GLOBAL THREE-DIMENSIONAL WATER VAPOR FEATURE-TRACKING FOR HORIZONTAL WINDS USING HYPER-SPECTRAL INFRARED SOUNDER DATA FROM OVERLAPPED TRACKS OF TWO SATELLITES

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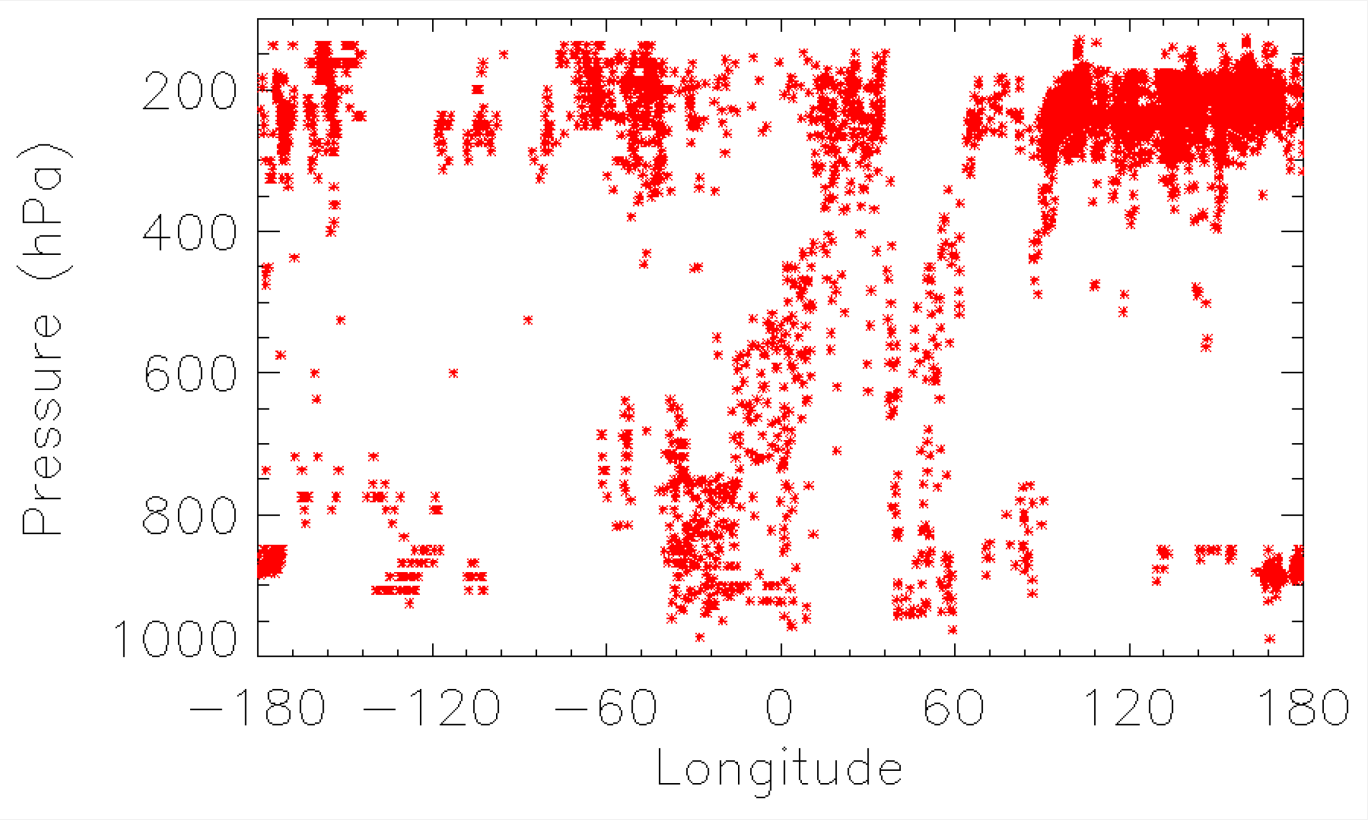
Ouyed, A., Smith, N., Zeng, X., Galarneau Jr, T., Su, H., & Dixon, R. D. (2023). Global Three-Dimensional Water Vapor Feature-Tracking for Horizontal Winds Using Hyperspectral Infrared Sounder Data From Overlapped Tracks of Two Satellites. *Geophysical Research Letters*, *50*(7), e2022GL101830.

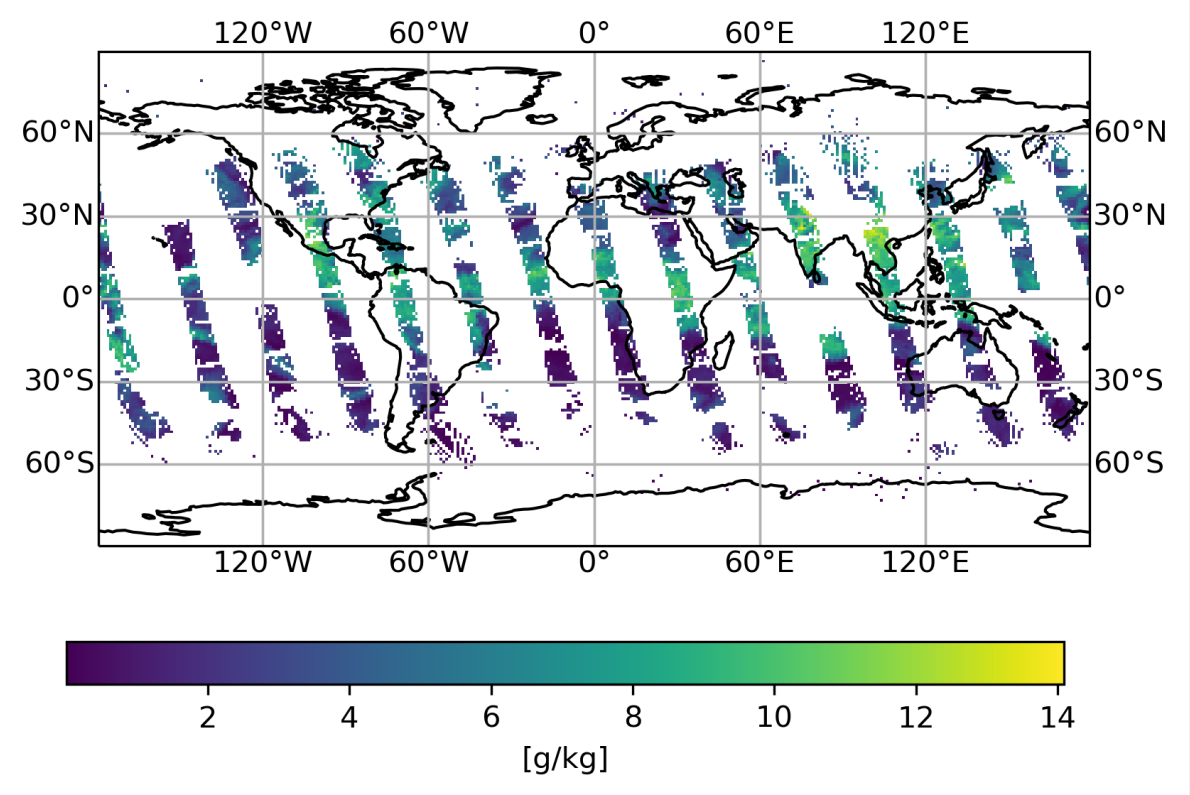
Cloud tracking AMVs leave a gap in the troposphere. Vertical cross section, 00 UTC on 10 December 2014



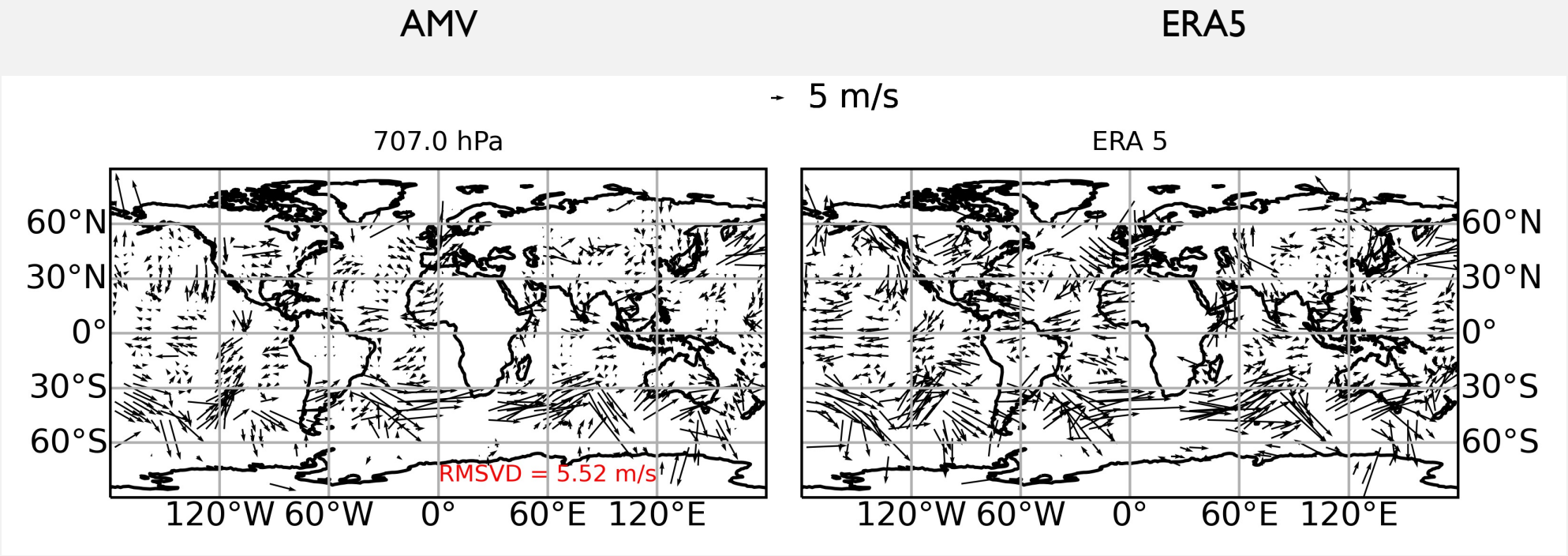
Santek, D., Nebuda, S., & Stettner, D. (2019). Demonstration and evaluation of 3D winds generated by tracking features in moisture and ozone fields derived from AIRS sounding retrievals. *Remote Sensing*, *11*(22), 2597.

We use 3D humidity fields (CLIMCAPS, 49 pressure levels) from Cross-track Infrared Sounder (CrIS) in Suomi-NPP/NOAA-20 (50 min separation) to calculate 3D AMVs from satellite overlap.

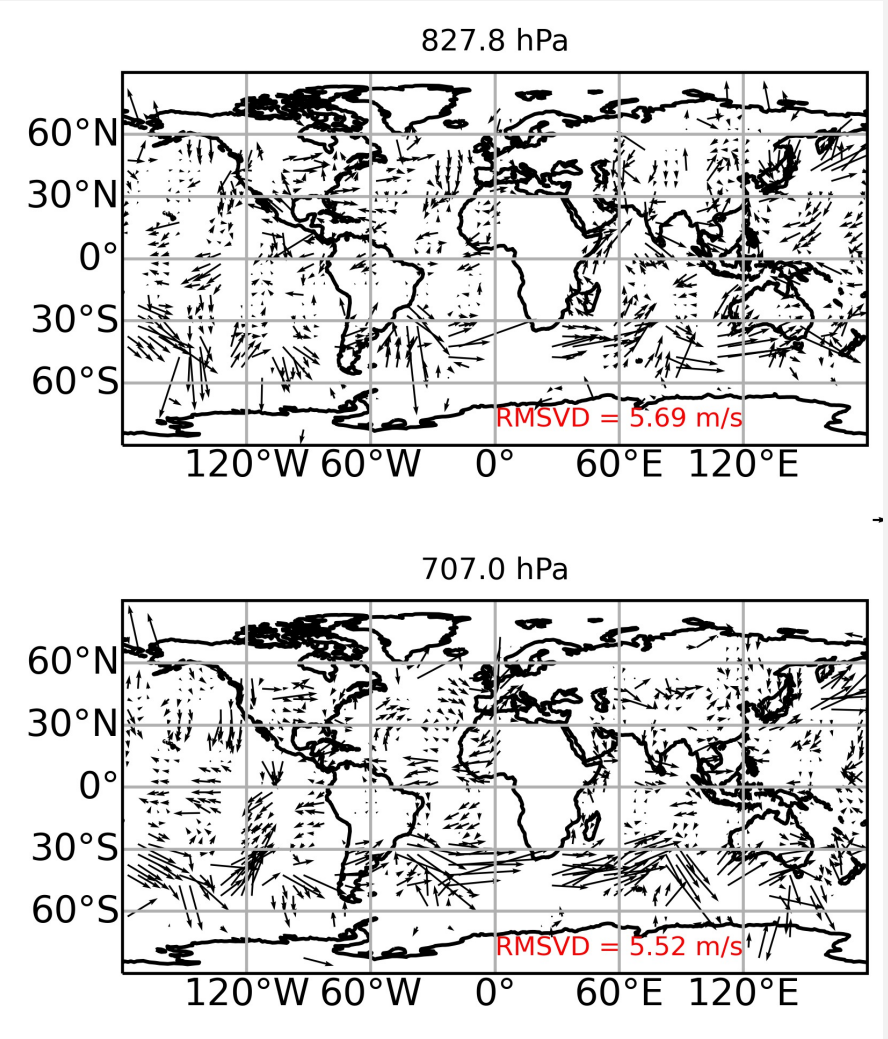
Moisture overlap patches (quality controlled) for P=706 hPa,
July 1, 2020 for Suomi-NPP, resolution= 1 degree

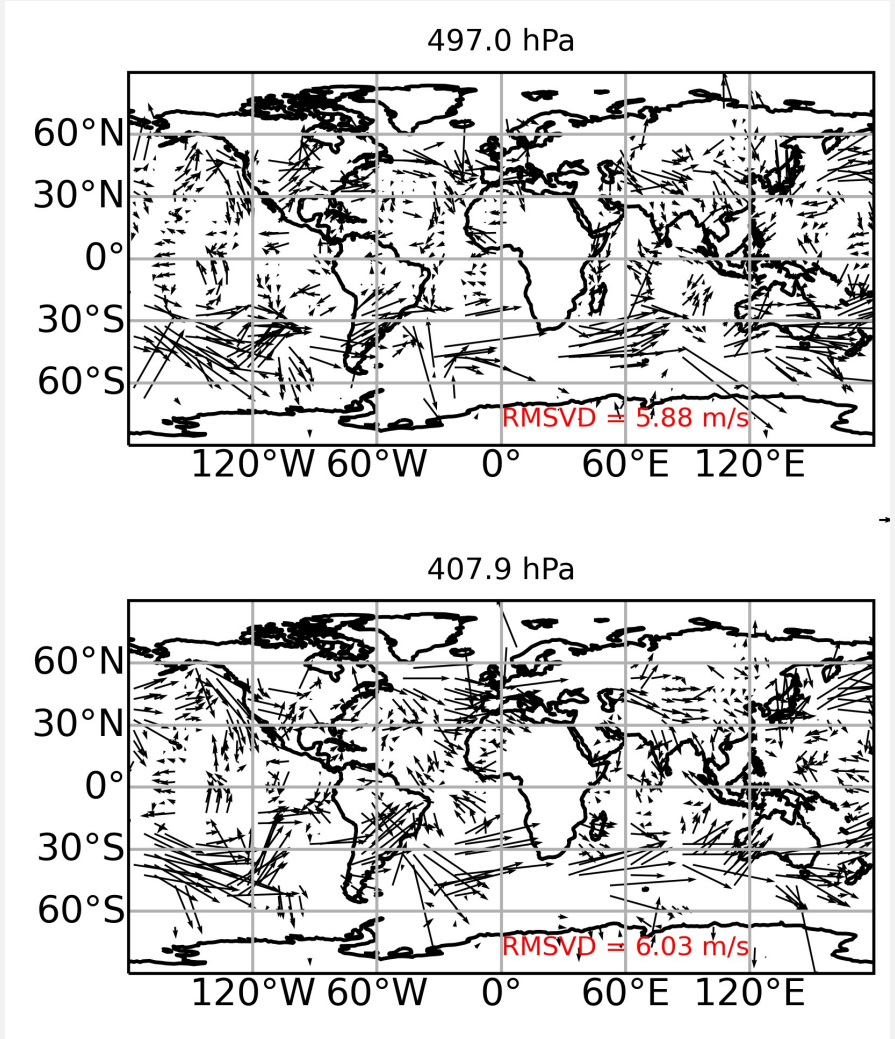


For quality control we use a threshold (δ = 10 m/s) for difference between AMVs and ERA5 (July 1, 2020, descending orbit). We also coarsen original 49 levels into 9 level, 1 deg resolution.

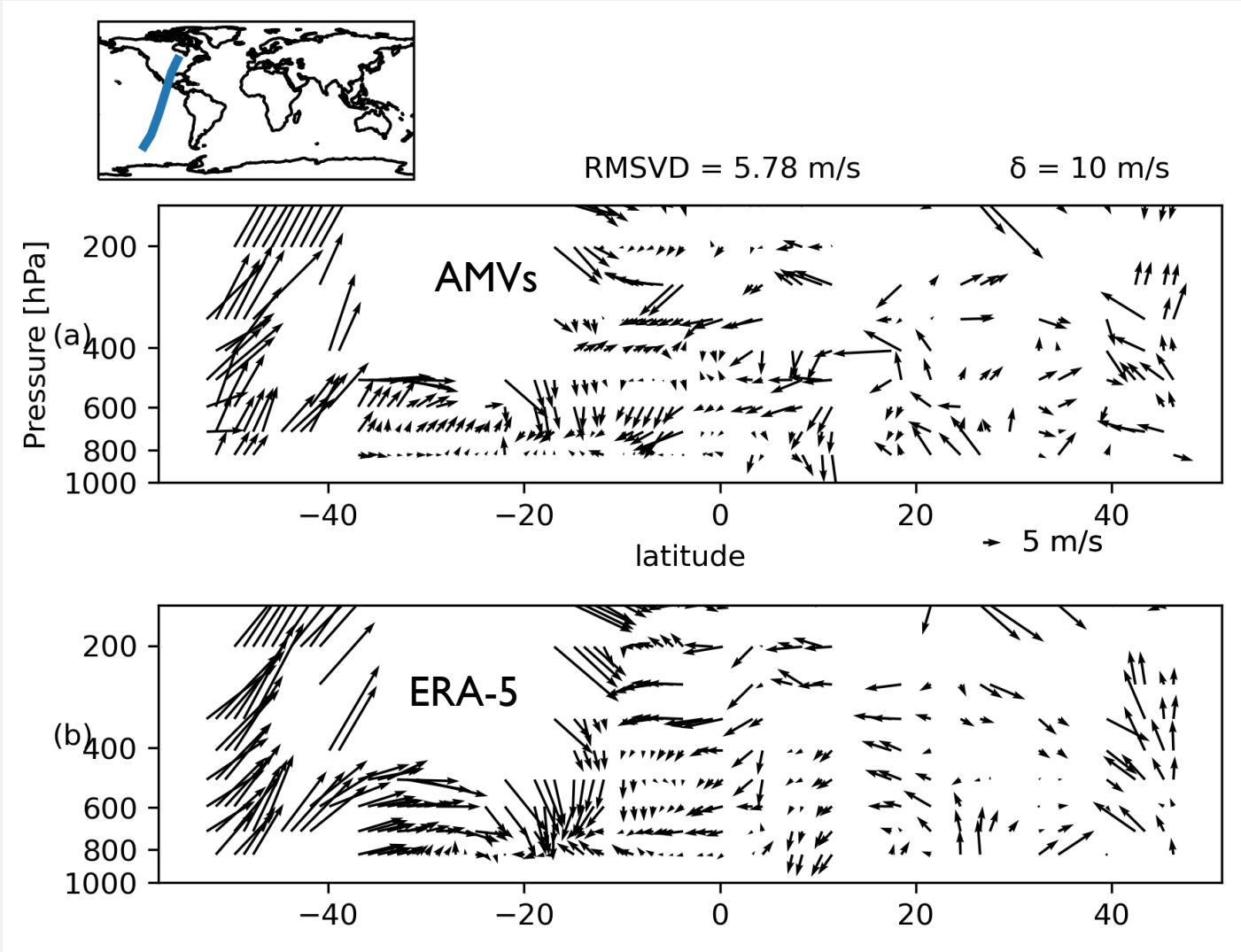


Results: First 3D AMVs that capture tropics and mid-latitudes (July 1, 2020)

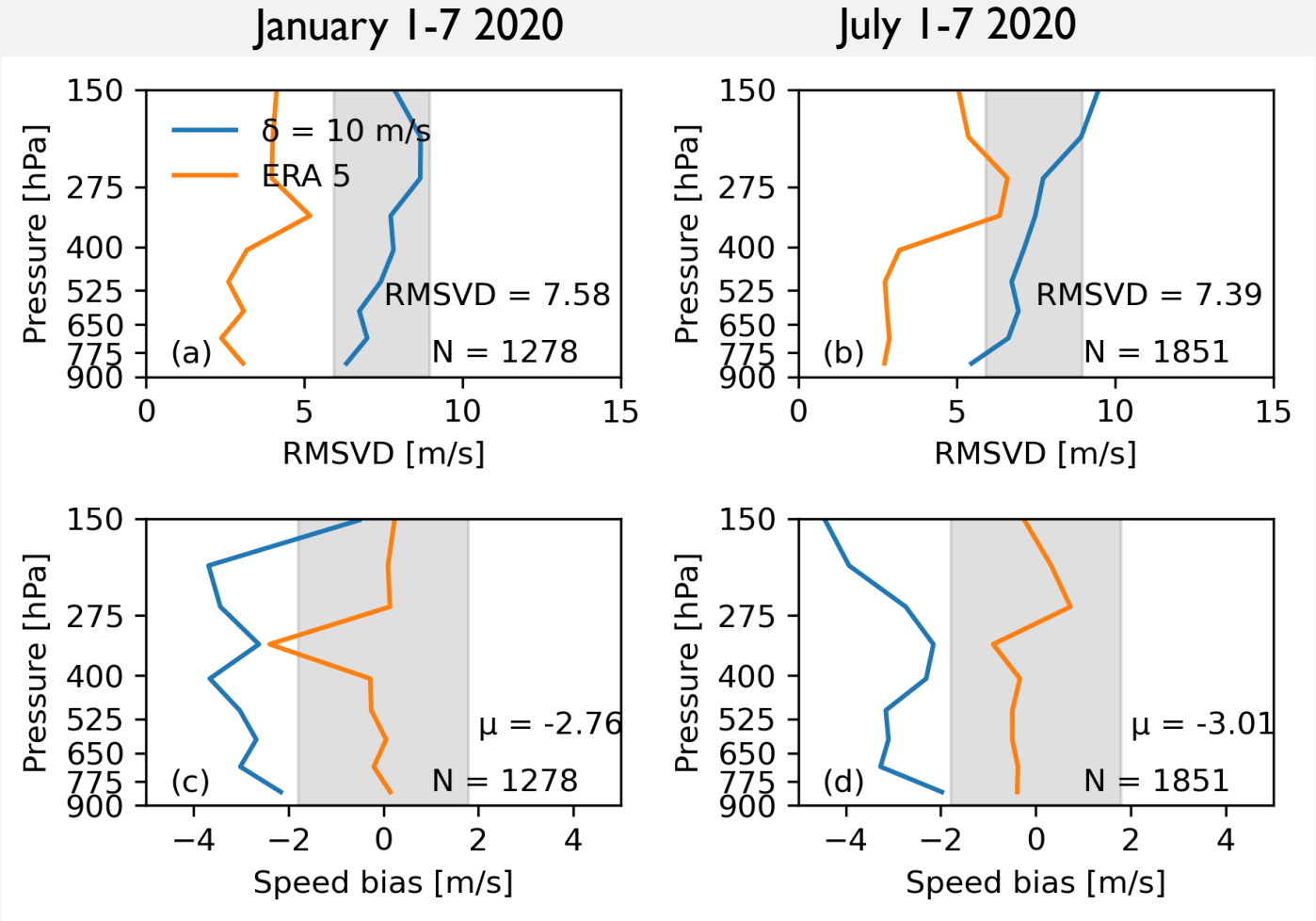




3D AMVs computed for 9 pressure levels, captures vertical profile (descending orbit).



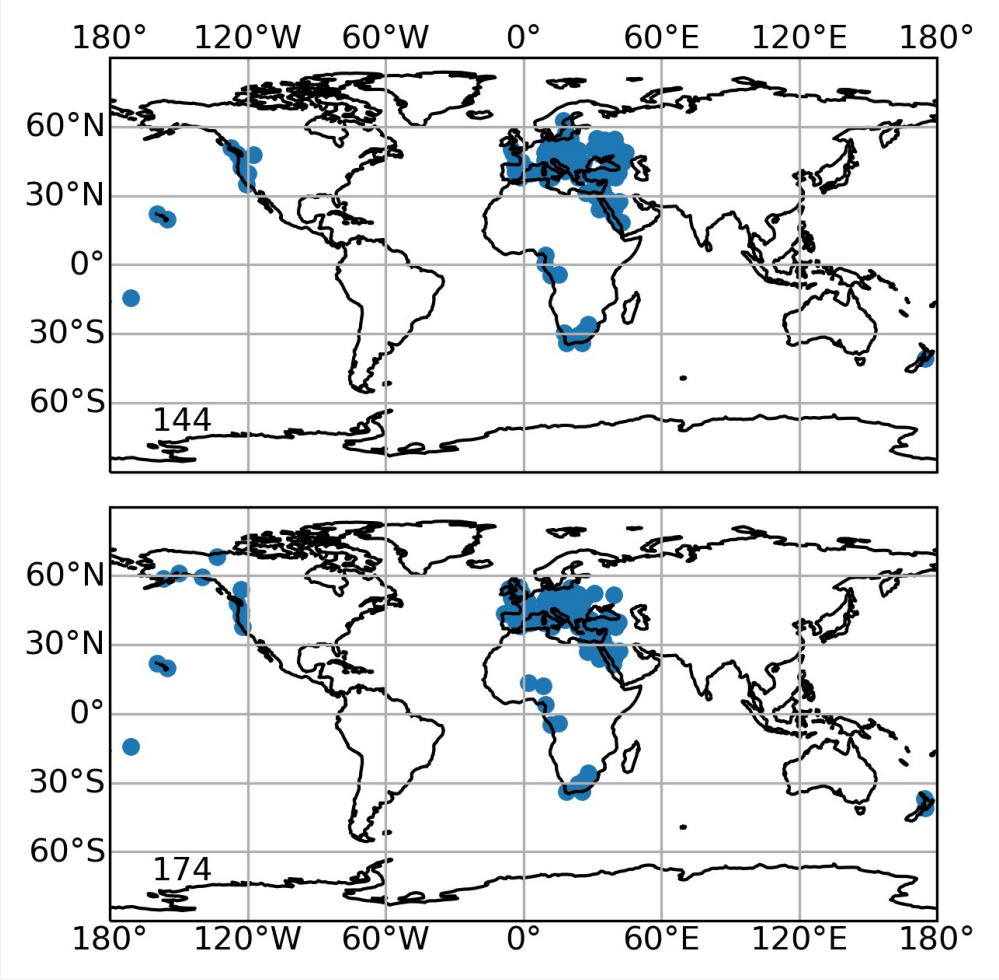
When compared to radiosondes, 3D AMVs within RMSVD of operational GEO AMVs (grey region). However, speed bias is large.



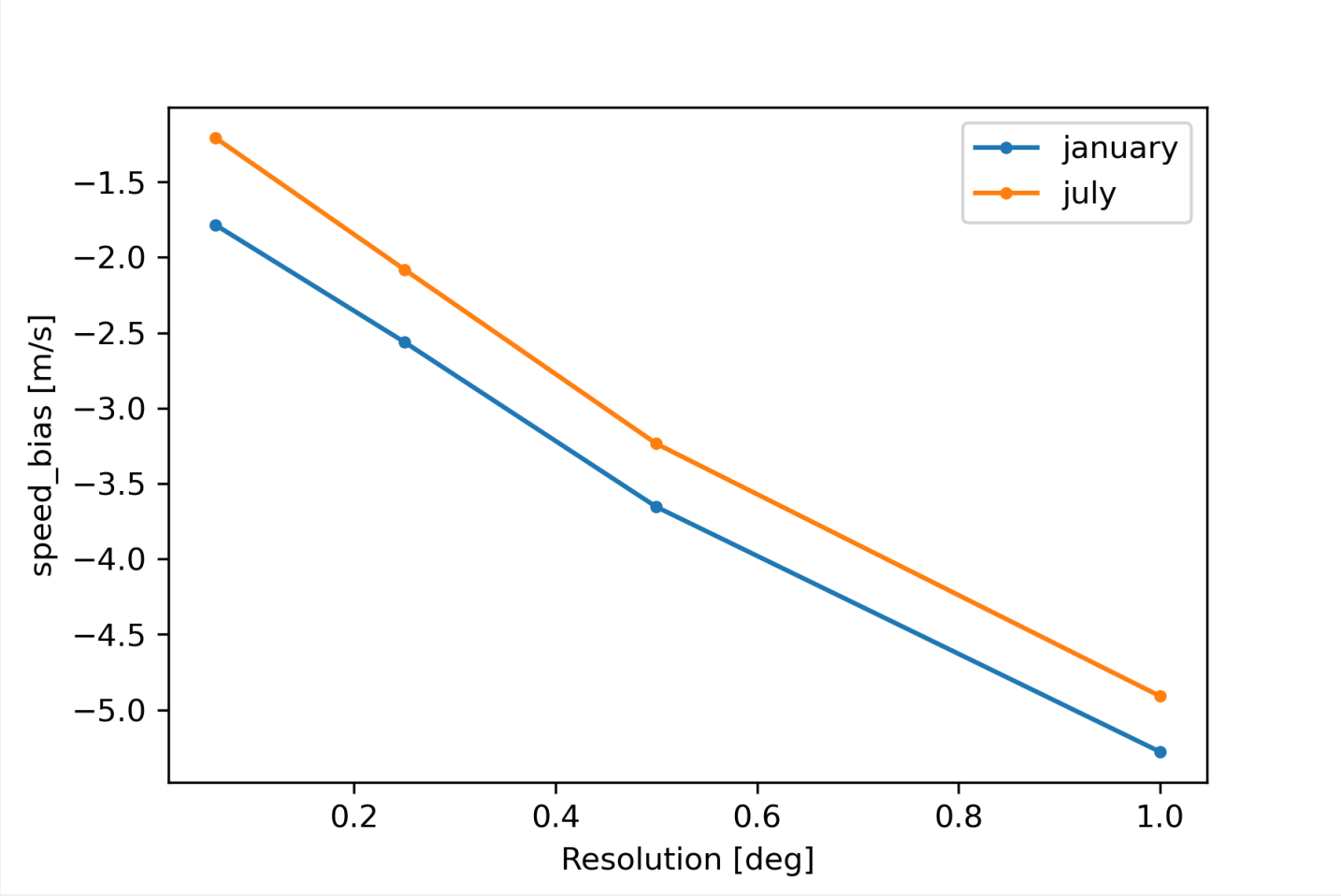
Maps of radiosondes used

January 1-7 2020

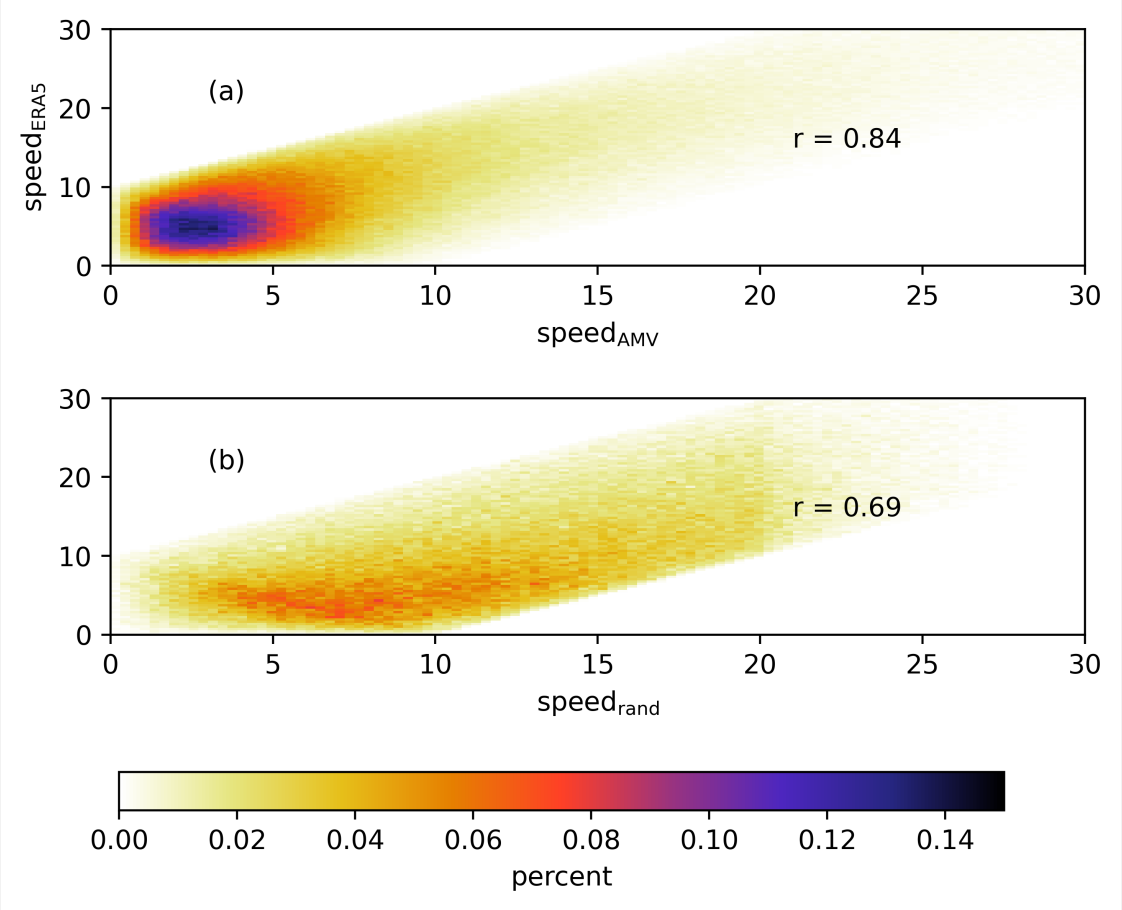
July 1-7 2020



Experiments with G5NR show that speed bias depends on resolution, therefore large speed bias of 3D AMVs related to coarse resolution



Even if coarse error check correlates AMVs with ERA-5, they are more informative than error-checked random vectors



Conclusion

- Produced 3D AMVs from 70S to 70N for the first time through CrIS (CLIMCAPS) from SNPP and NOAA-20 satellite overlap.
- Algorithm outputs ~10,000 wind profiles per day.
- Coarse resolution (1 deg) leads to large slow speed bias.
- To reduce slow speed bias, higher resolution hyperspectral infrared instruments needed.