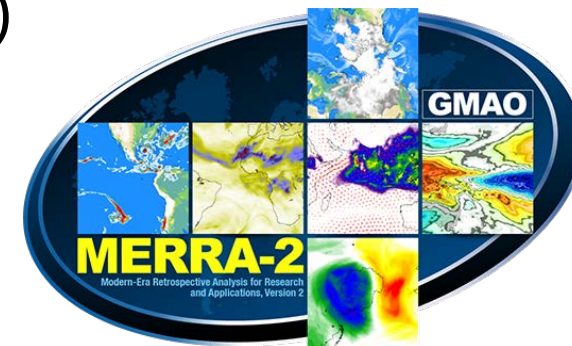


ARTMIP Tier 2 Reanalysis Discussion

Allie Collow^{1,2} & Bin Guan³

- Differences due to reanalysis systems
- Differences due to product resolution (Is information lost from regridding to the coarsest resolution? Are there resulting differences in related parameters?)
- Uncertainty in a single reanalysis (ERA5 ensemble members; MERRA-2 and JRA55 AMIP simulations)

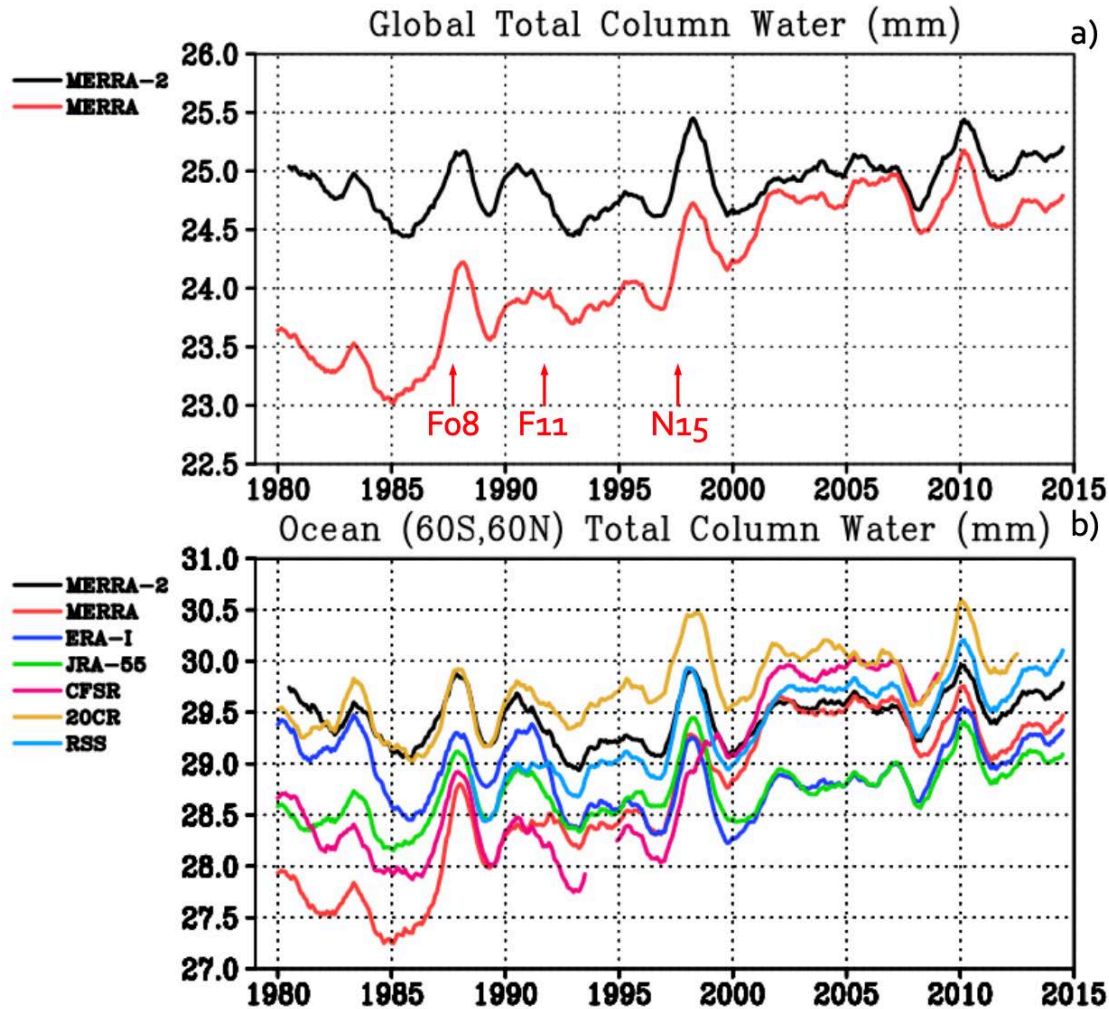


¹Universities Space Research Association

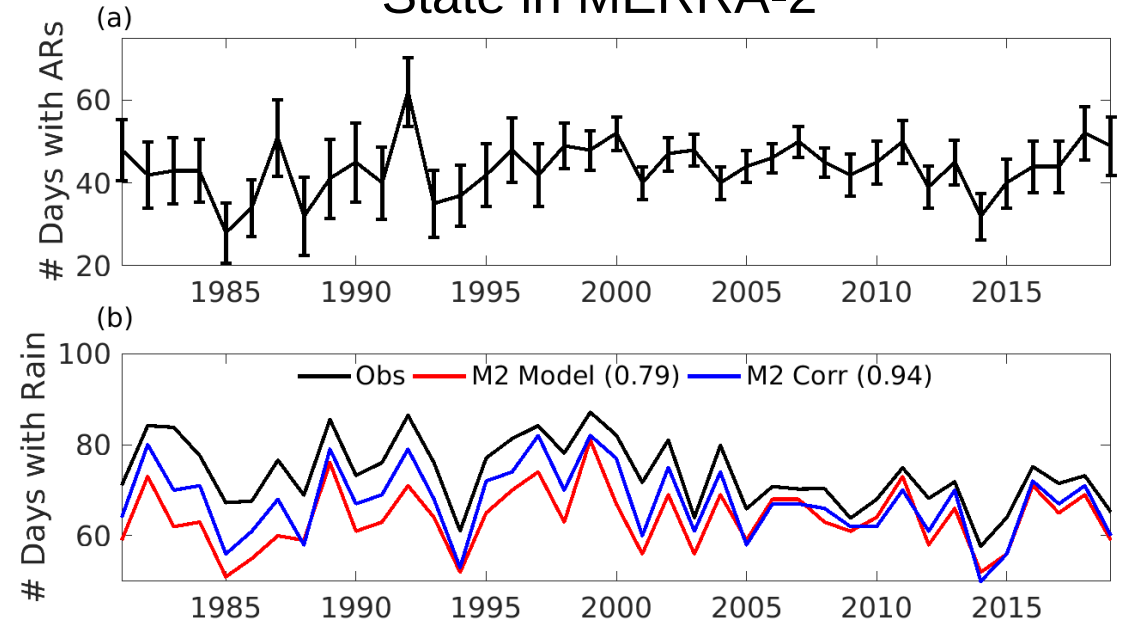
²NASA GSFC, Code 610.1 (GMAO)

³UCLA

Motivation for a Reanalysis Comparison



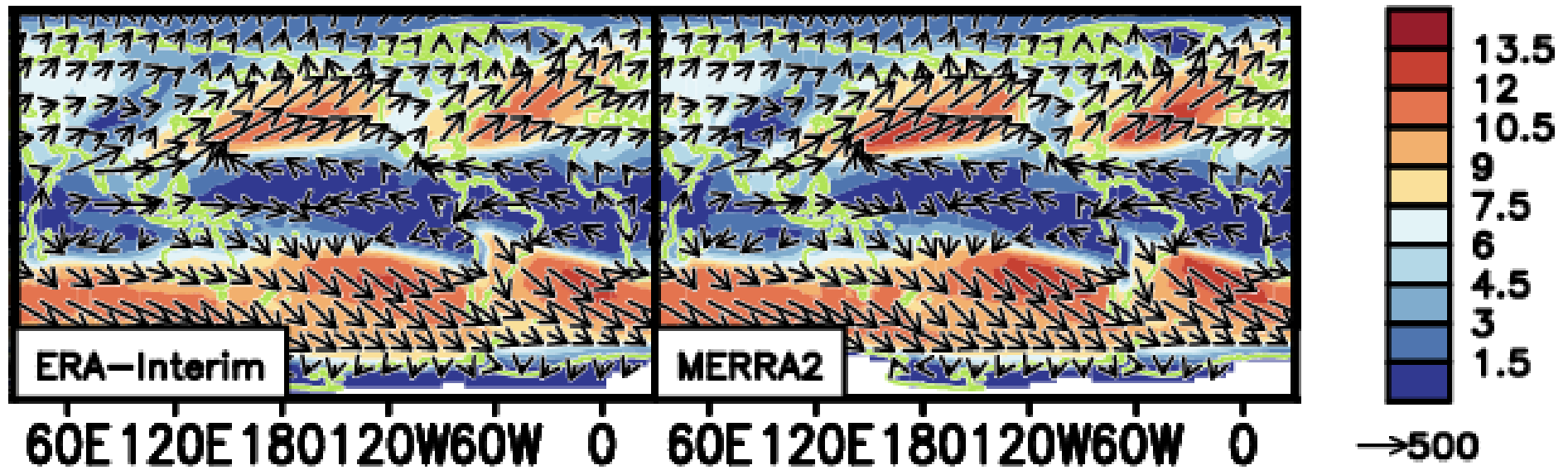
Along the Coast of Washington State in MERRA-2



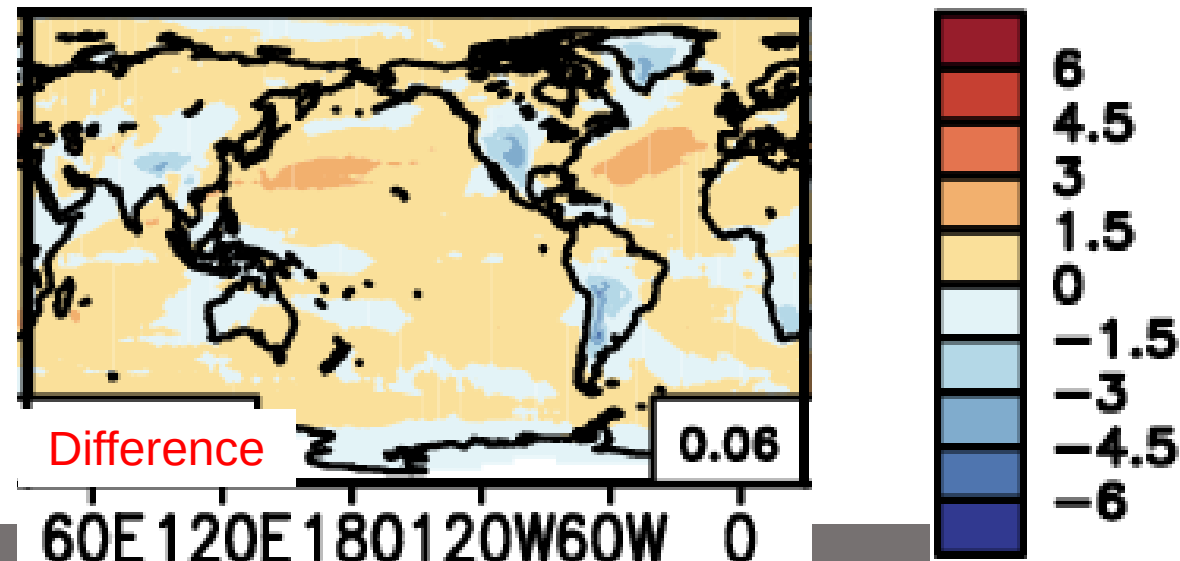
- Variability in atmospheric moisture exists among reanalyses, especially prior to the EOS era
- Reanalyses are reliant on data assimilation and an underlying MODEL
- This can be translated into AR detection and the associated precipitation

AR Frequency

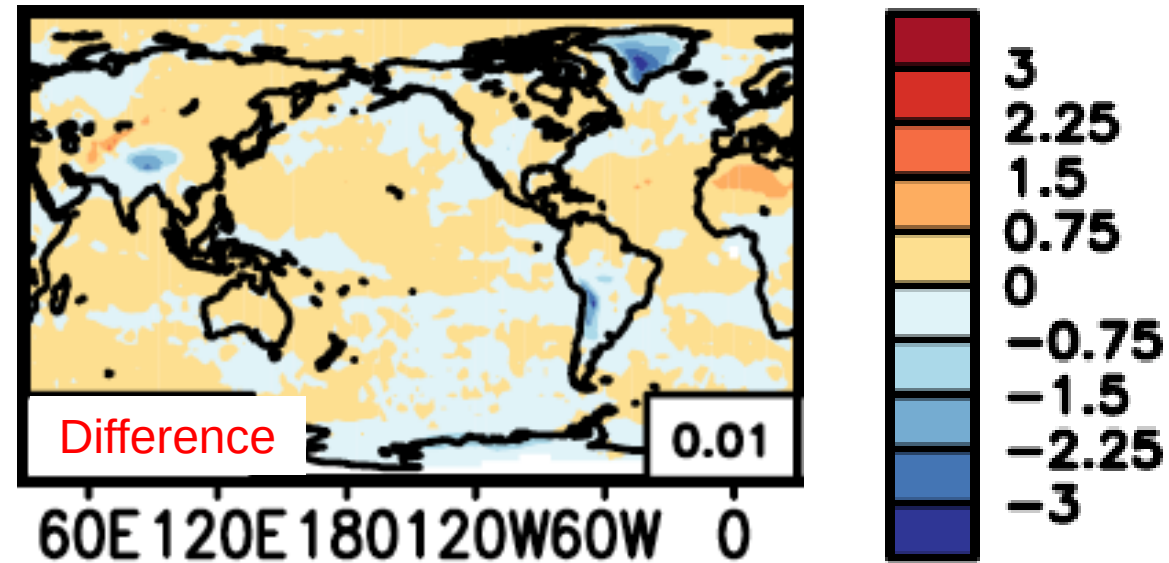
AR detection is based on ERA-Interim-derived AR threshold



ERA-Interim vs.
MERRA-2:
AR Frequency
(From Bin)



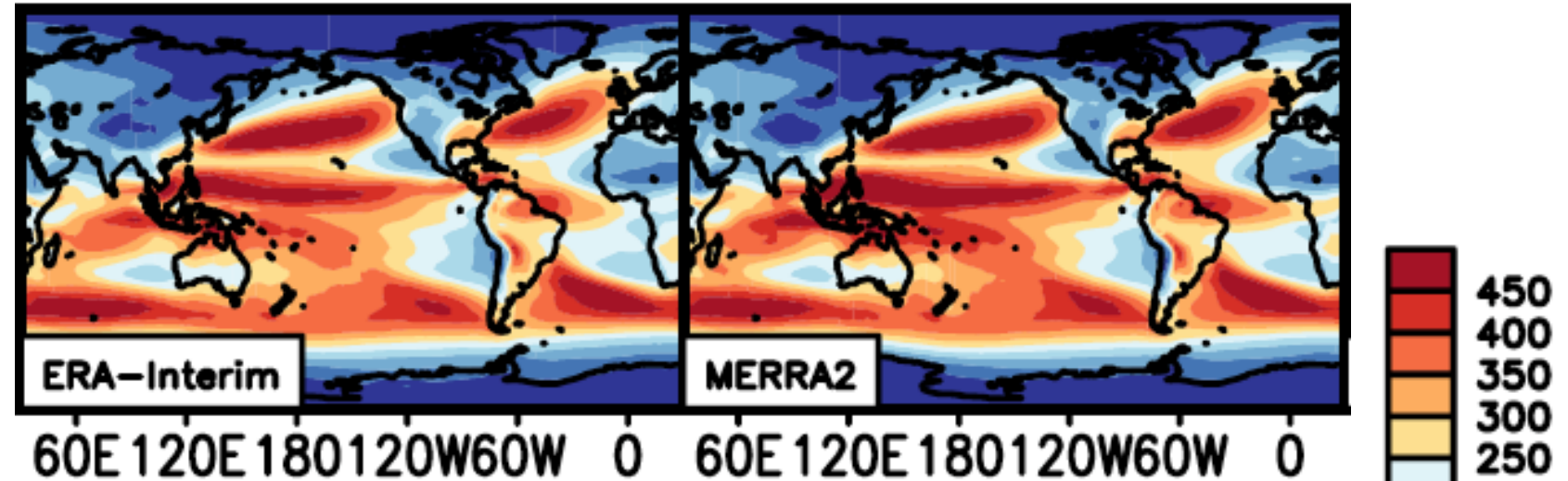
As bottom of previous slide, except AR threshold is dataset-dependent



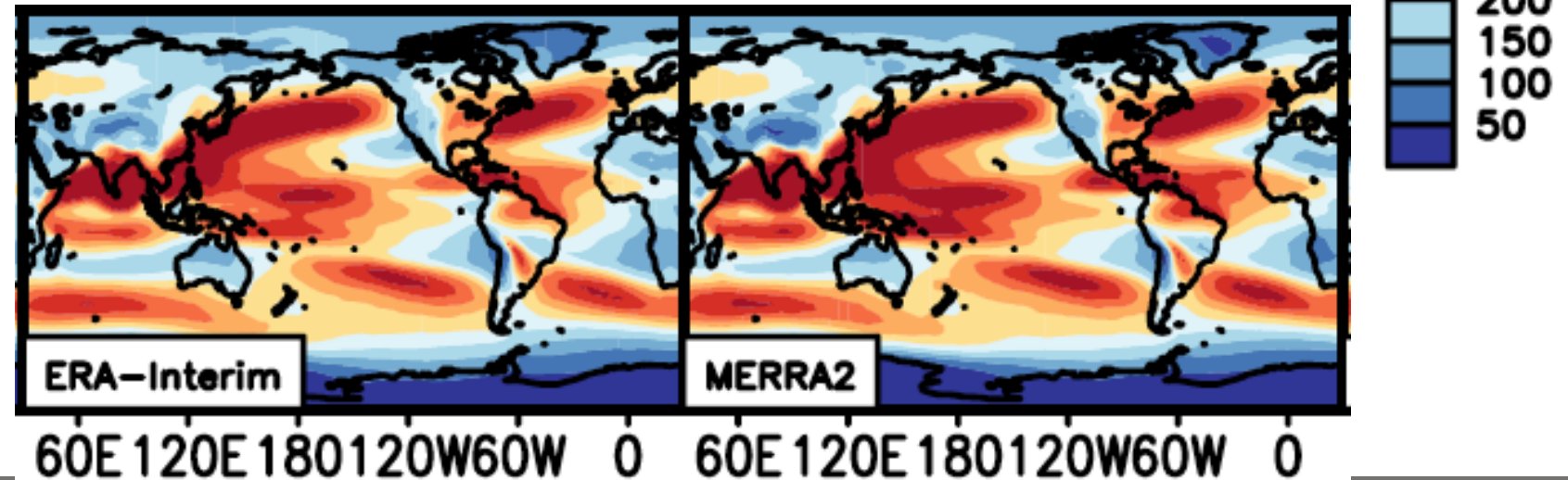
No major difference between ERA-Interim and MERRA-2 both here and in previous slide, but using dataset-dependent AR threshold makes their difference in AR frequency further smaller

IVT 85th Percentile Based on all 6-hourly data

Winter (NDJFM)



Summer (MJJAS)



ERA-Interim representation of 21 dropsonde-observed ARs

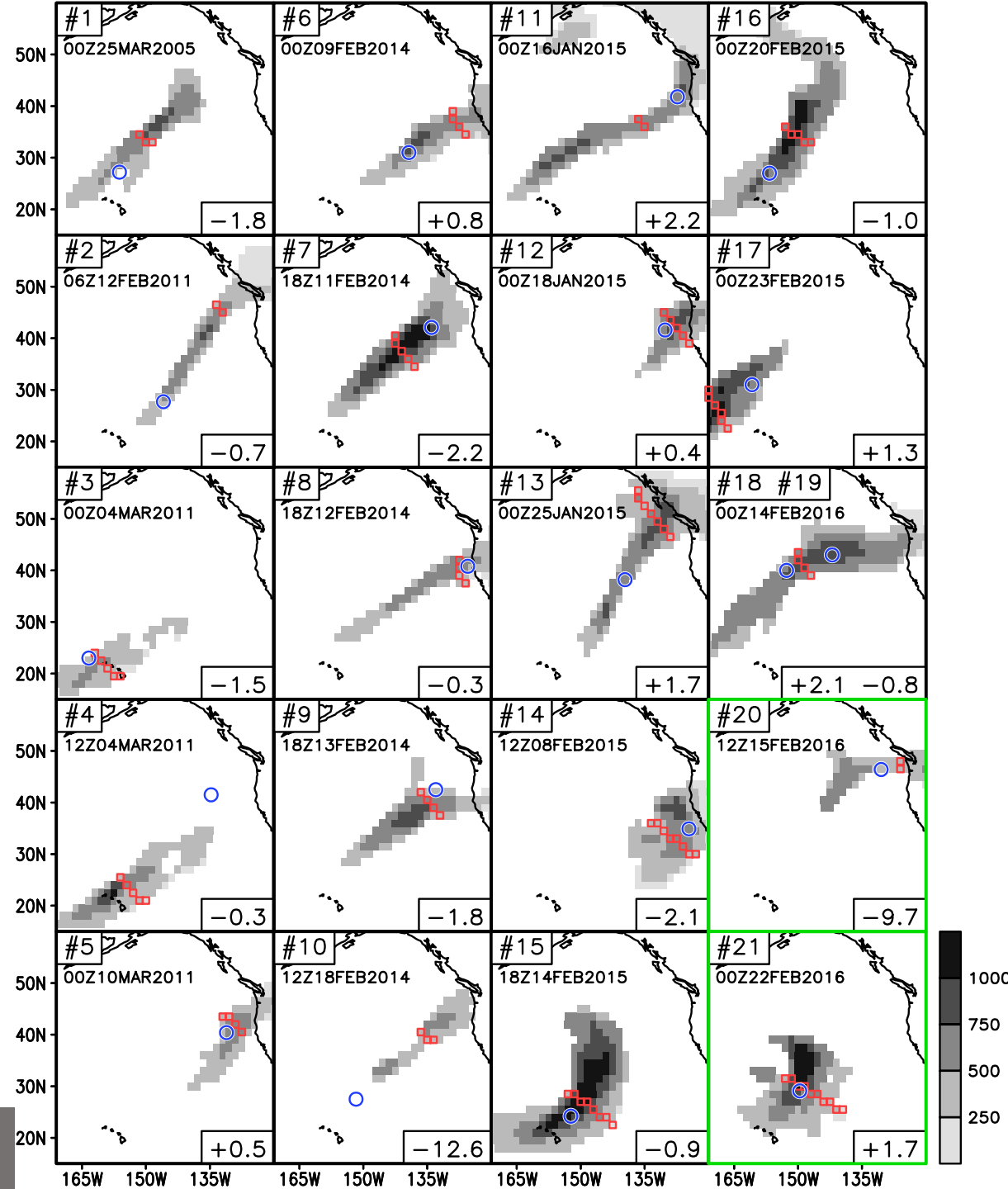
Algorithm + Reanalysis

- Shading: AR shapes.
- Red: transect going through AR centroid.

Dropsonde

Blue: midpoint of AR transect.

All 21 dropsonde ARs have a matching reanalysis AR; 19 of them matched within ± 3 hours.



MERRA-2 representation of 21 dropsonde-observed ARs

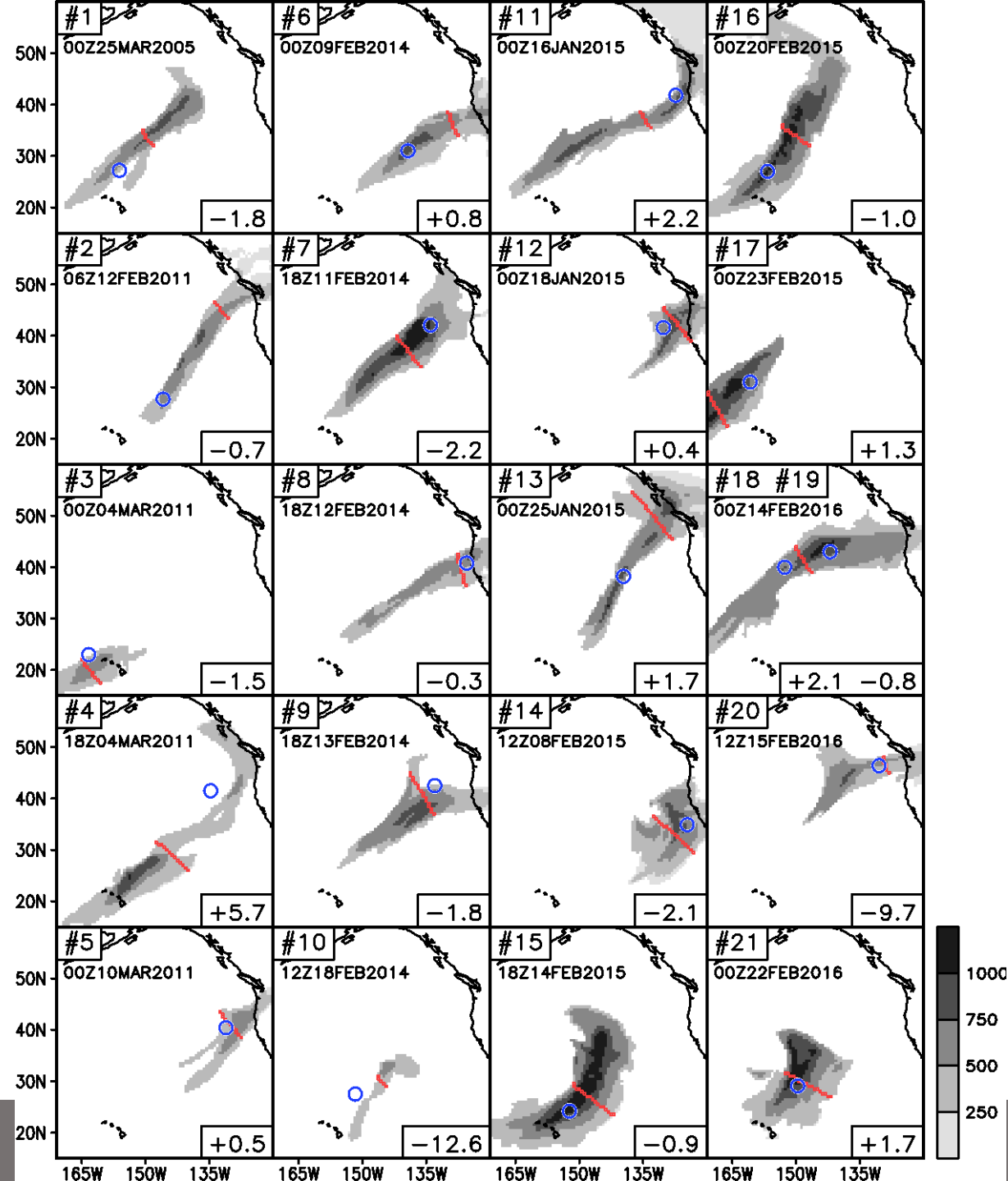
Algorithm + Reanalysis

- Shading: AR shapes.
- Red: transect going through AR centroid.

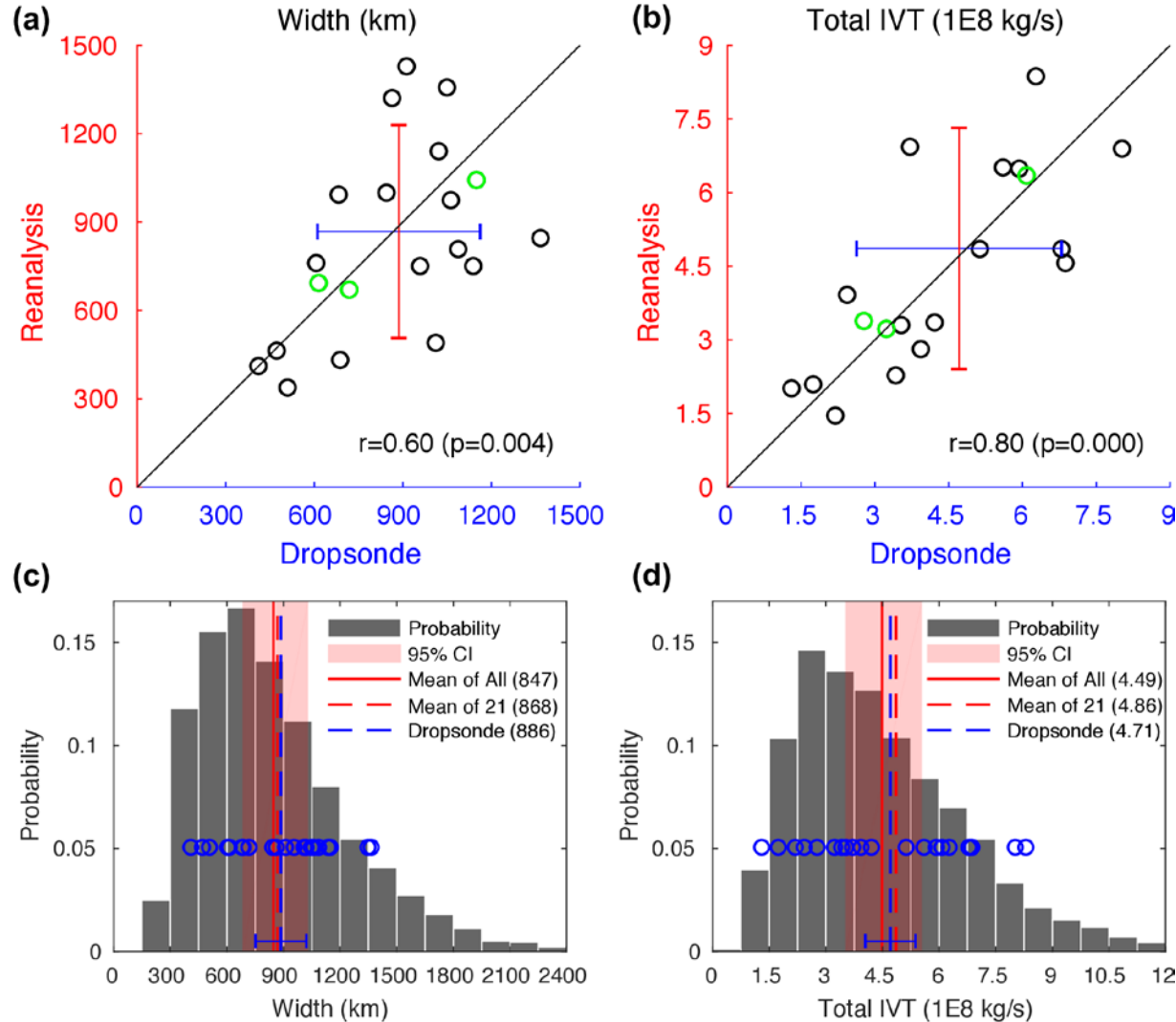
Dropsonde

Blue: midpoint of AR transect.

All 21 dropsonde ARs have a matching reanalysis AR; 19 of them matched within ± 3 hours.



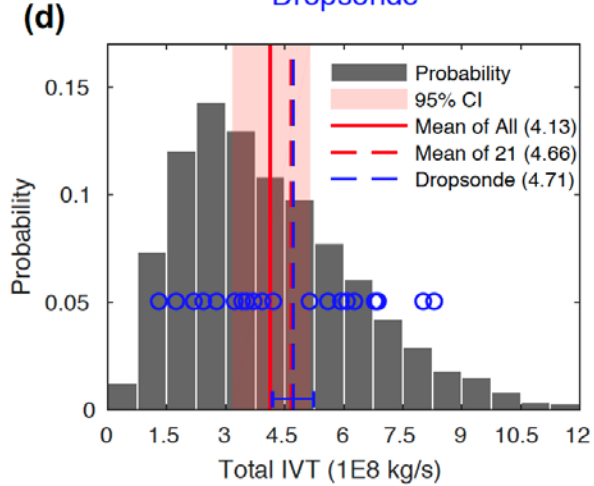
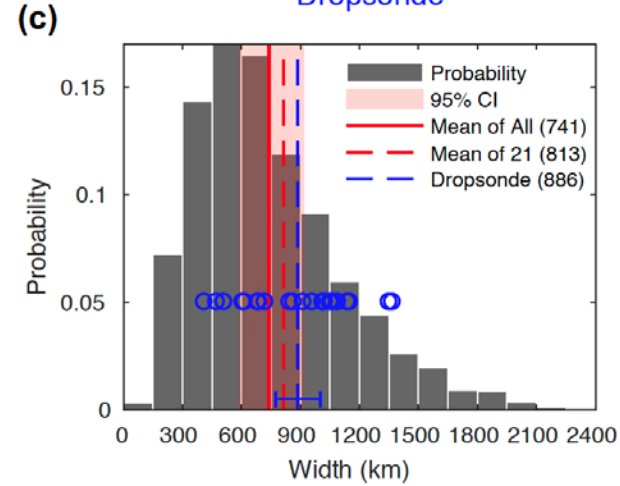
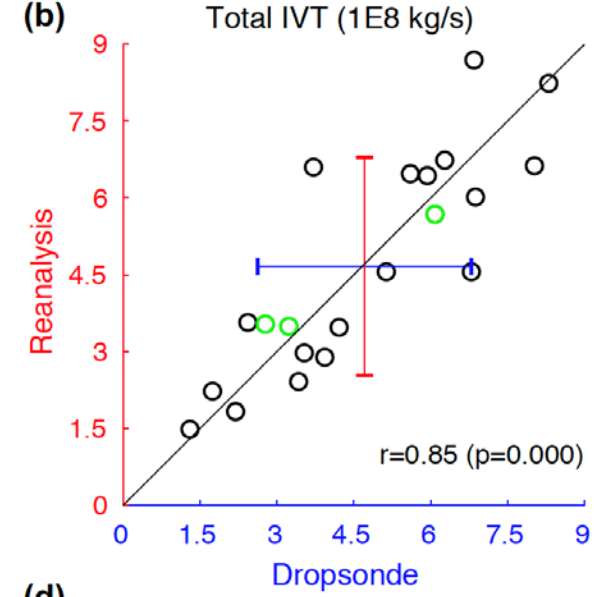
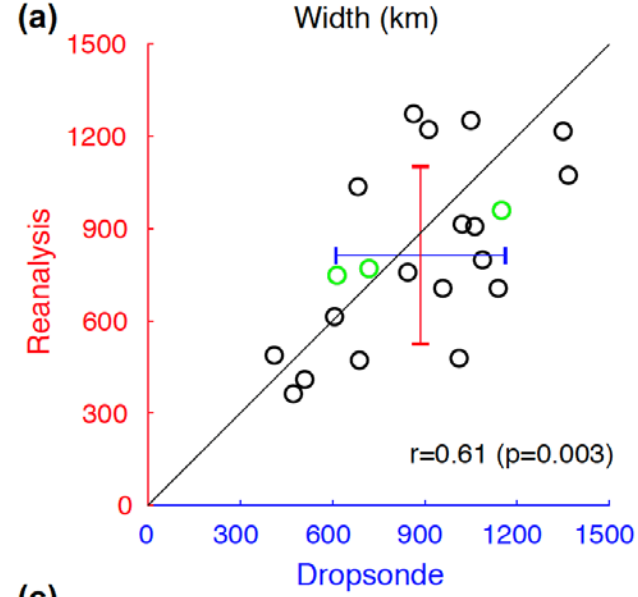
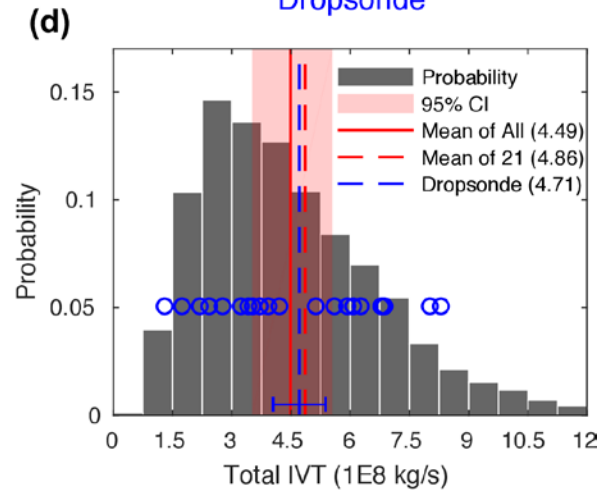
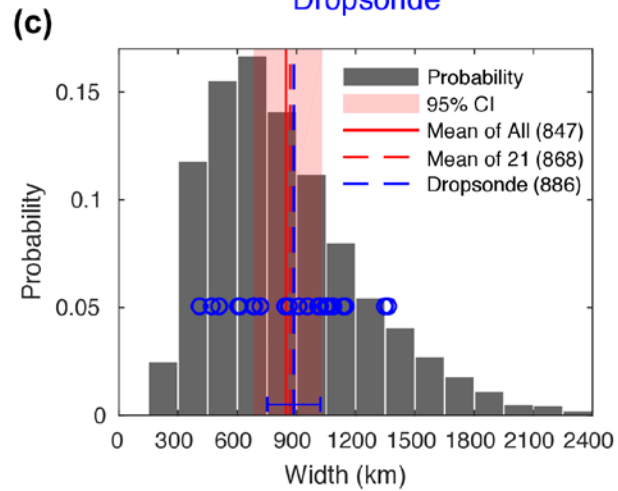
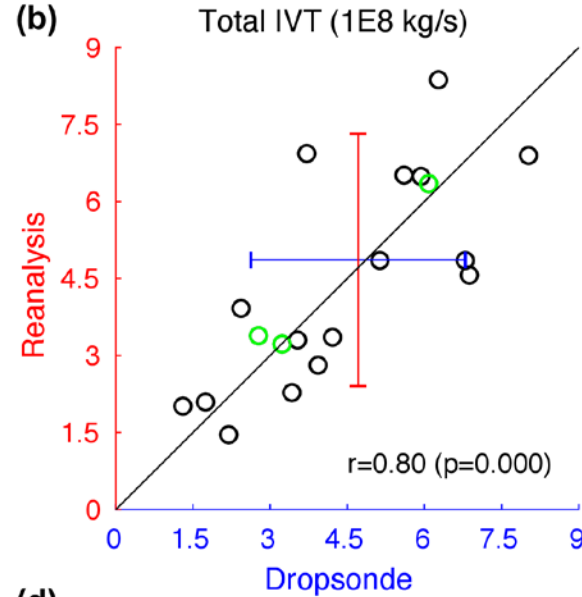
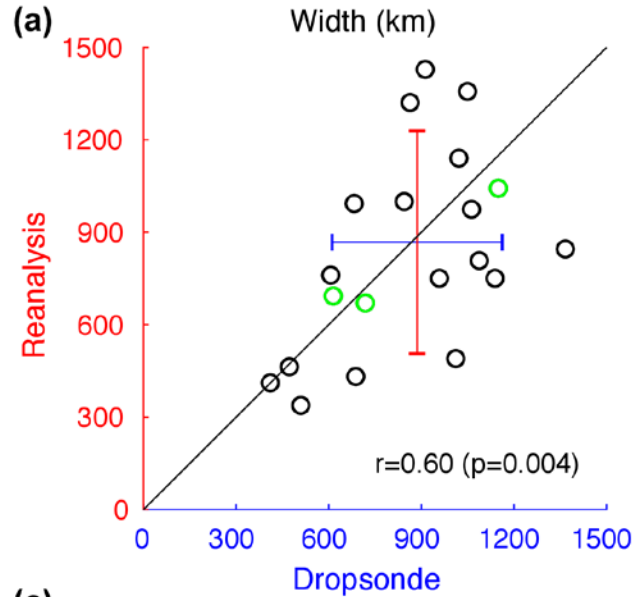
Remarkable Agreement Between Two Totally Independent AR Catalogs (ERA-Interim vs. Dropsonde)



- Top: ERA-Interim-based AR width (-2% error) and total IVT (+3% error) validate well against dropsonde observations.
- Bottom: Dropsonde-observed AR width (5% difference) and total IVT (5% difference) well represent the entire population (21 vs. ~6000 ARs).

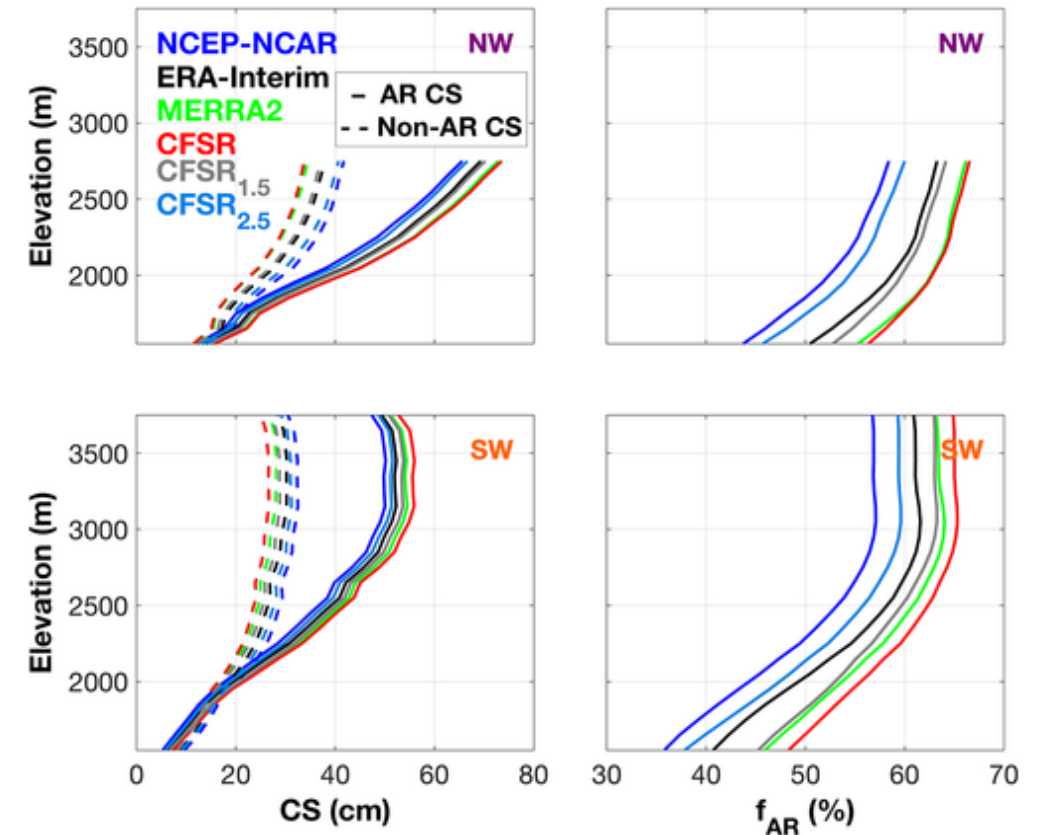
ERA-Interim

MERRA-2



Impact of Resolution

Reanalysis	Resolution
ERA5	~30km/0.28°
CFSR	0.5° and 2.5°
MERRA-2	~50km/0.625° x 0.5°
ERA-I	~79km/0.75°
JRA-55	1.25°
NCEP/NCAR	2.5°

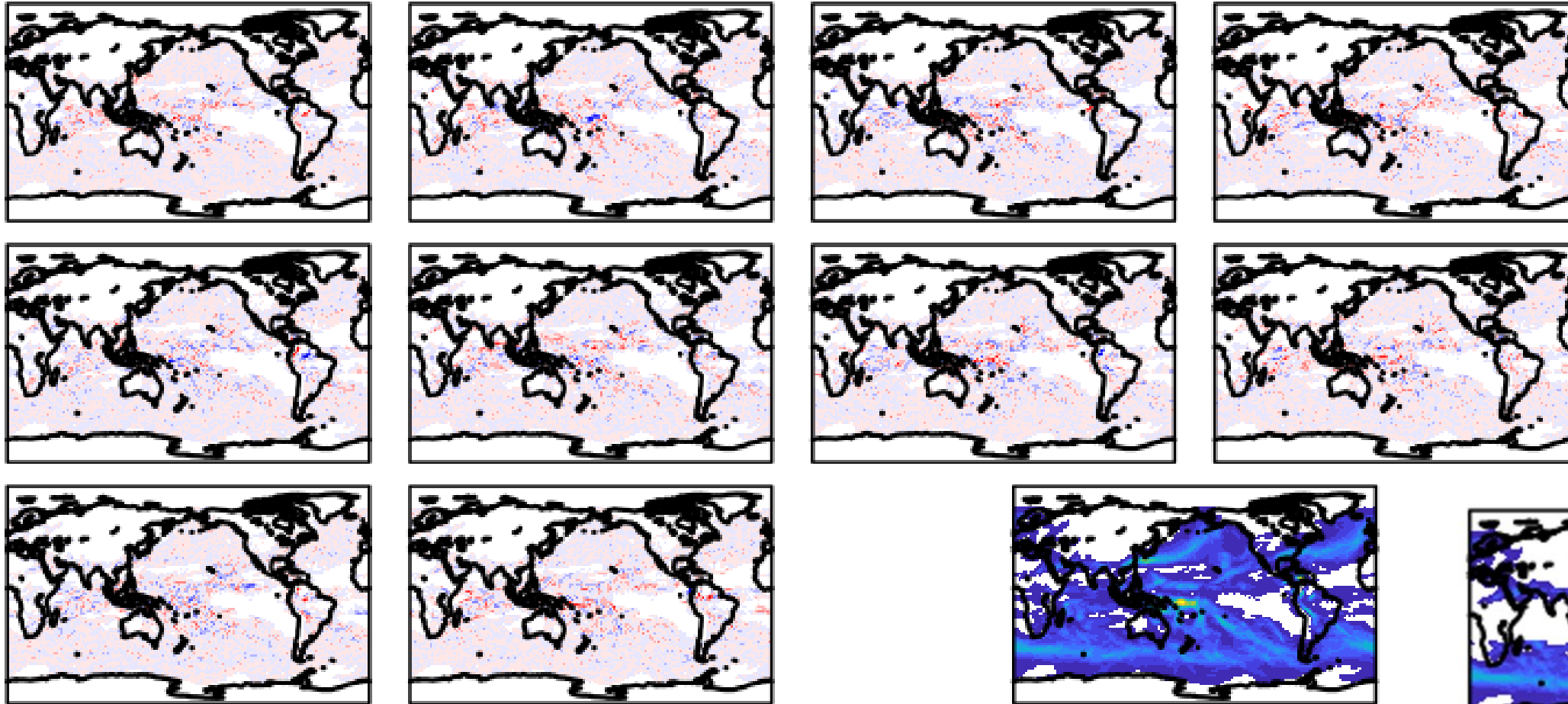


(Figure 2 from Huning et al., 2019)

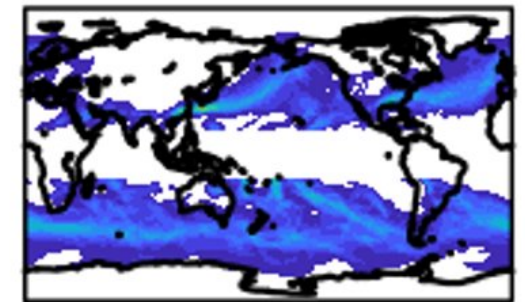
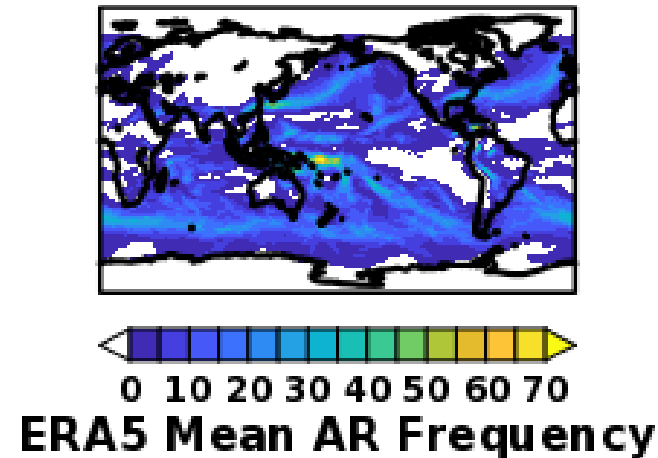
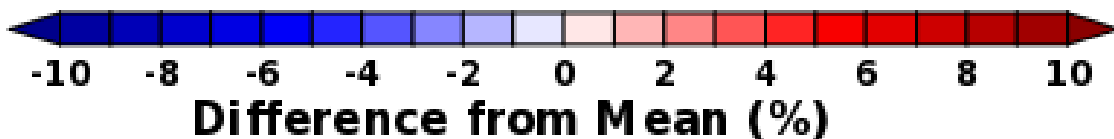
"Spatial resolution differences have relatively minor effects on the number of ARs diagnosed, with higher-resolution data sets identifying four more AR days per year, on average, during the 1985–2015 winters. However, this can lead to ~10% difference in AR attribution to the mean domain-wide seasonal cumulative snowfall (CS) and differences up to 47% snowfall attribution at the seasonal scale."

Uncertainty within a Reanalysis

February 2019



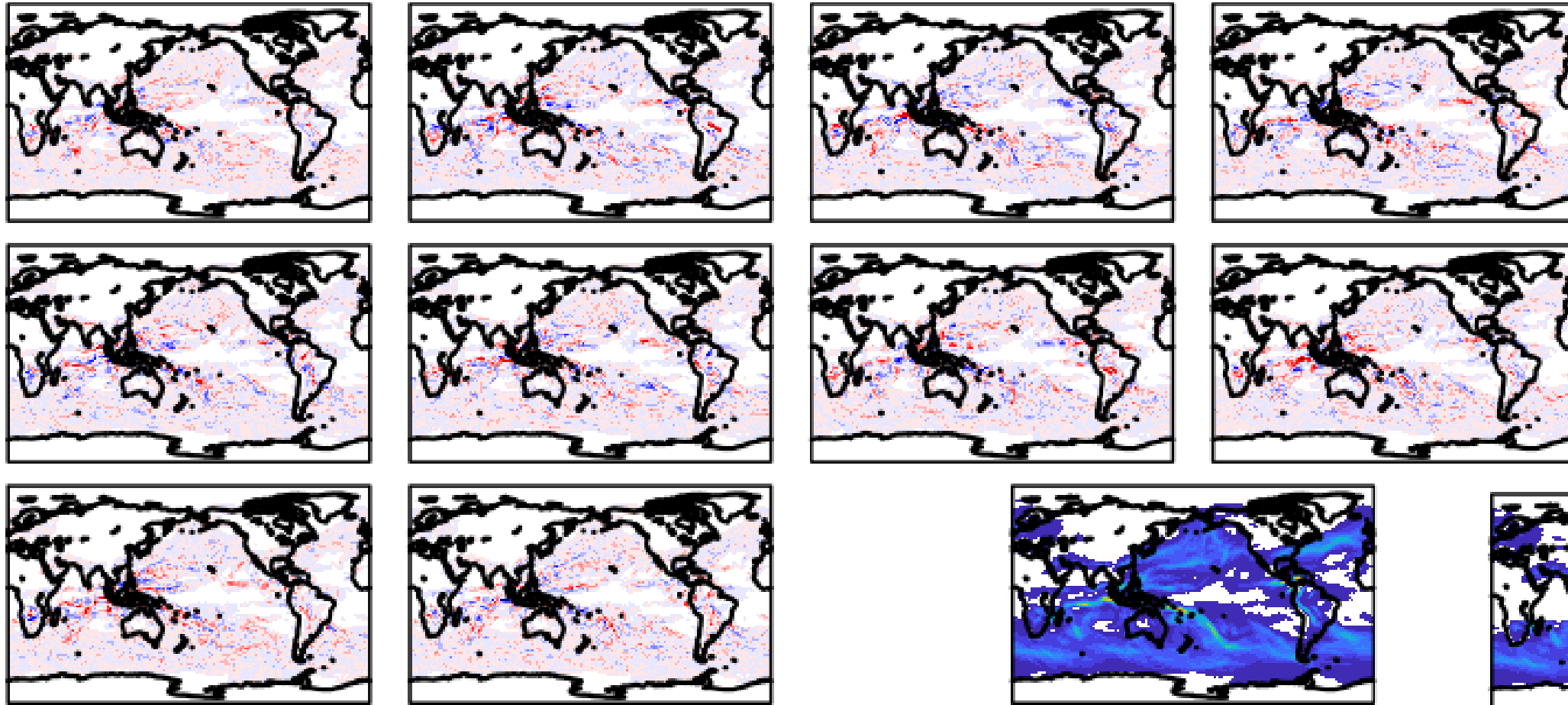
- Individual ensemble members in ERA5
- Differences are minimal, except though nearing 10% in the tropics



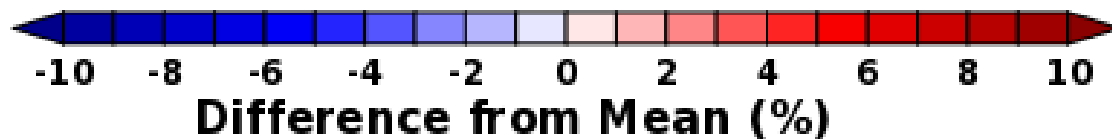
MERRA-2
(only for mid latitudes)

Uncertainty within a Reanalysis

February 1989



- Individual ensemble members in ERA5
- Differences expand to midlatitudes



MERRA-2
(only for mid
latitudes)



Moving Forward and Topics for Discussion