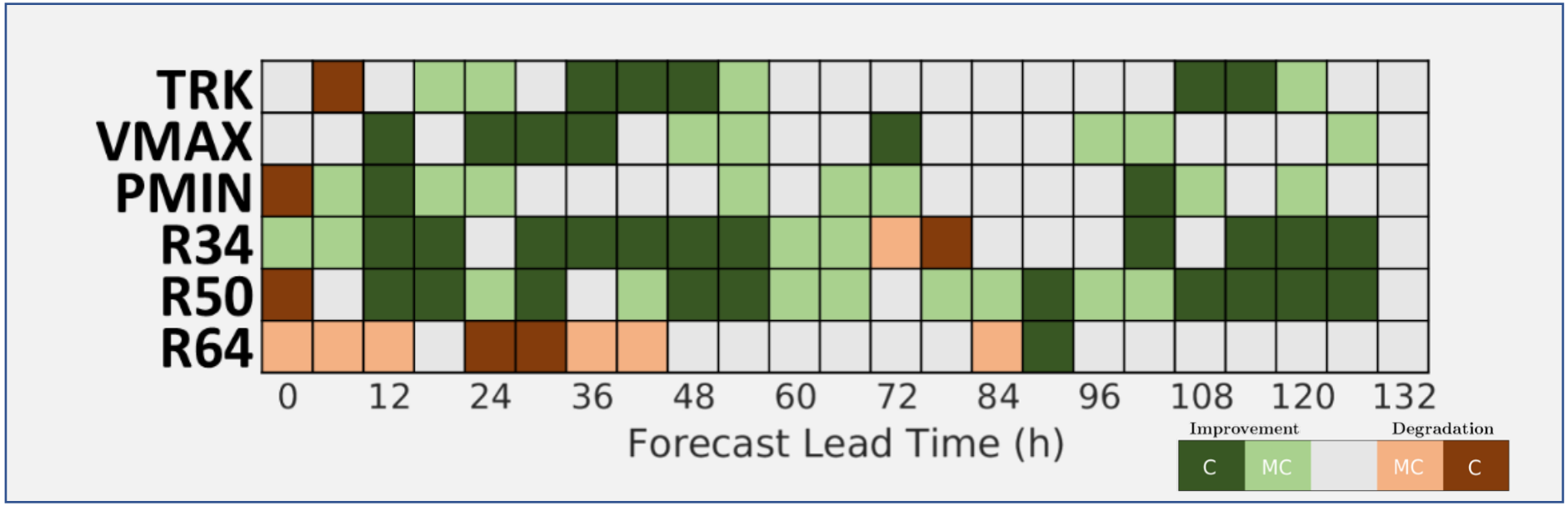
OK, but how do dropsondes affect the forecast… overall?

- We know they improve the track forecast
- We also know they cost $
- A lot of unknowns



What happens in HWRF if we take away ALL dropsondes?

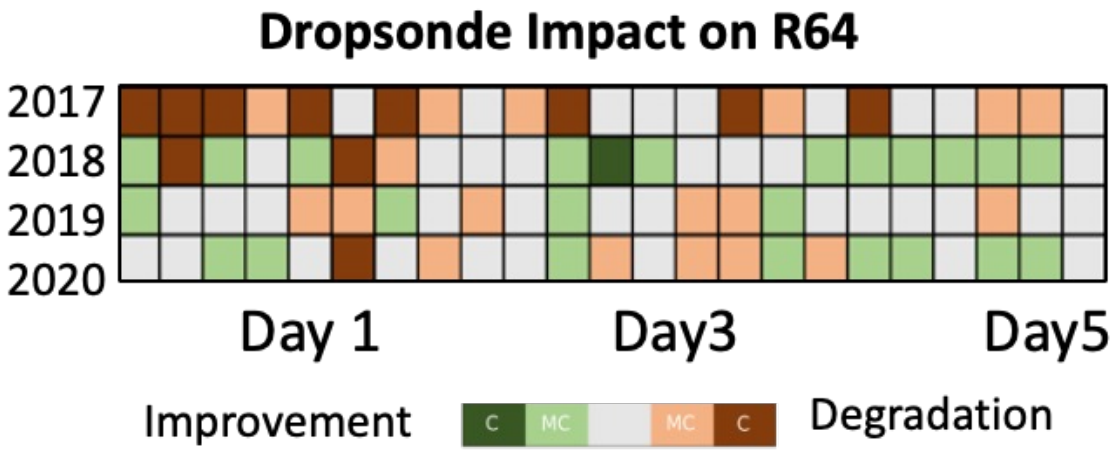
Ongoing OSE Work

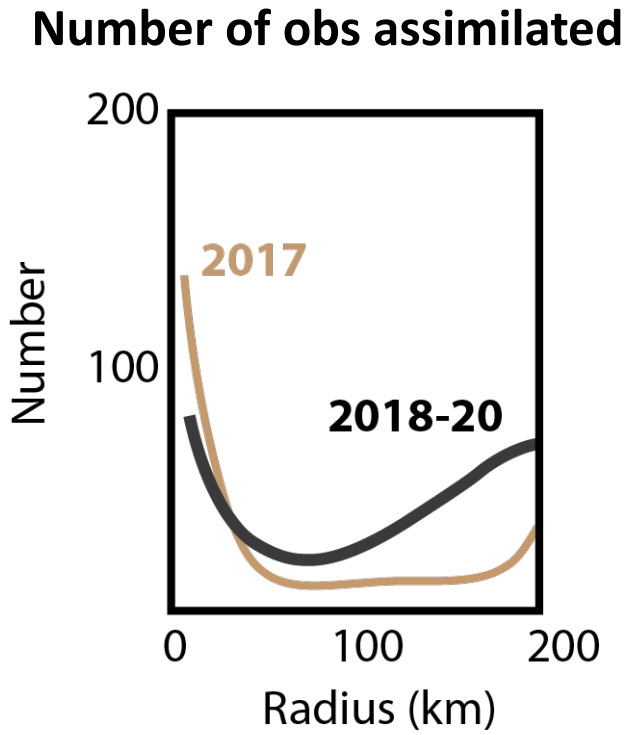


OVERALL IMPACT OF DROPSONDES IN HWRF

- Some benefits for track and intensity
- Big benefits for significant wind radii(!)
- What's up with R64?

Ongoing OSE Work



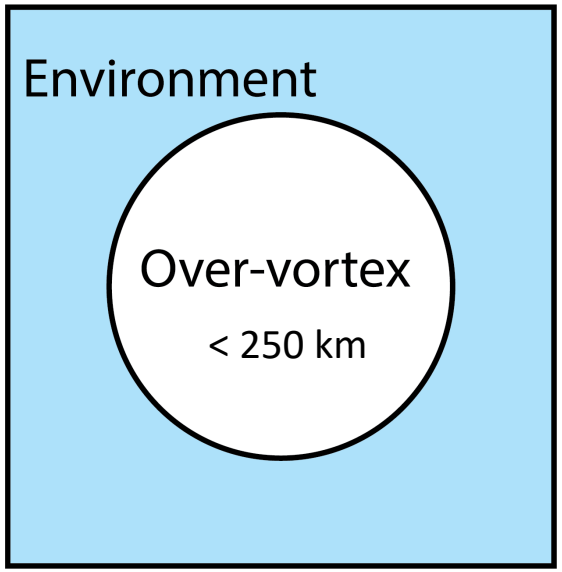


What's up with R64?

- R64 degraded in 2017 only (left)
- Poor near-core coverage in 2017 (right)
- Improved impacts and coverage starting in 2018

Ongoing OSE Work

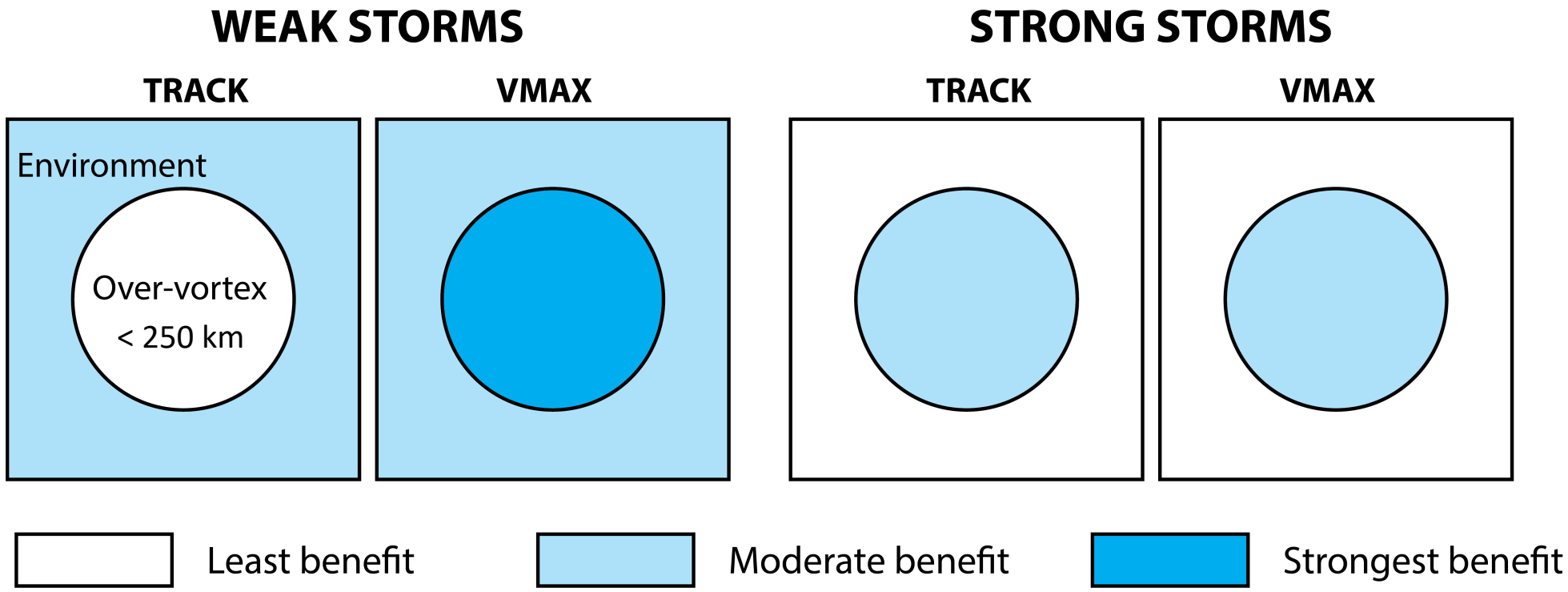
Can we say anything about how different dropsondes affect the forecast differently? ***YES!***



Example: *What are the relative impacts of environmental and over-vortex dropsondes?*

Ongoing OSE Work

Comparing environmental vs. over-vortex dropsonde impacts



Ongoing OSE Work

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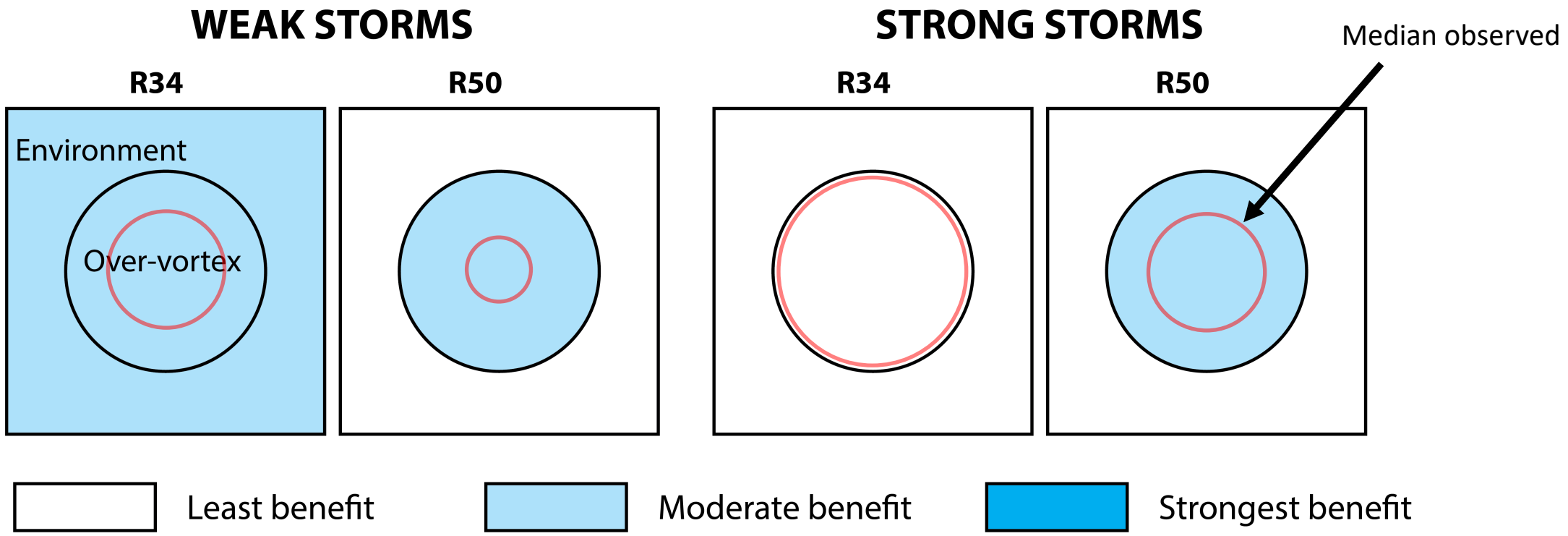
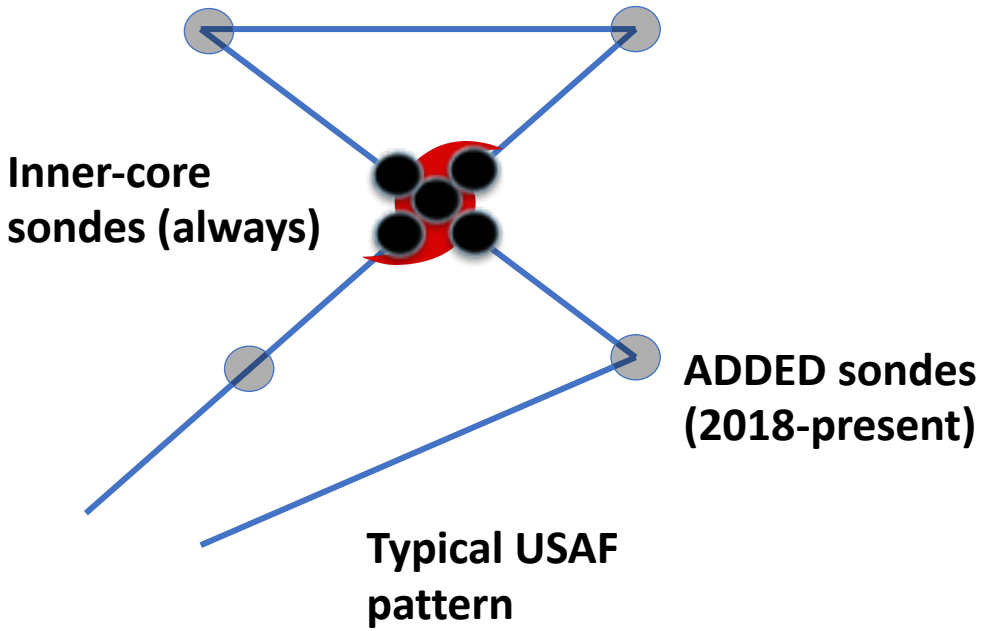


Ongoing OSE Work

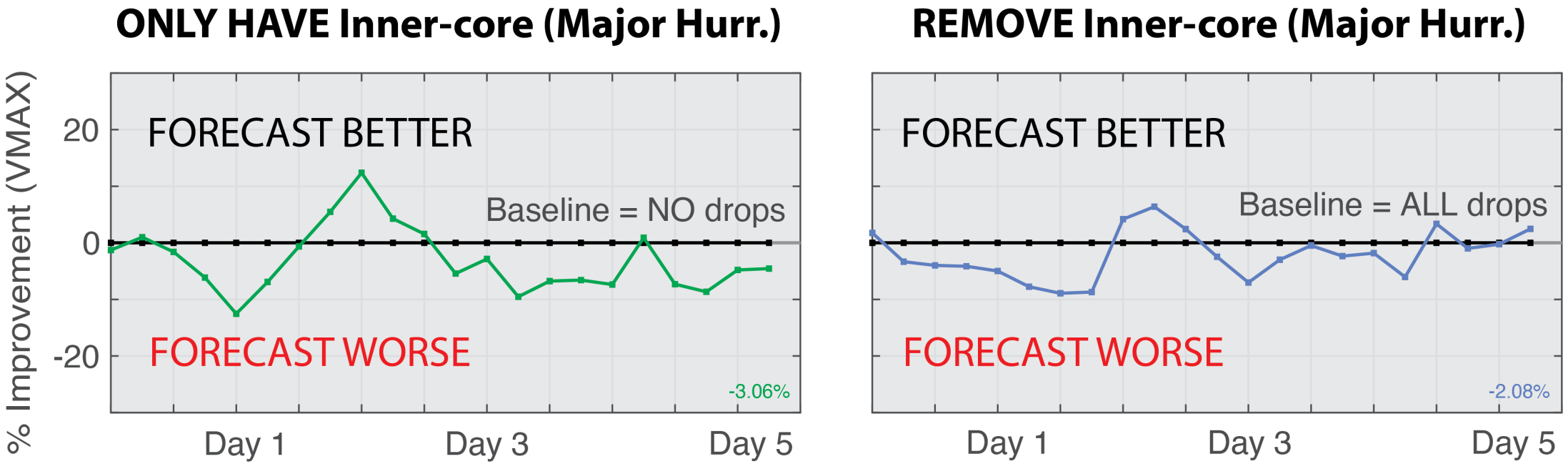
Turning back to that USAF pattern….



TWO QUESTIONS:

1. What happens if we ONLY HAVE inner-core dropsondes
2. What happens if we TAKE AWAY inner-core dropsondes

Ongoing OSE Work

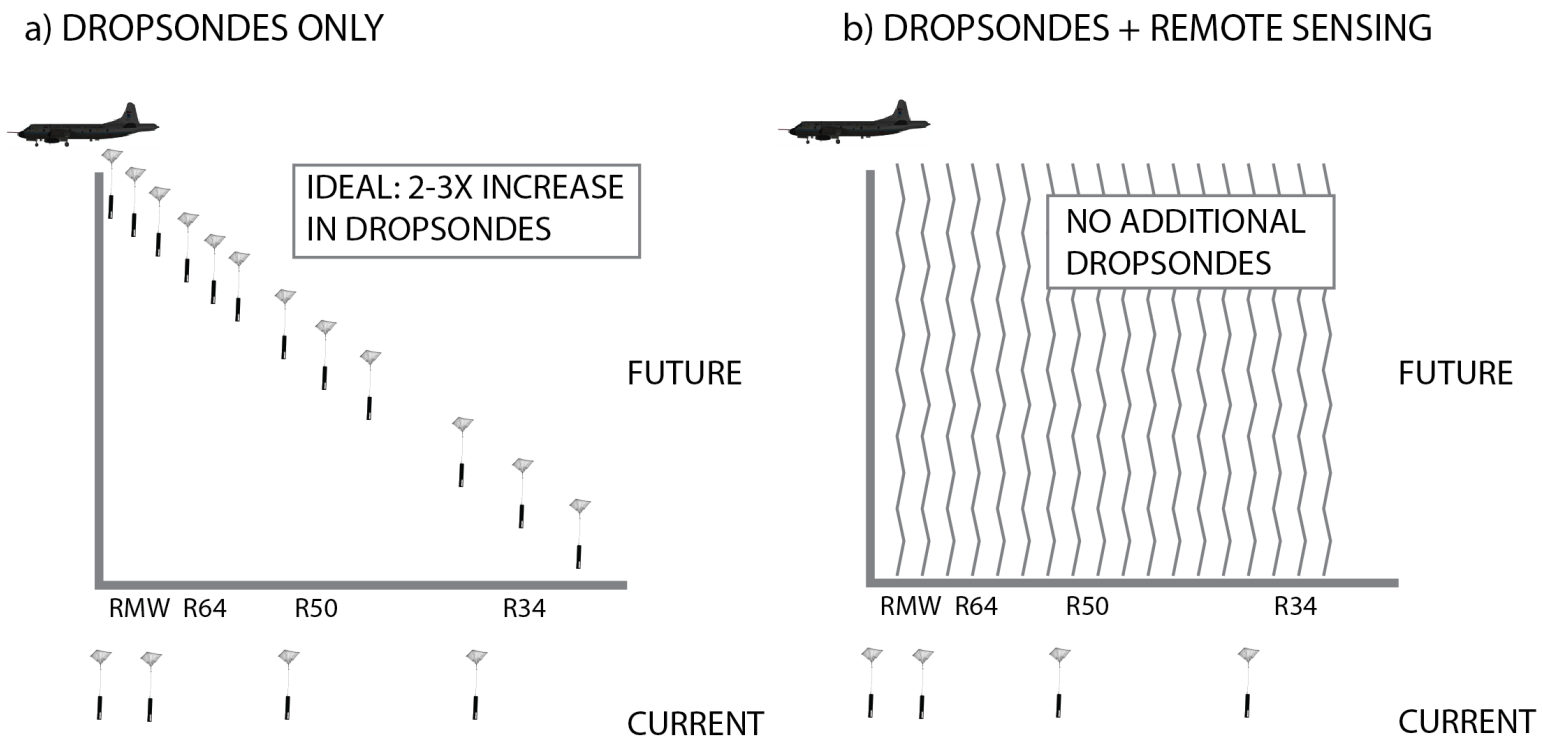


1. ONLY inner-core sondes: Inner-core sondes **degrade** forecast (left)
2. Good sonde sampling: Inner-core sondes **improve** forecast (right)

Ongoing OSE Work

For optimal sampling, we need either:

- Significantly more dropsondes; or
- Remote sensing

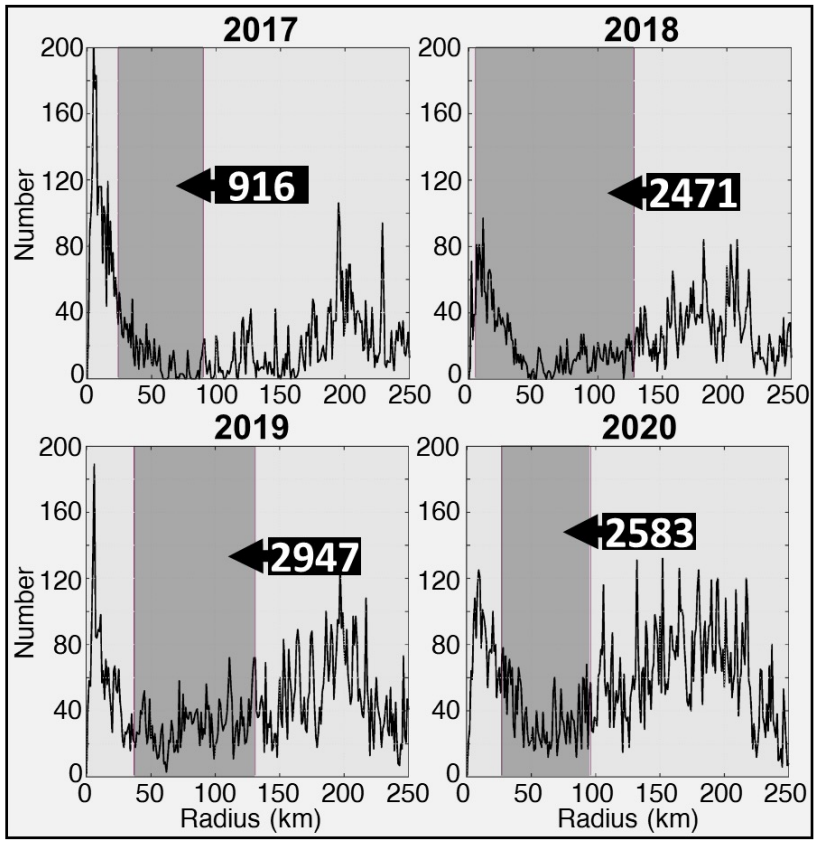


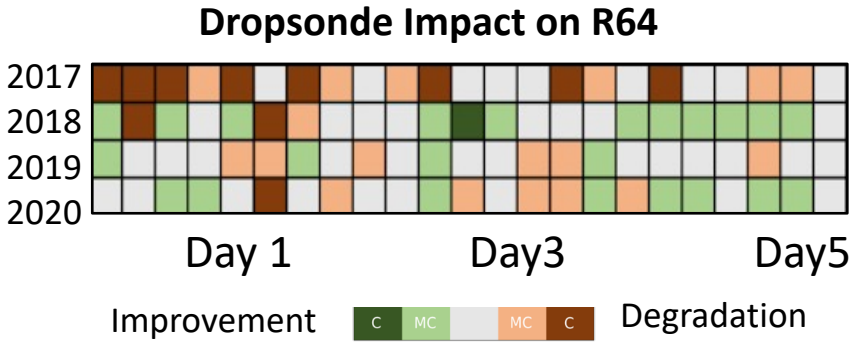
Conclusions

- Dropsondes improve most aspects of the forecast, particularly significant wind radii
- Weak storms benefit most from added dropsondes
- Gaps in coverage degrade the forecast (and can make it worse than having NO dropsondes at all)
- Optimum coverage targets all aspects of interest (e.g., significant wind radii) and argues for supplemental remote sensing observations

BONUS SLIDES

Ongoing OSE Work





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- Degradation corresponds with poor near-core coverage
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Ongoing OSE Work

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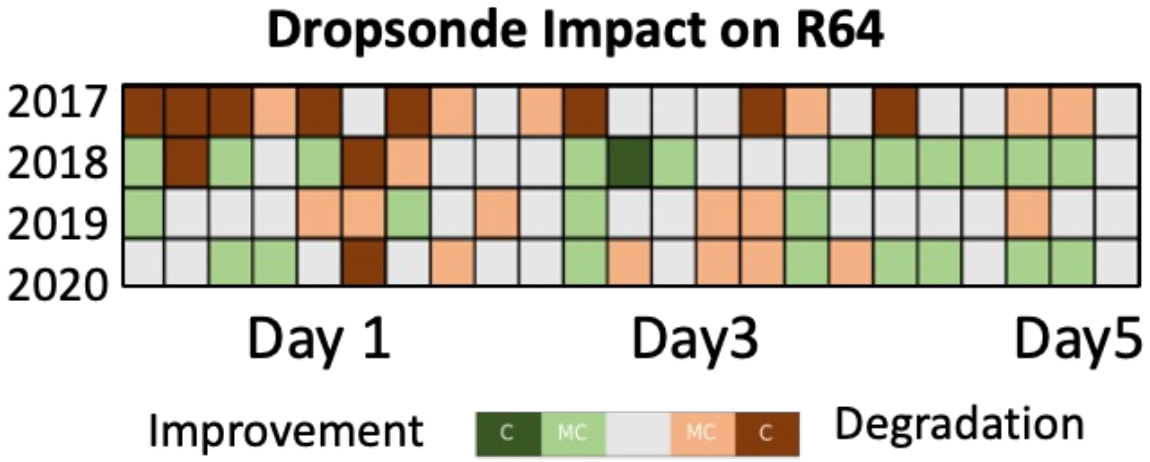


Dropsonde Obs in R64 region

2017: 916	2019: 2947
2018: 2471	2020: 2583

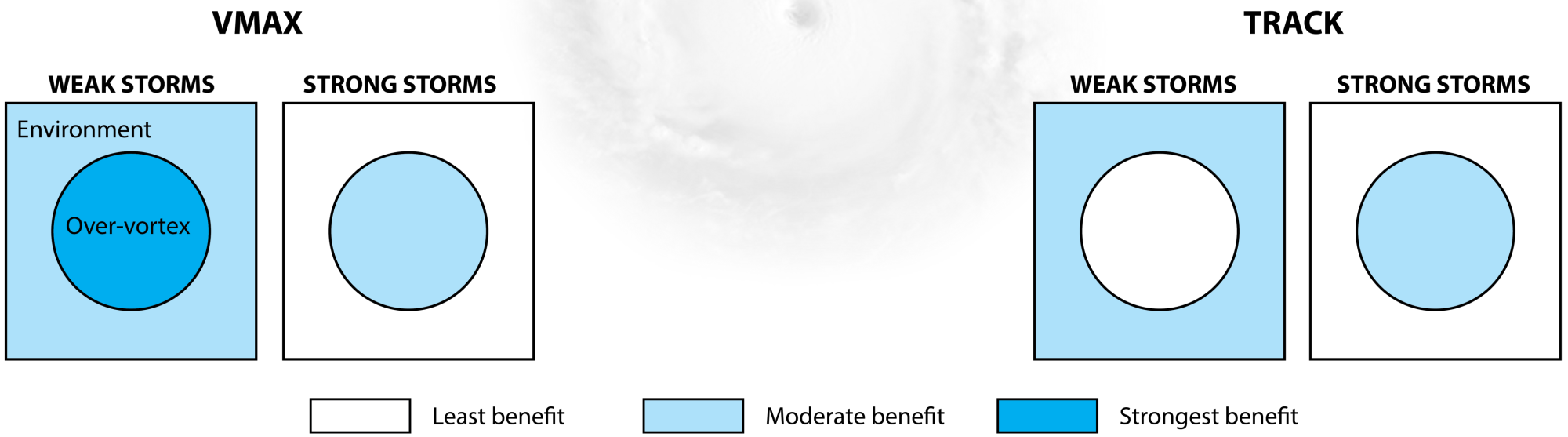
Ongoing OSE Work

FOR INTENSITY (VMAX):

- Over-vortex in all storms (HUGE benefit for weak storms)
- Environment in weak storms

FOR TRACK:

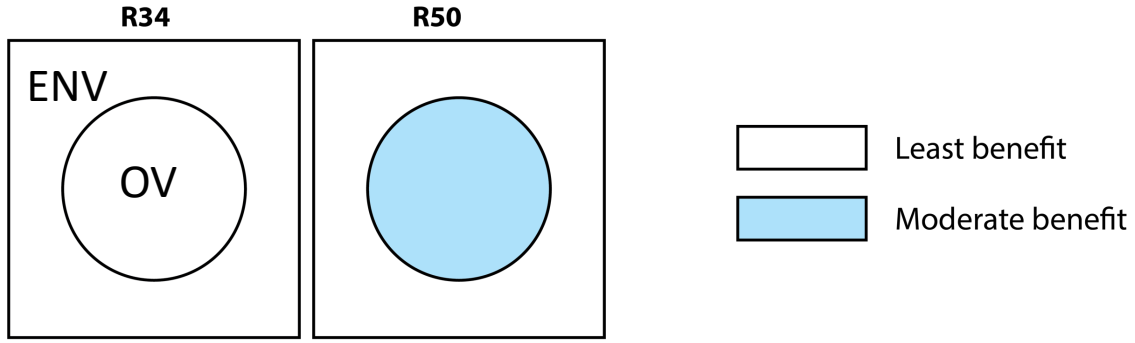
- Environment in weak storms
- Over-vortex in strong storms

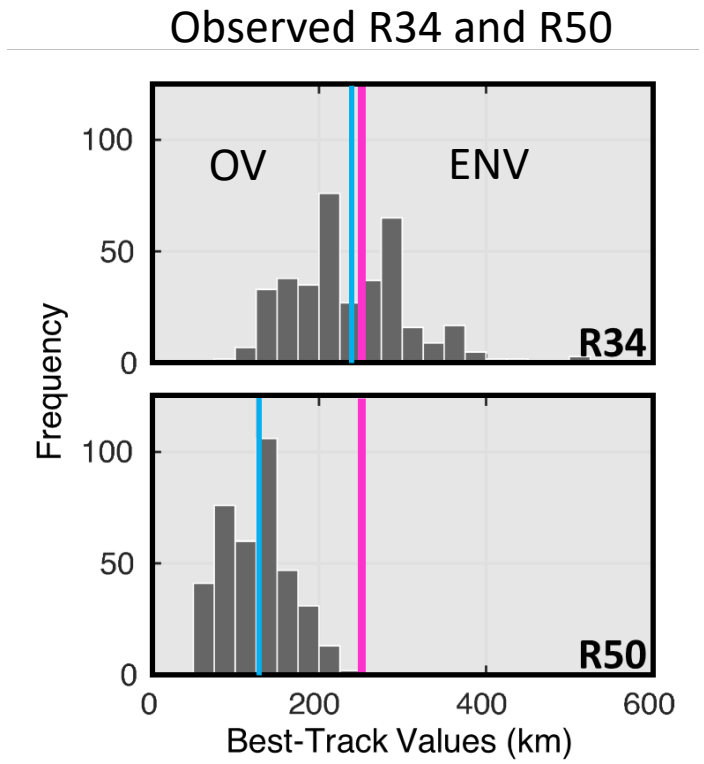


Ongoing OSE Work

A closer look at strong storms:

- Observed R50 lies in the “over vortex” region
- Observed R34 near the vortex/environment border
- Sondes *either* in environment or over-vortex can improve R34, but neither region dominates

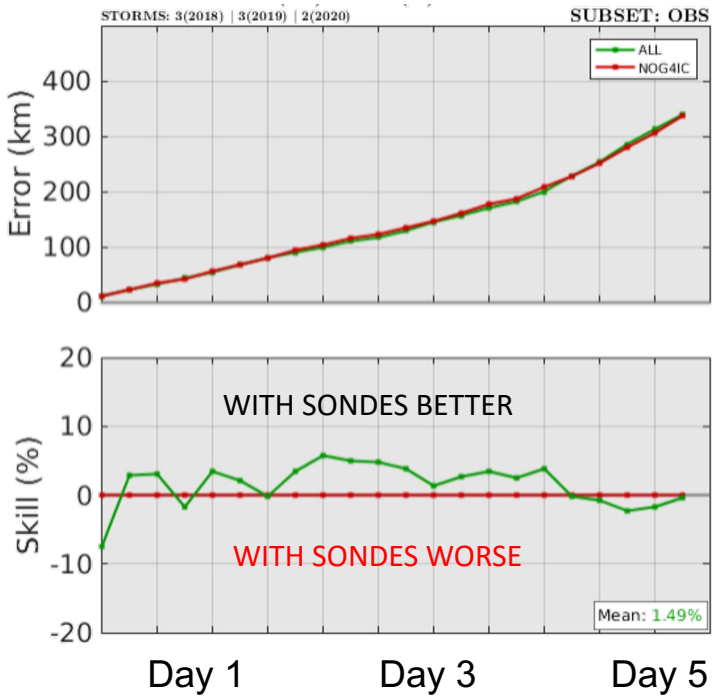


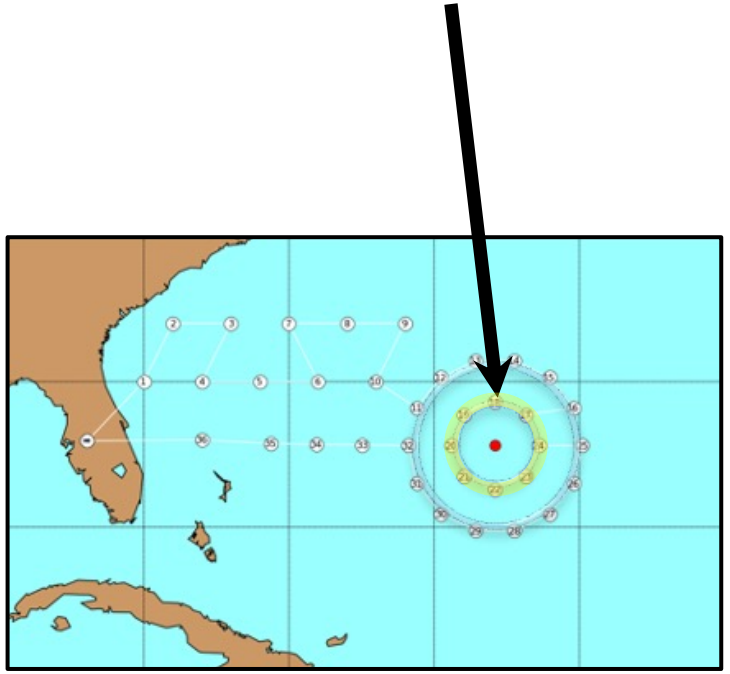


Recent OSE Work

Example 2: G-IV "Inner circumnav" added in 2018

Inner Circumnav Sondes: Impact on HWRF Track





G-IV dropsondes for Hurricane Florence

Inner Circumnav Bonus: Additional TDR Data