Jet Propulsion Laboratory
California Institute of Technology

Validation of AIRS Total Precipitable Water Vapor (TPW) Over CONUS

Qing Yue

03/2016 AIRS Spring STM

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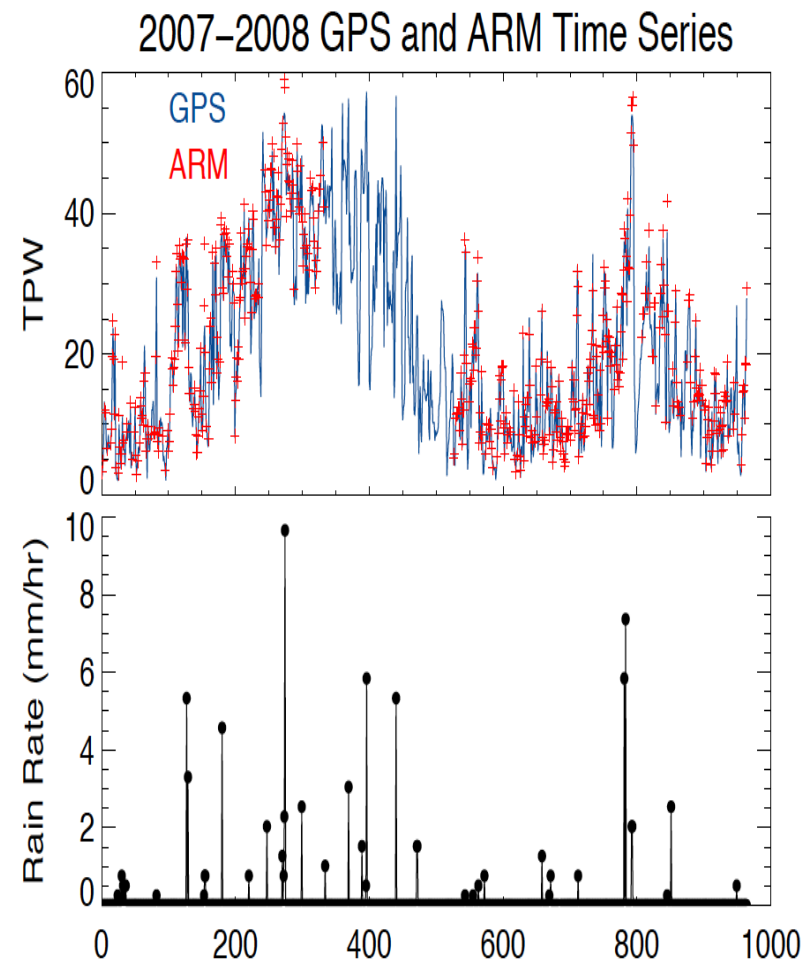
Testing/Validation

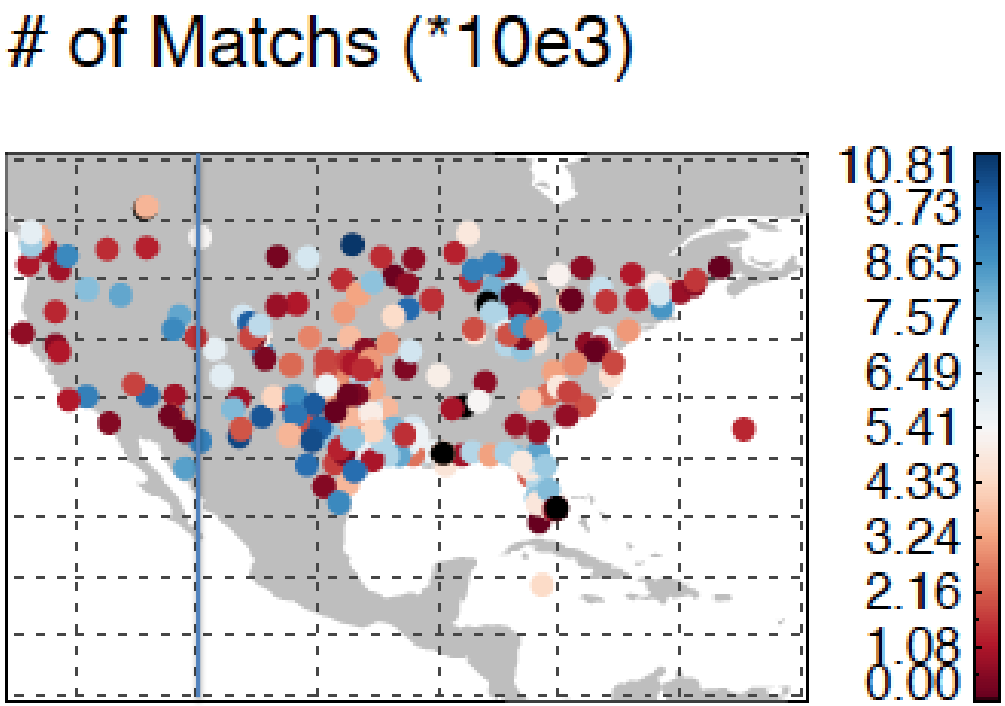
- Comparison of AIRS TPW standard retrieval (V6.22, V6.2, V6.0), and AIRS Neural Network (NNW) TPW and ground-based observations:
  1. SuomiNet TPW data from ground-based GPS receiver (Ware et al. , 2000, BAMS).
     - 30min average data from 2006-2014

- Collocation criteria:
  - Temporal: < 30min
  - Spatial: < 100 km (~60 km)

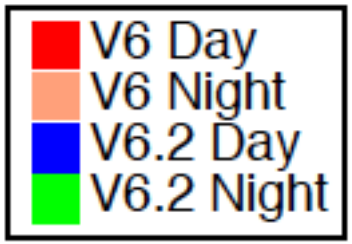
- GPS data quality: <= 2mm; not affected by cloud and precip.
  - 1 mbar pressure error => 0.36 mm of PWV error
  - 5K of temp error => 0.13mm PWV error



SuomiNet GPS Stations



- 240 stations.
- Data at 30min resolution from 2006 to 2014
- These stations have co-located surface met packs
- Divided into W.US and E.US by -110° longitude
- **From a user's point of view, examine the quality of AIRS TPW data at different versions.**



- Greatly Increased QC=0 Yield in V6.22

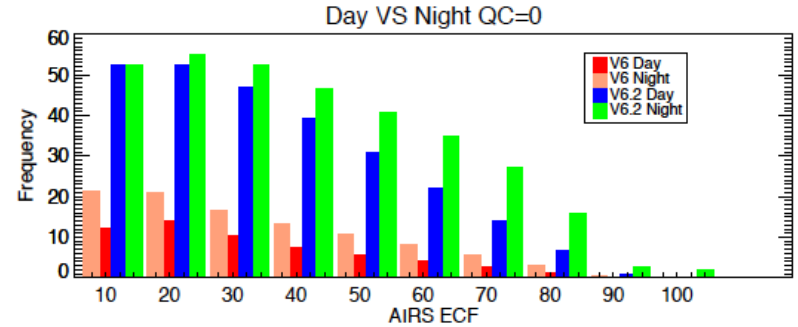
6.22 vs 6

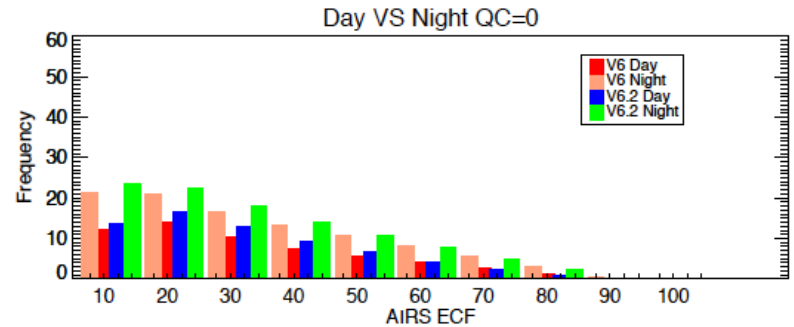
6.2 vs 6

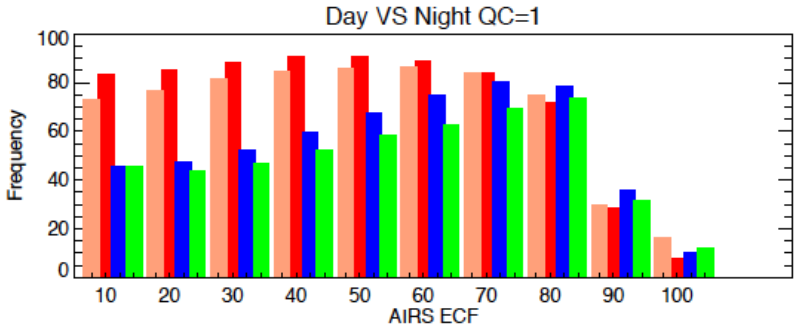
QC= 0

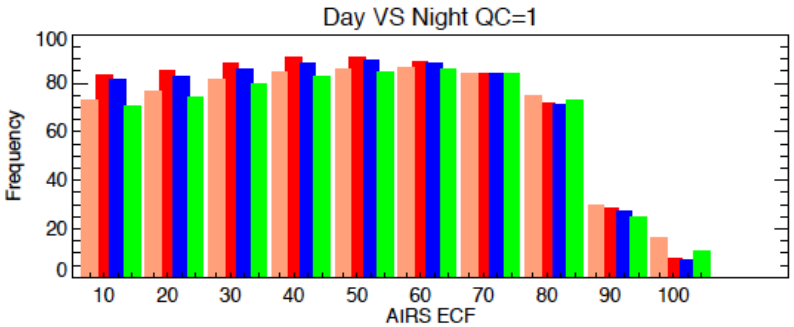
QC= 1

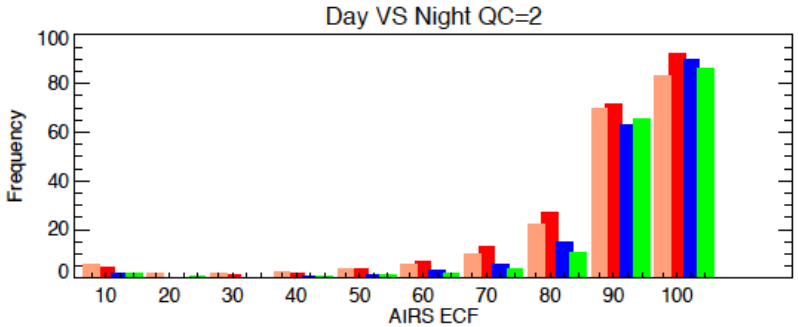
QC= 2

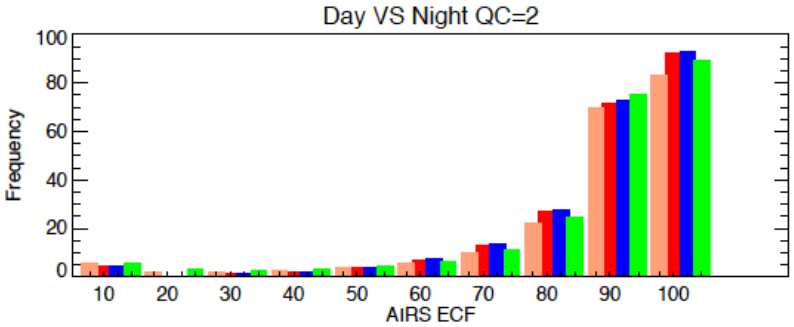




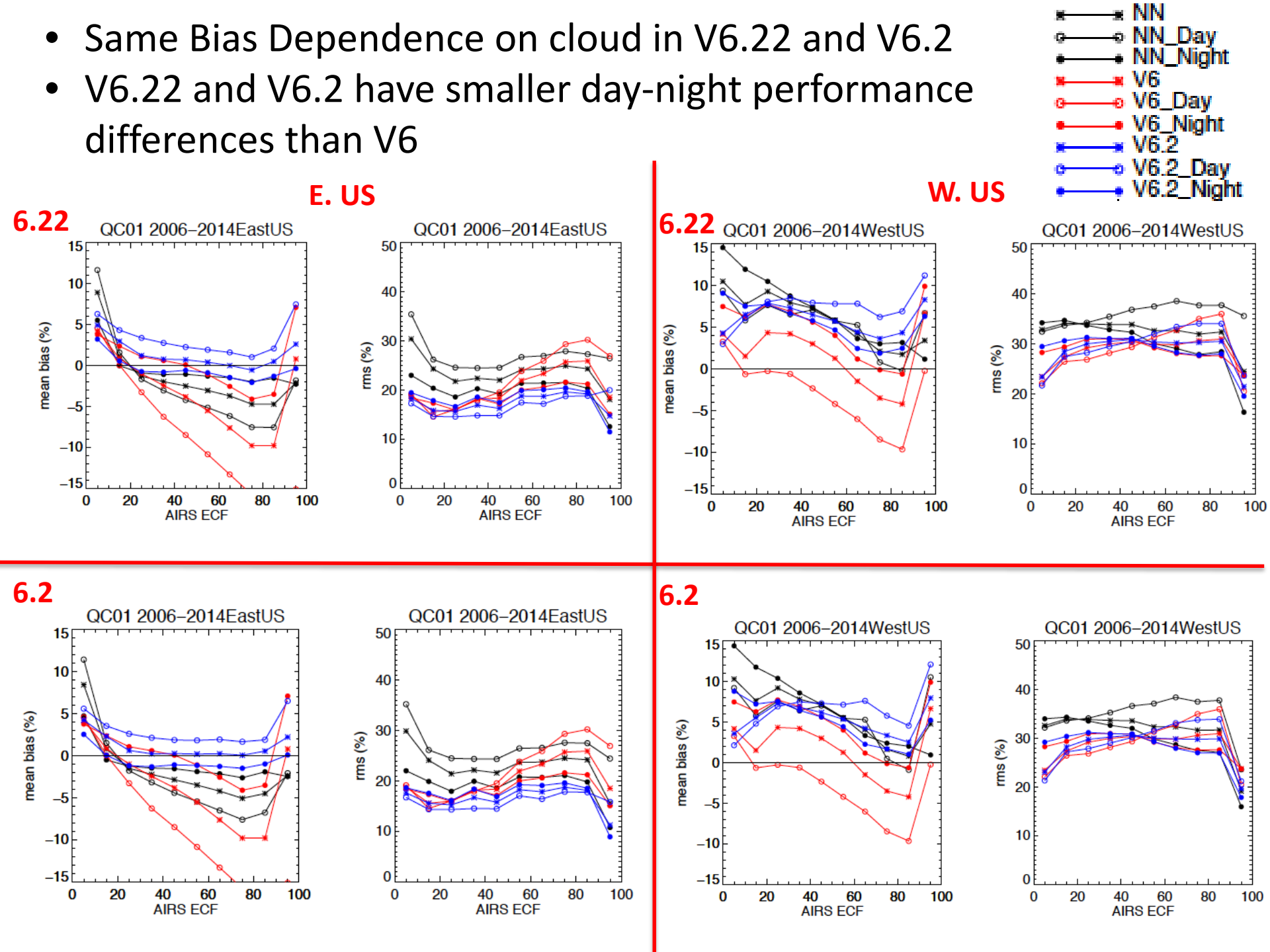






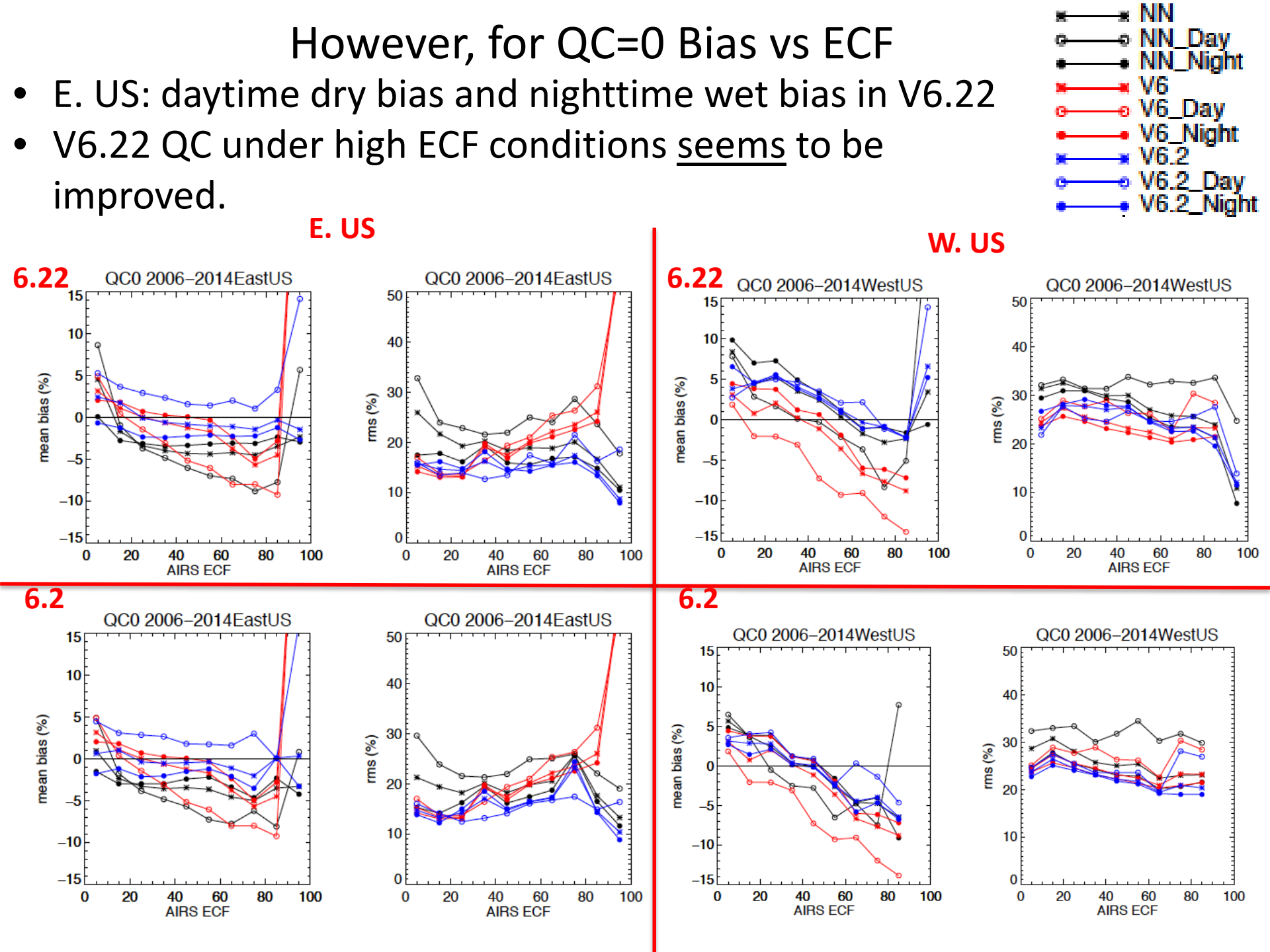


- Same Bias Dependence on cloud in V6.22 and V6.2
- V6.22 and V6.2 have smaller day-night performance differences than V6



However, for QC=0 Bias vs ECF

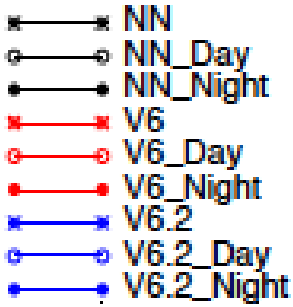
- E. US: daytime dry bias and nighttime wet bias in V6.22
- V6.22 QC under high ECF conditions <u>seems</u> to be improved.



Sampling Bias by ECF: Better Mean TPW Climatology in V6.22

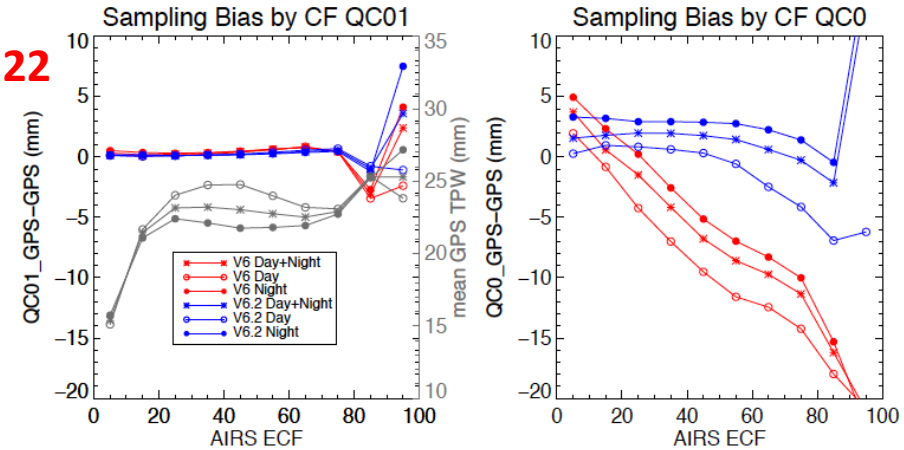
Quantified as the difference between GPS filtered by AIRS QC and GPS with no filtering

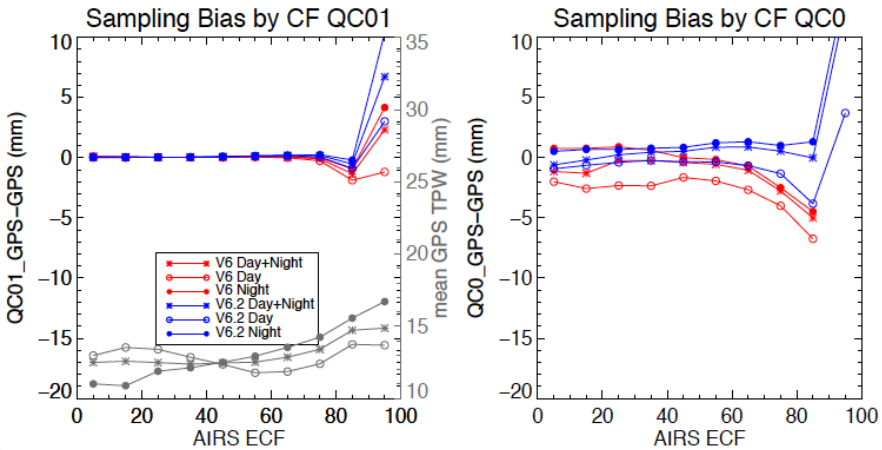
- Sampling bias smaller in V6.22
- QC=0 Climatology?



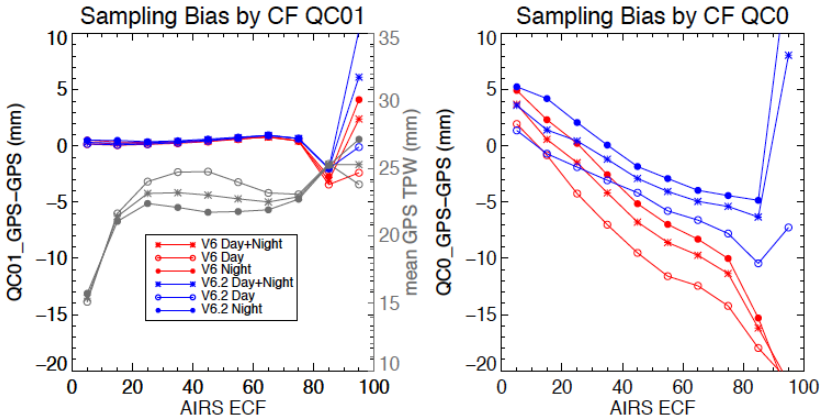
E. US **W. US**

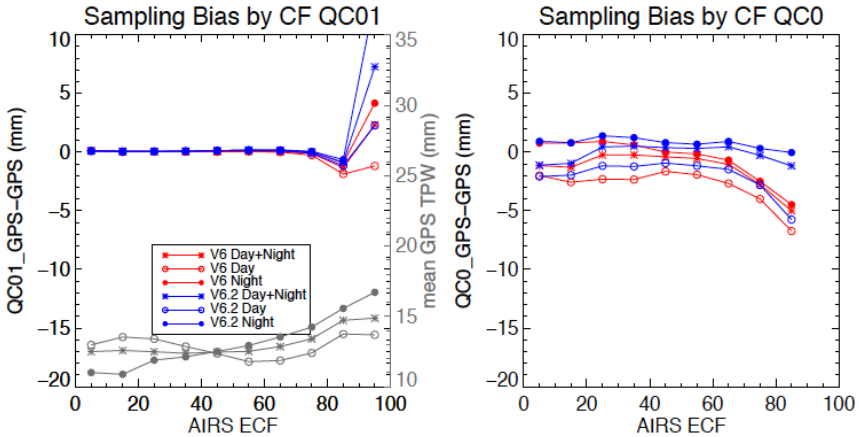
6.22





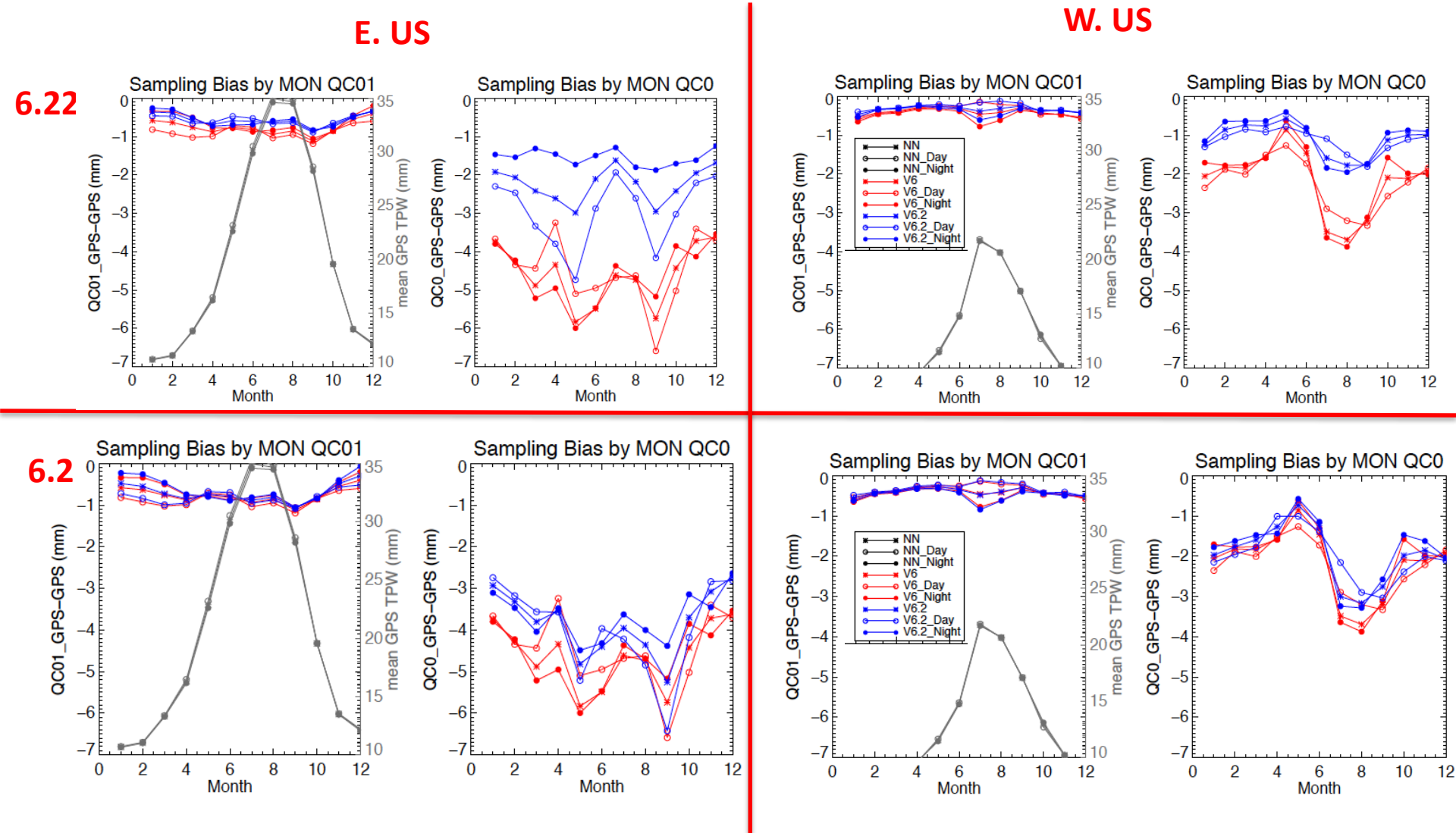
6.2



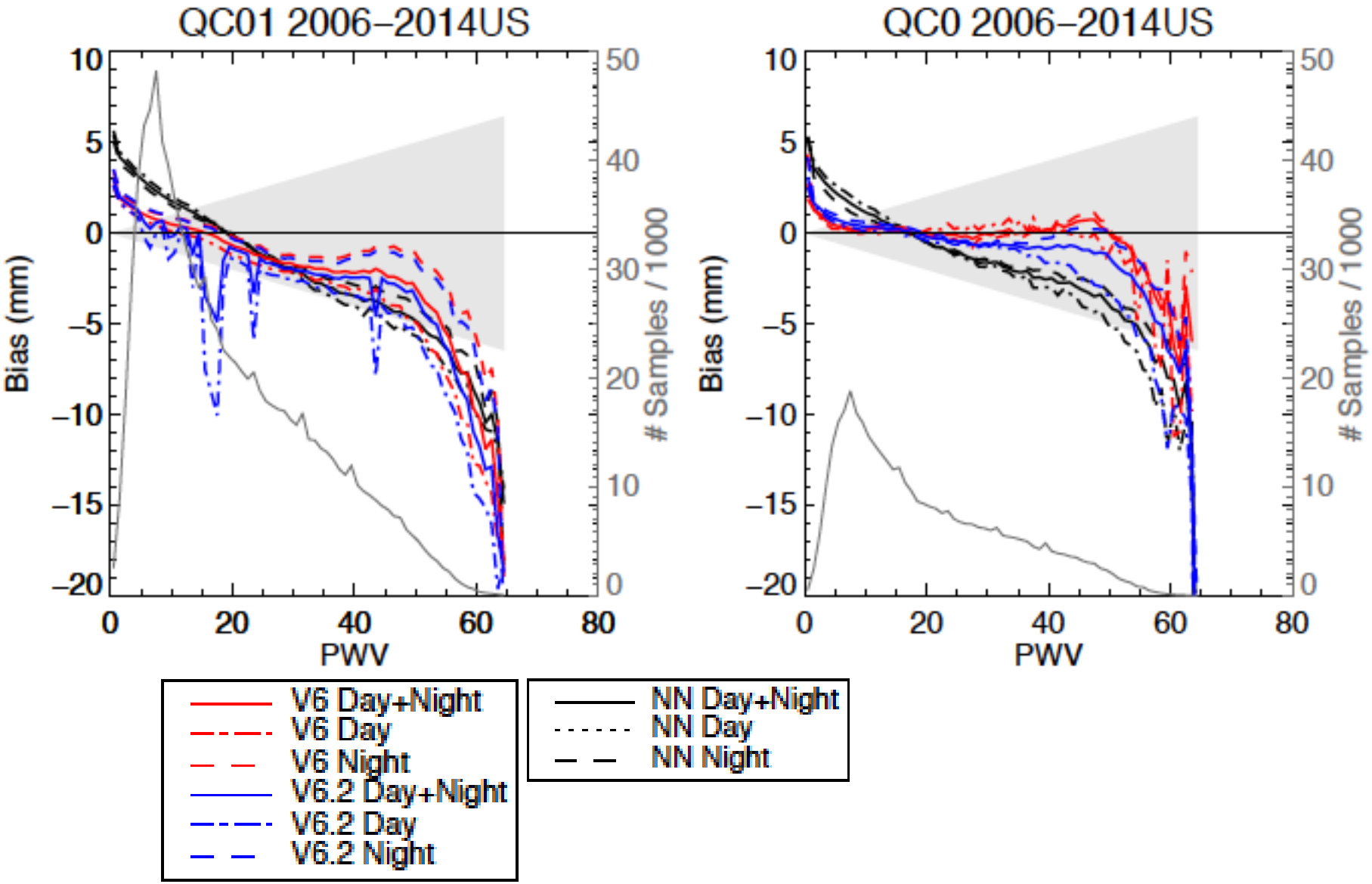


Sampling Bias by Month: Better Mean TPW Climatology in V6.22

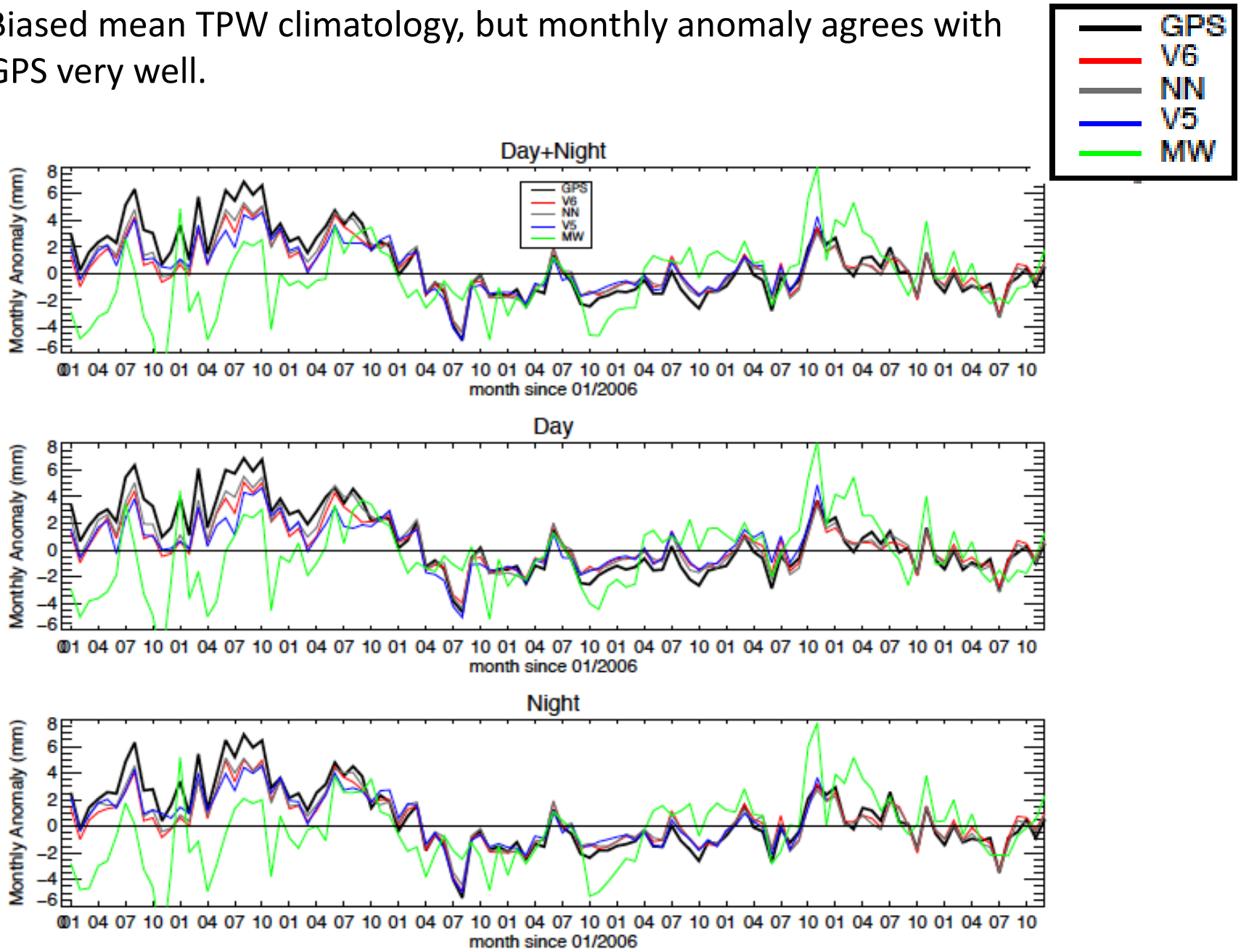
- Sampling bias smaller in V6.22
- QC=0 Climatology?



- Wet bias under dry conditions and dry bias under wet conditions, which does not change with versions, and also exists in NNW.



- Biased mean TPW climatology, but monthly anomaly agrees with GPS very well.



Summary

- Limited validation from a user's point of view. Qced by different flags.
- Wet bias under dry conditions and dry bias under wet conditions, which does not change with versions, and also exists in NNW.
- For most of PWV ranges, on average AIRS retrieved TPW is within 10% difference with the GPS TPW.
- Biased mean climatology, great monthly anomaly time series.
- Yield increase: V6.22>>V6.2>V6
- Bias vs ECF:
  - E. US: V6.22≈V6.2 > V6
  - W. US: not clear, but day-night performance difference smaller in V6.22 and V6.2
- Sampling bias: V6.22 < V6.2 < V6