

Consistent Cloud Retrievals Through Harmonization of Infrared Bands Using Deep Learning and Coincident Geostationary Imagery

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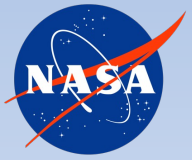
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Data Curation

- Identify all “good” G13 and G16 pixels per image on overlap days 1-5 Jan 2018
 - +/-60° Latitude and Phase either clear, snow, liquid water, or ice cloud
- Aggregate each G13 and G16 image to a 10' grid
- Identify suitable matching G13 and G16 grid boxes – homogeneity requirement must balance cloud advection and dynamic range considerations
 - At least 5 samples per grid box
 - Cloud/Clear phase of grid box must be homogenous and in agreement
 - 3.9- μm and 11- μm BT < 1 K



Training Method

- Split into 95% Training (3,074,022), 4% Validation (129,432), and 1% Testing (32,359)
- Predict G13 T11, T39, T67, and T133 using G16 predictors
 - T39
 - T67
 - T87
 - T11
 - T12
 - T133
 - T39 – T11
 - T67 – T11
 - T87 – T11
 - T11 – T12
 - T11 – T133
 - T12 – T133
 - SZA
- Can account for spectrally induced bias and absolute radiometric bias (small if any)
- Not meant to and impossible to account for time difference/advection
 - Time matching better in the NH and on FD scans – bottom of SH → 30-min Δt
 - Clouds will be different even with perfect calibration



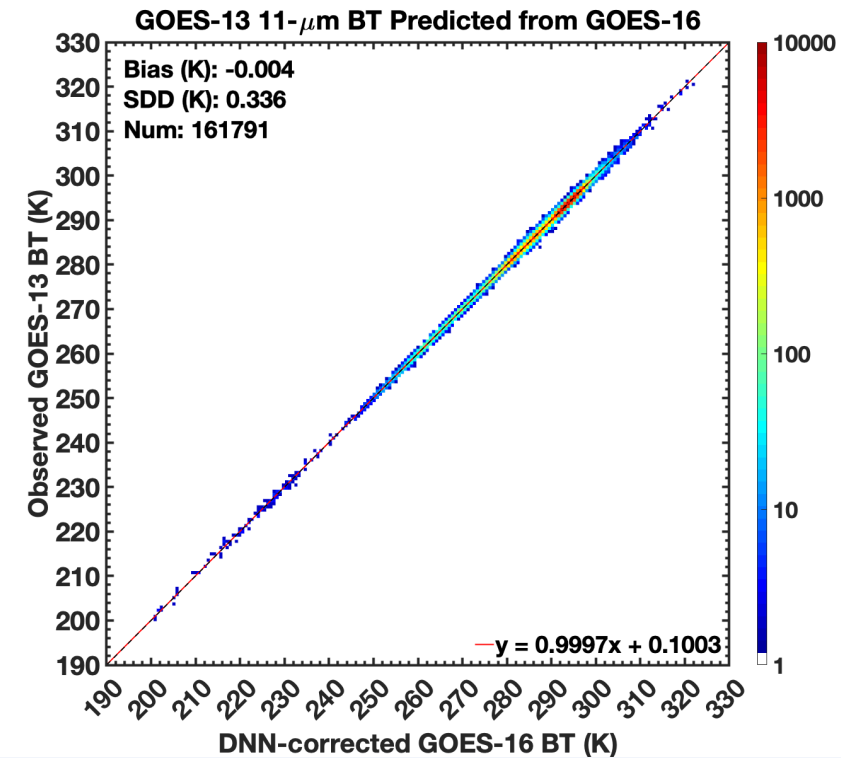
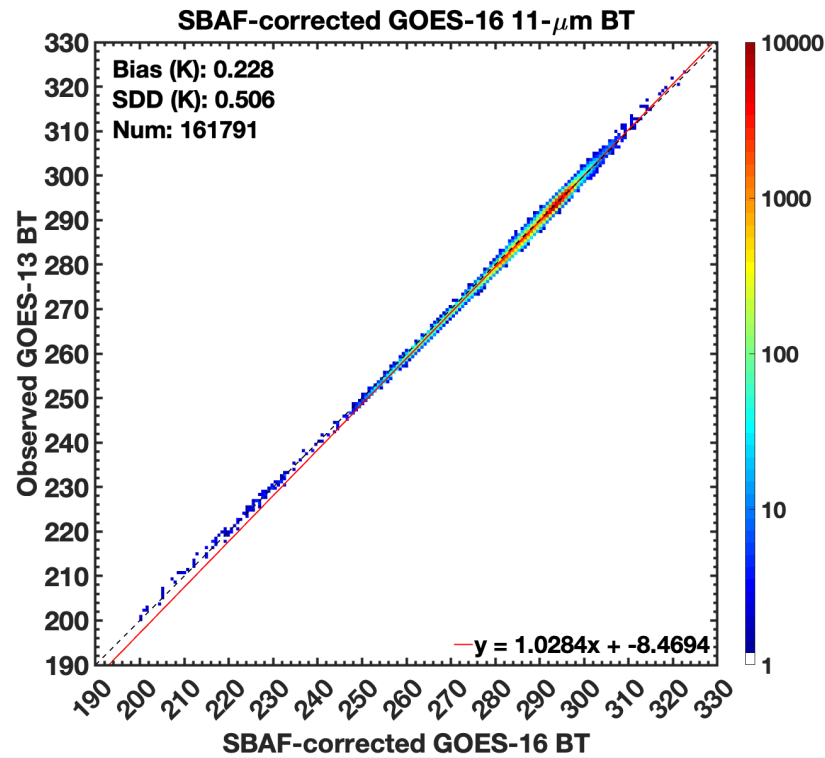
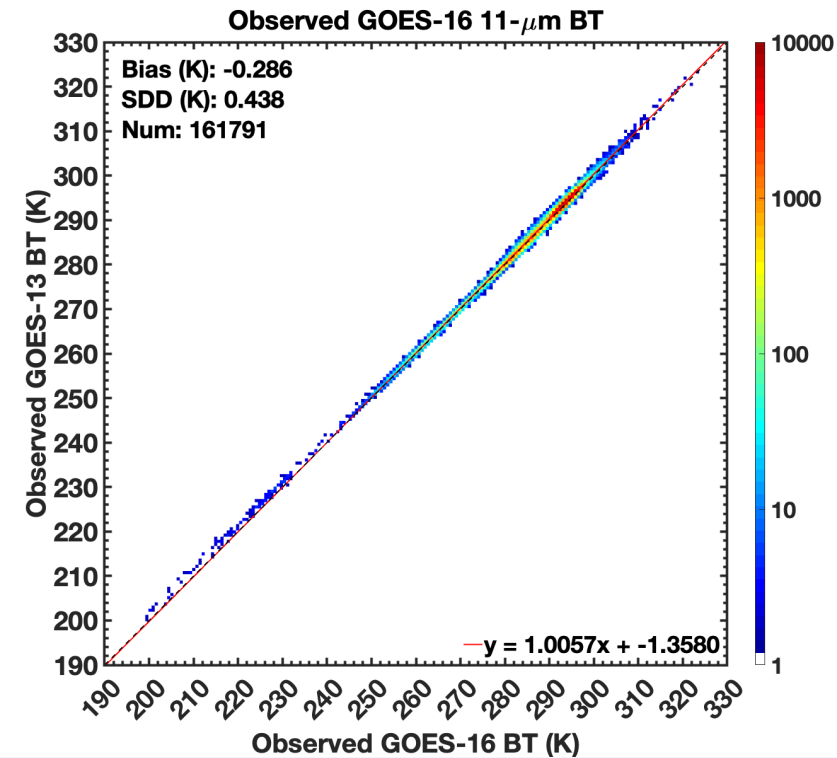
Validation + Testing Sets

11- μ m

Original

With SBAF

With Neural Net





Validation + Testing Sets

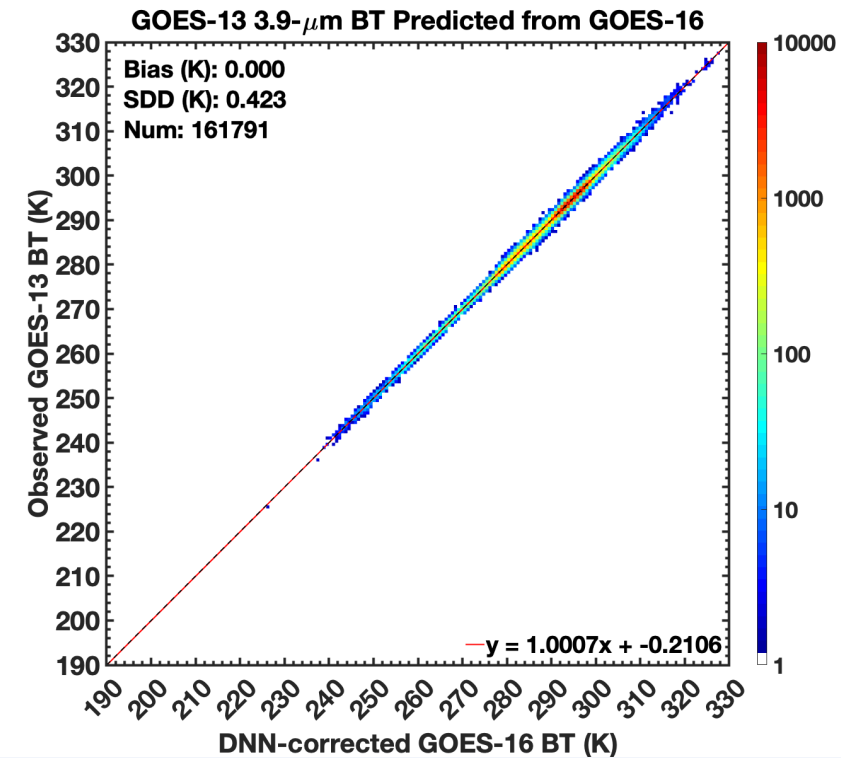
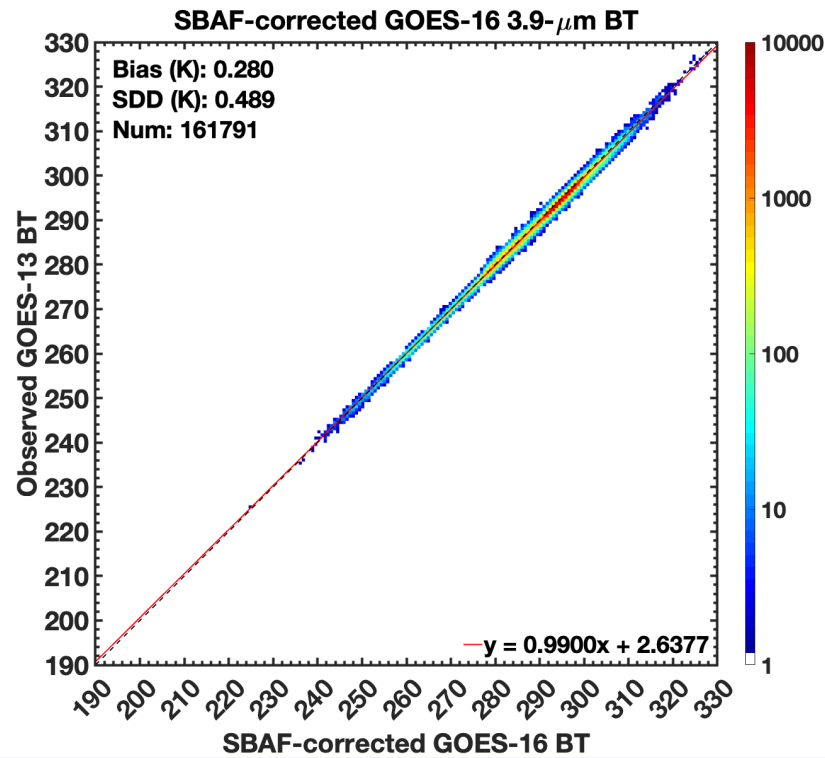
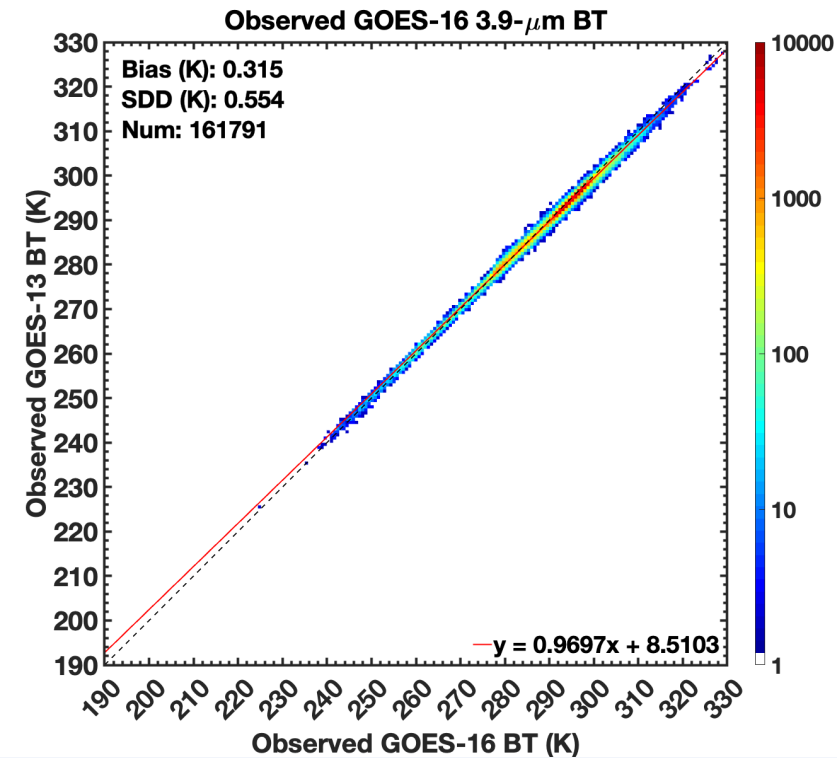
3.9- μm



Original

With SBAF

With Neural Net





Validation + Testing Sets

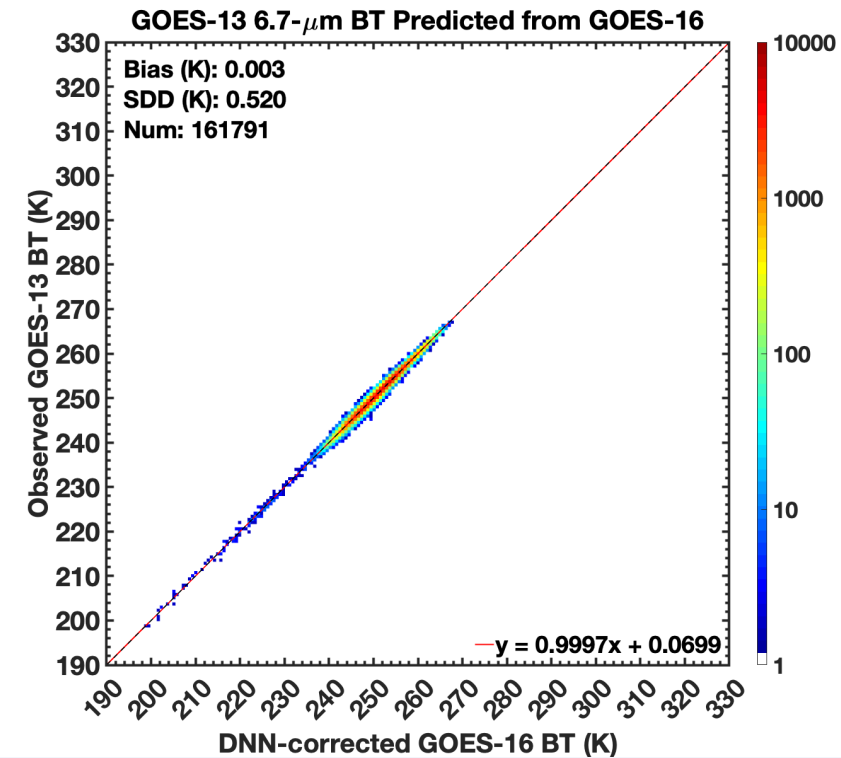
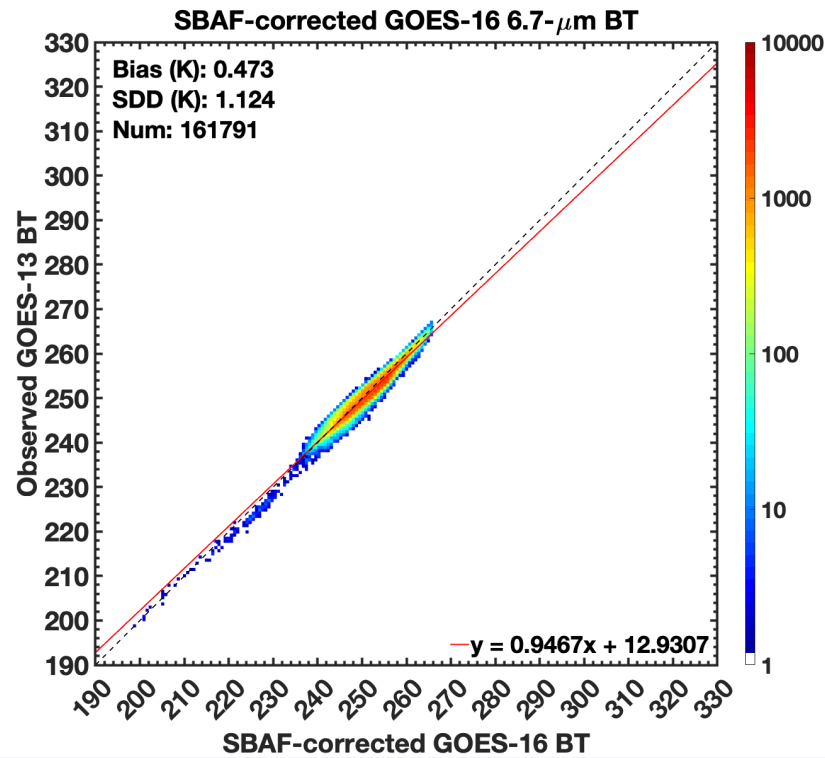
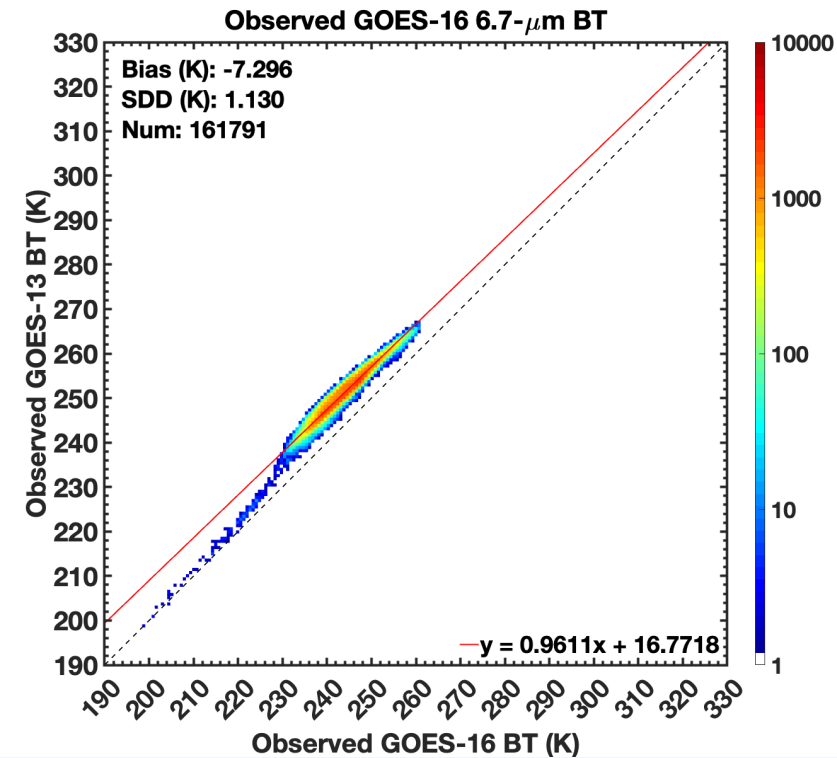
6.7- μm



Original

With SBAF

With Neural Net





Validation + Testing Sets

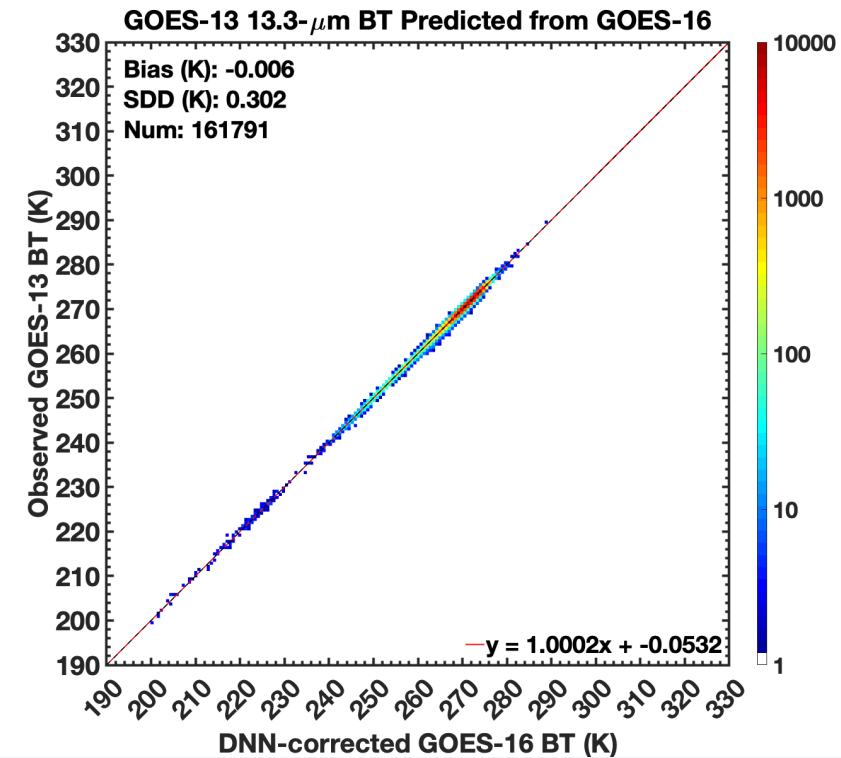
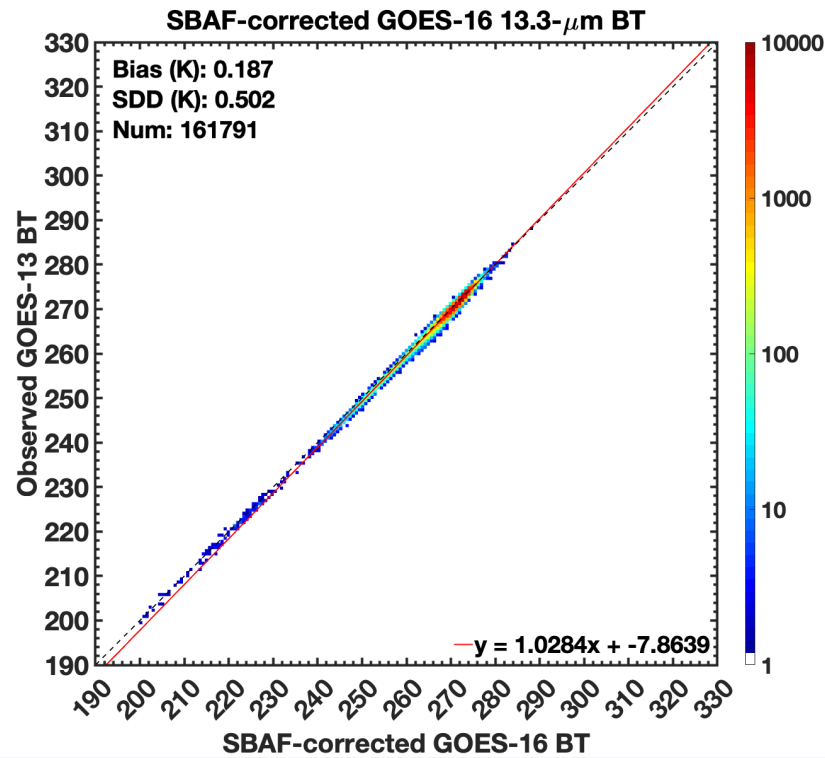
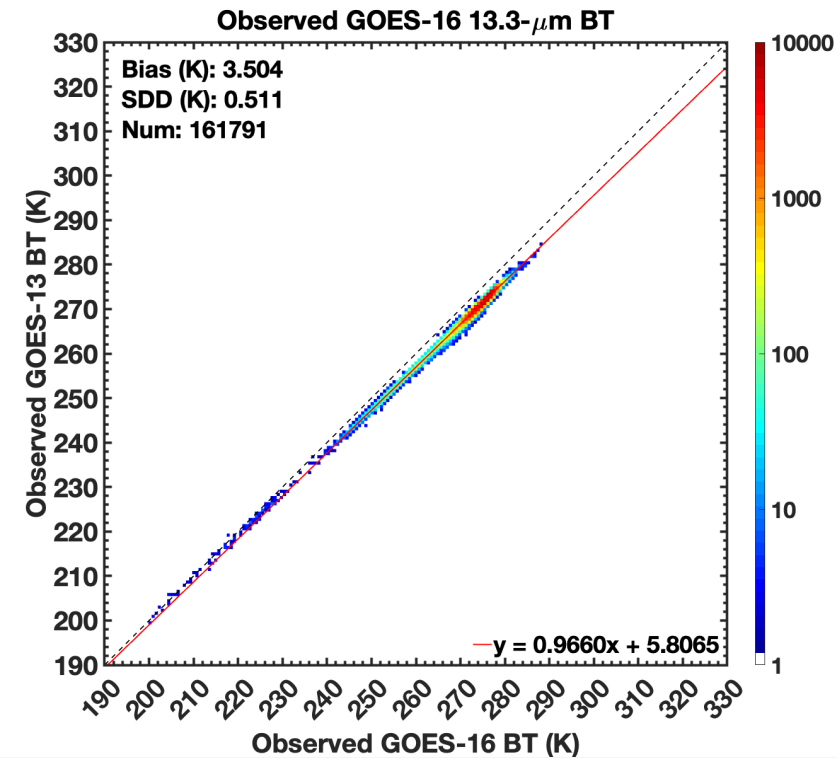
13.3- μm

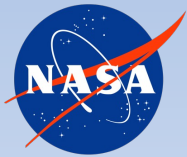


Original

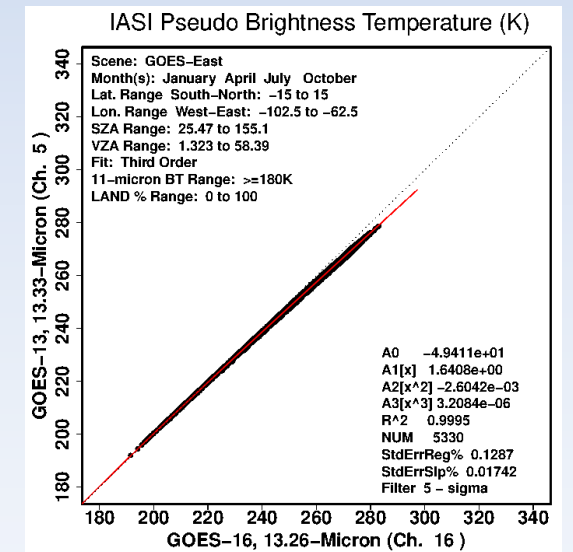
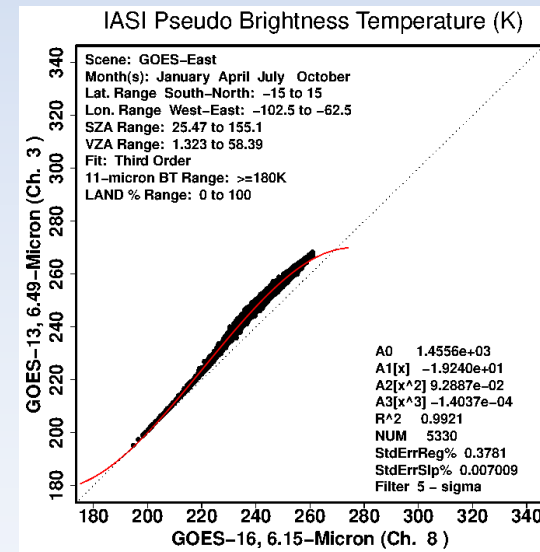
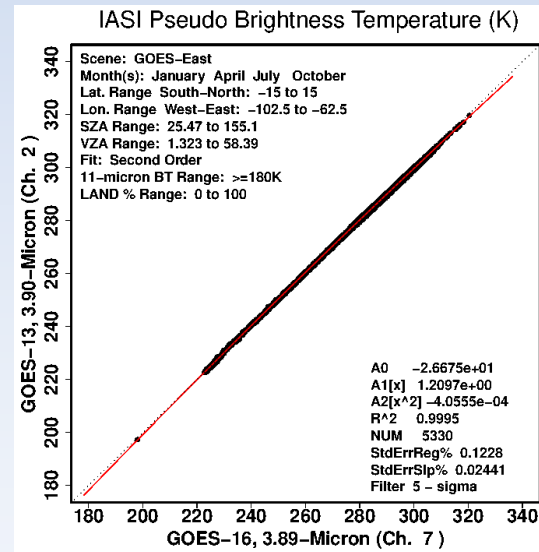
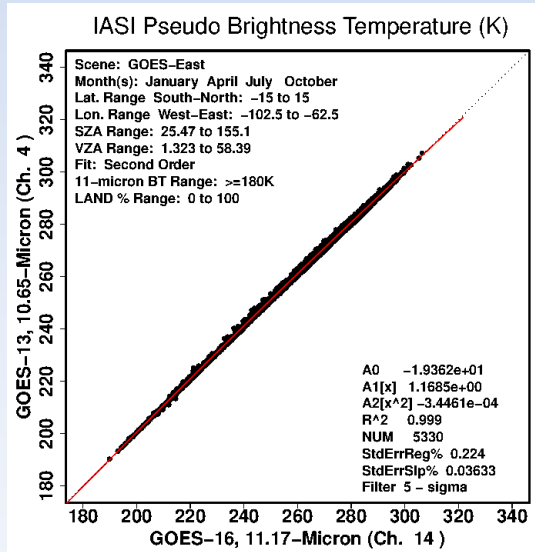
With SBAF

With Neural Net





Spectral Band Adjustment Factors (SBAFs)





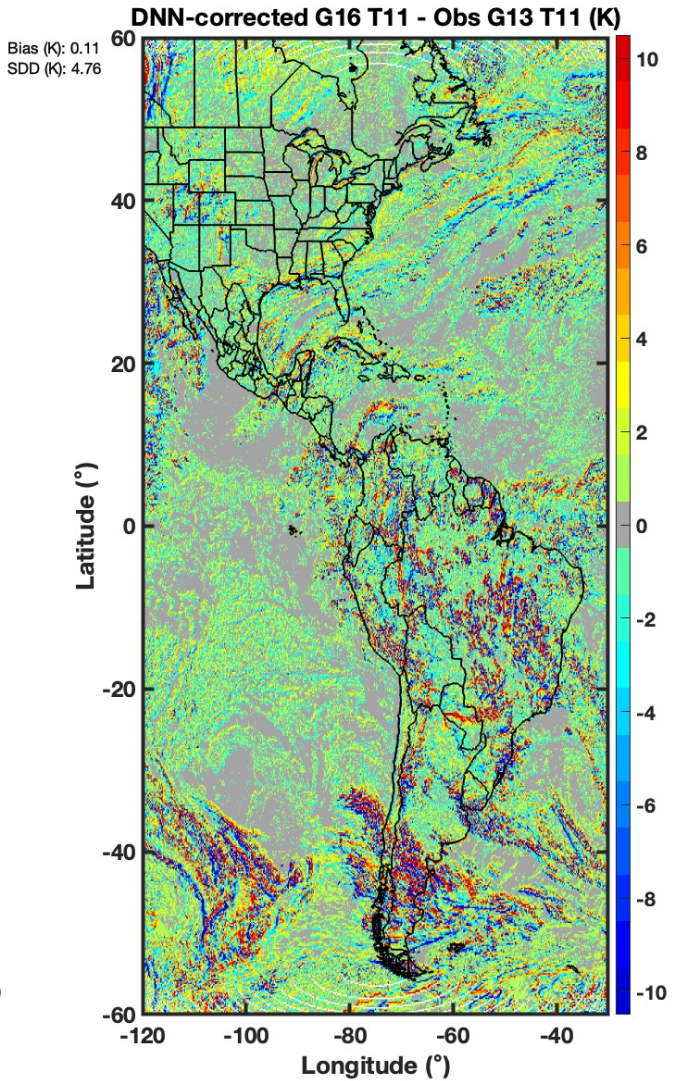
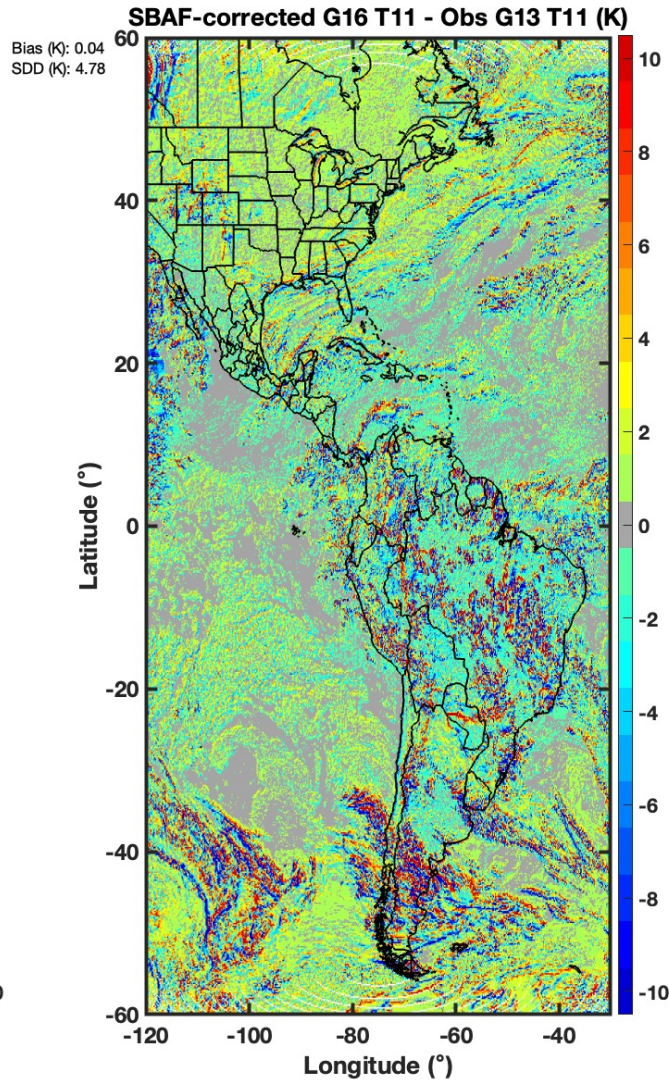
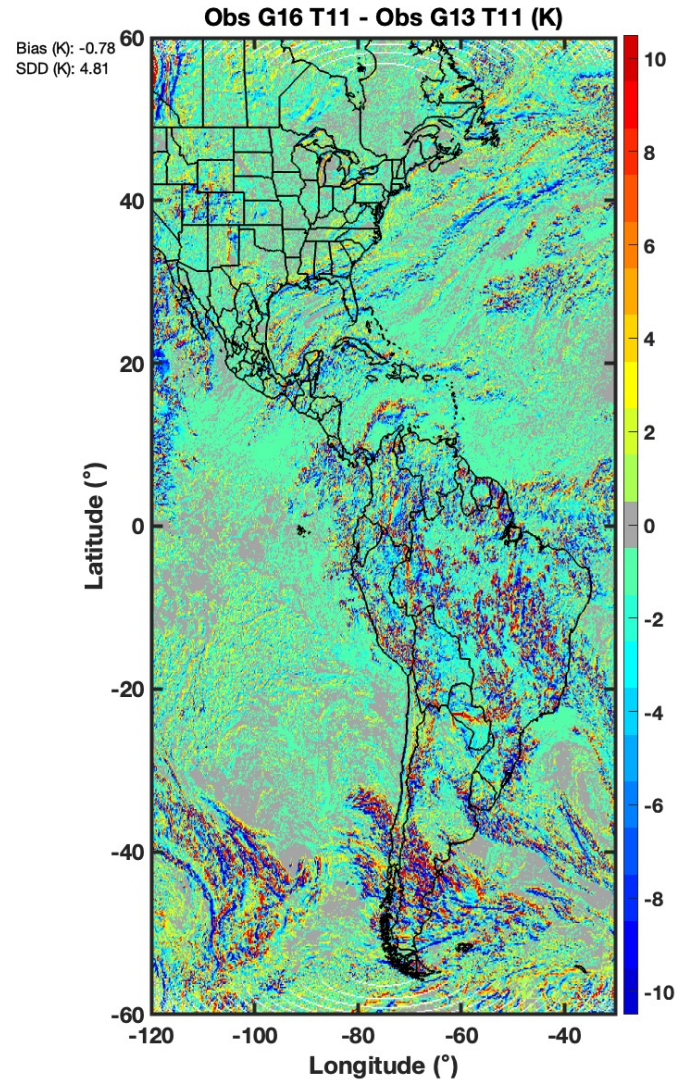
GOES-16 – GOES-13 11- μ m



Original

With SBAF
2018.001.1745

With Neural Net





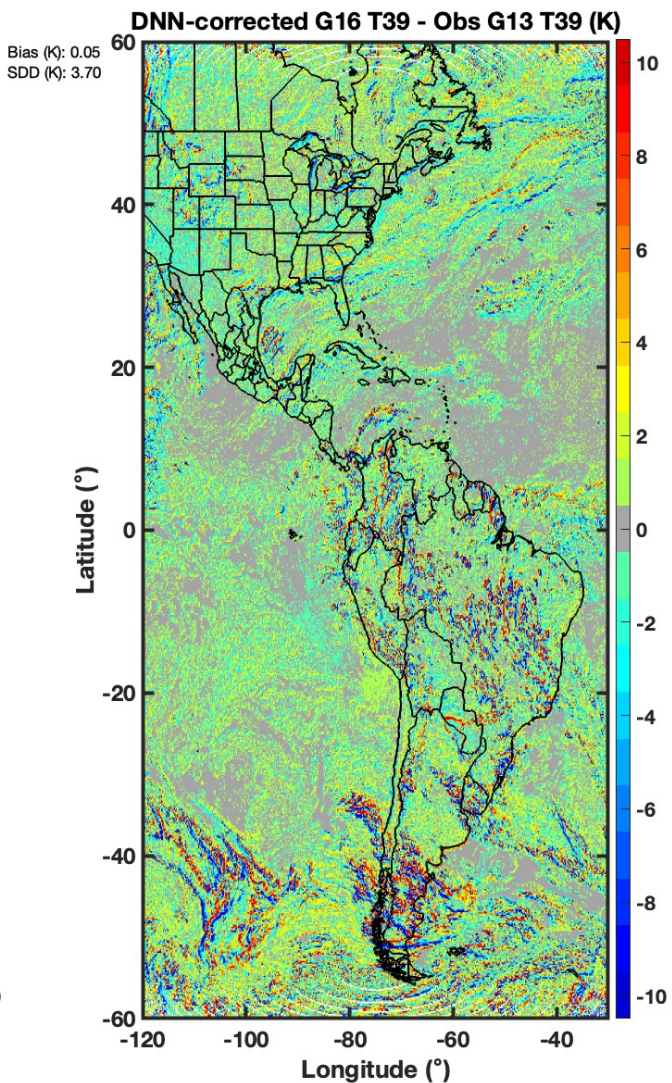
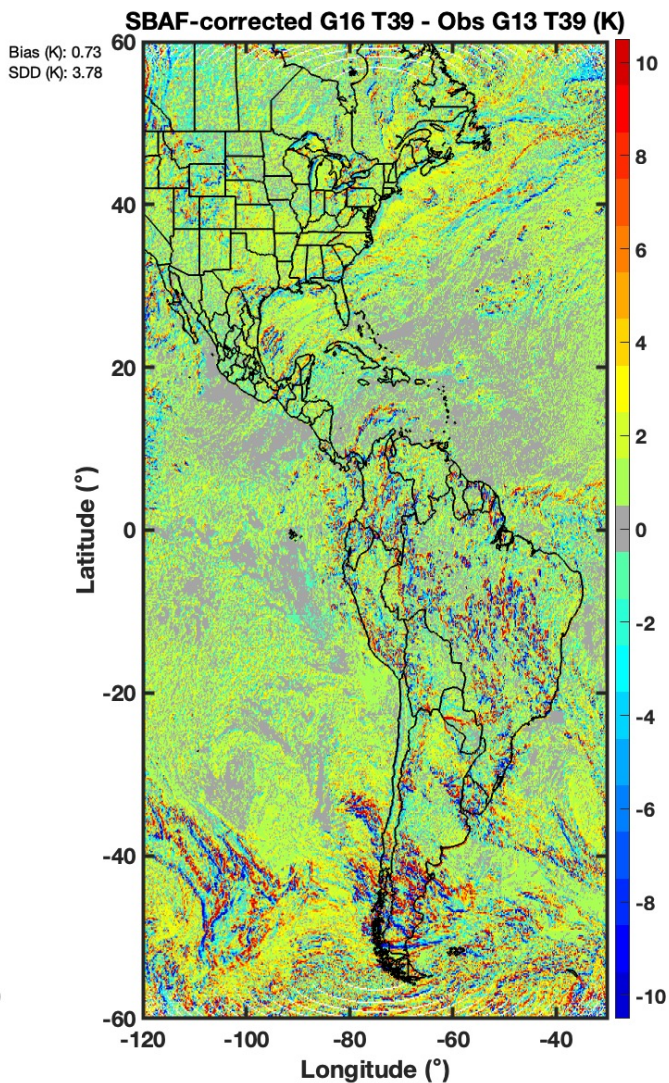
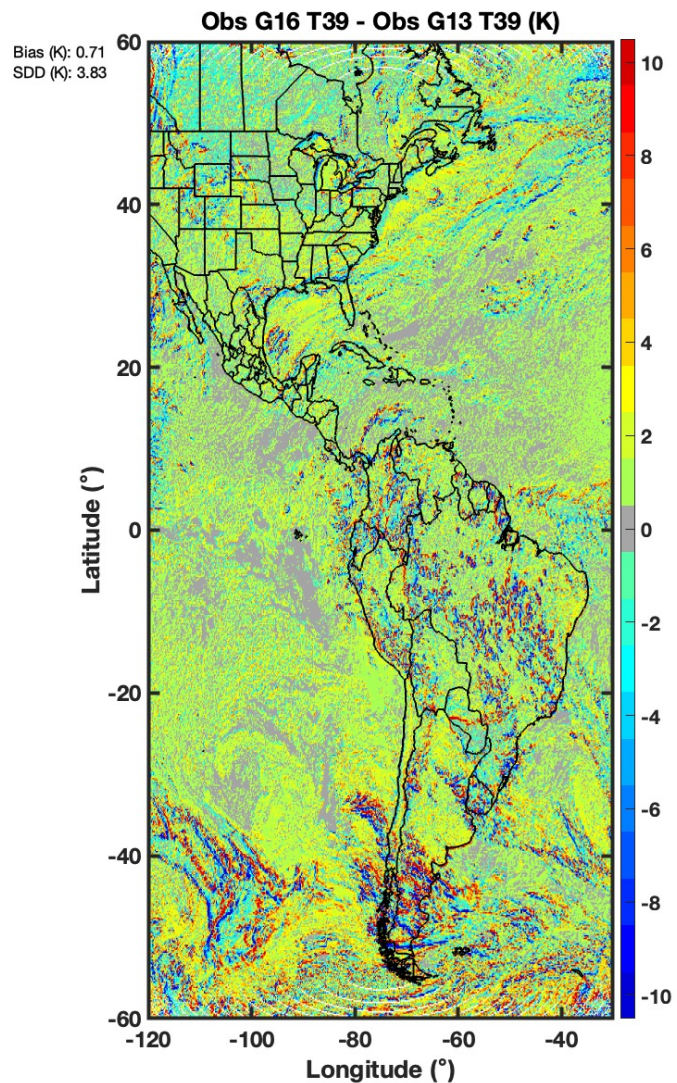
GOES-16 – GOES-13 3.9- μm



Original

With SBAF
2018.001.1745

With Neural Net





GOES-16 – GOES-13

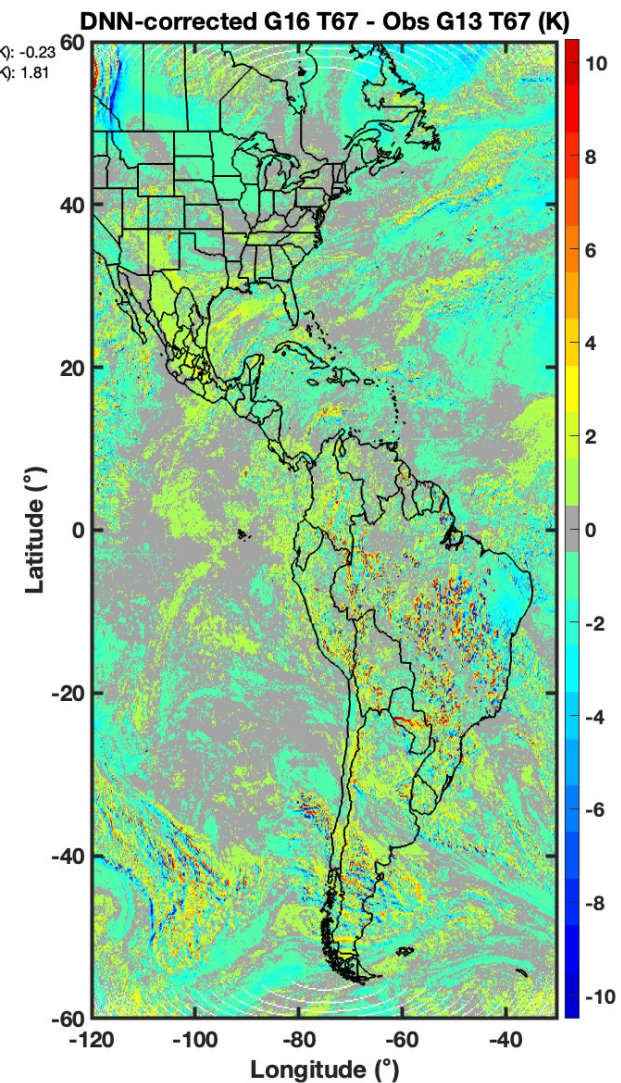
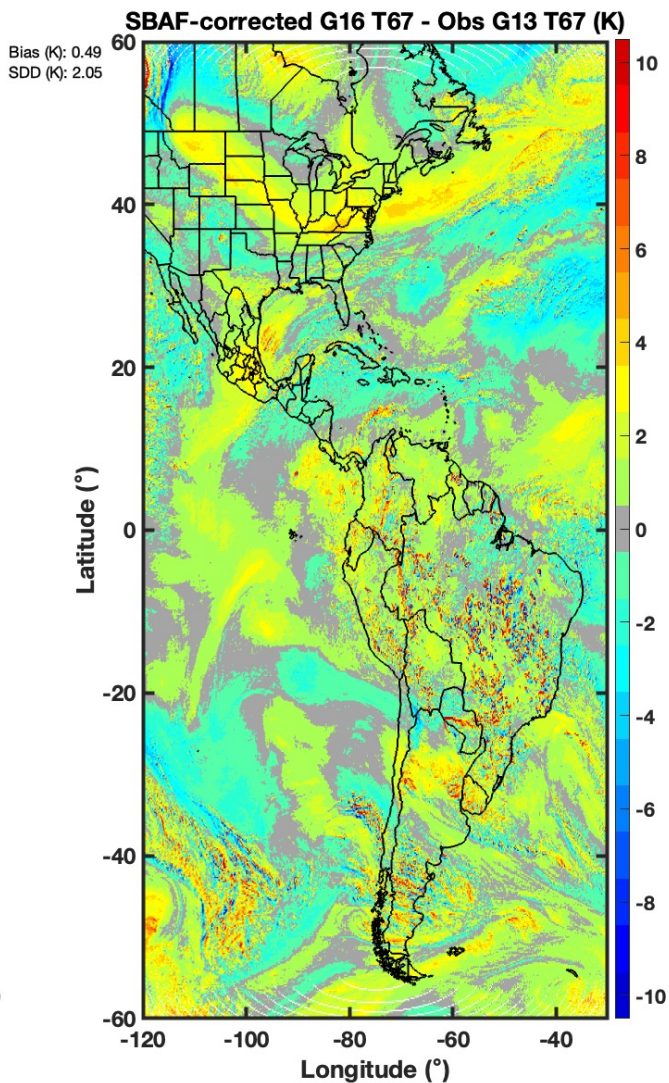
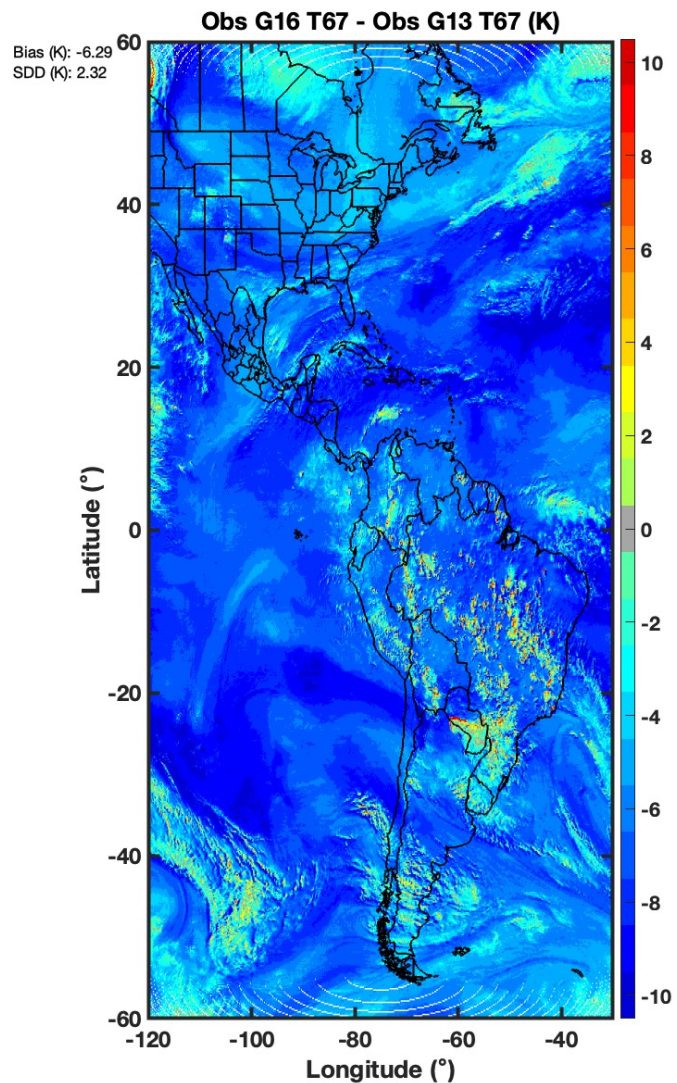
6.7- μm



Original

With SBAF
2018.001.1745

With Neural Net





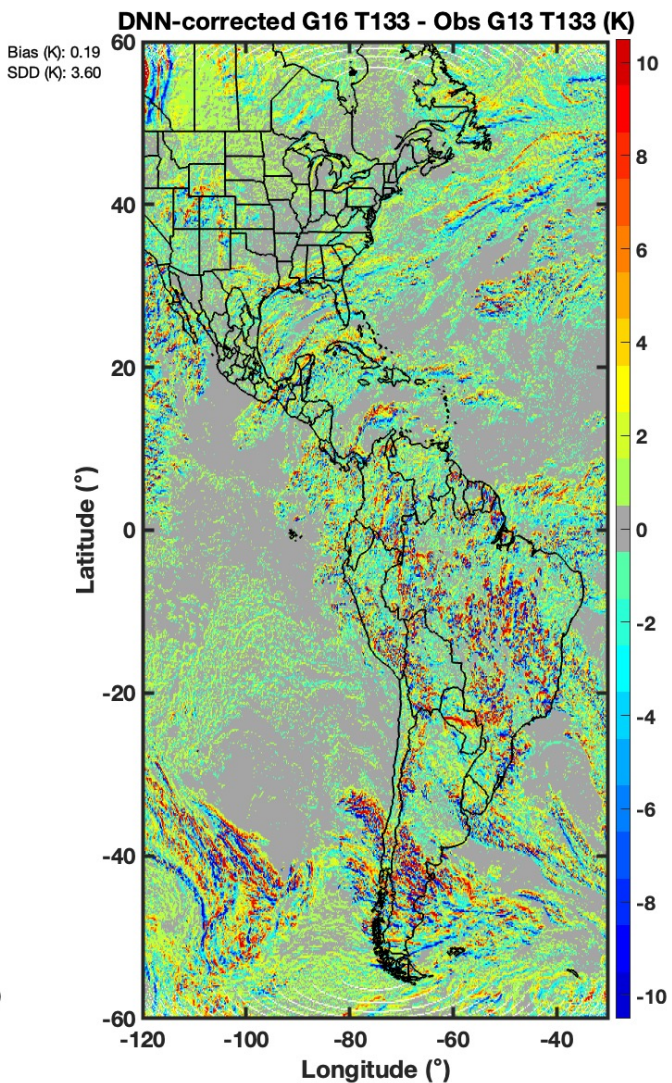
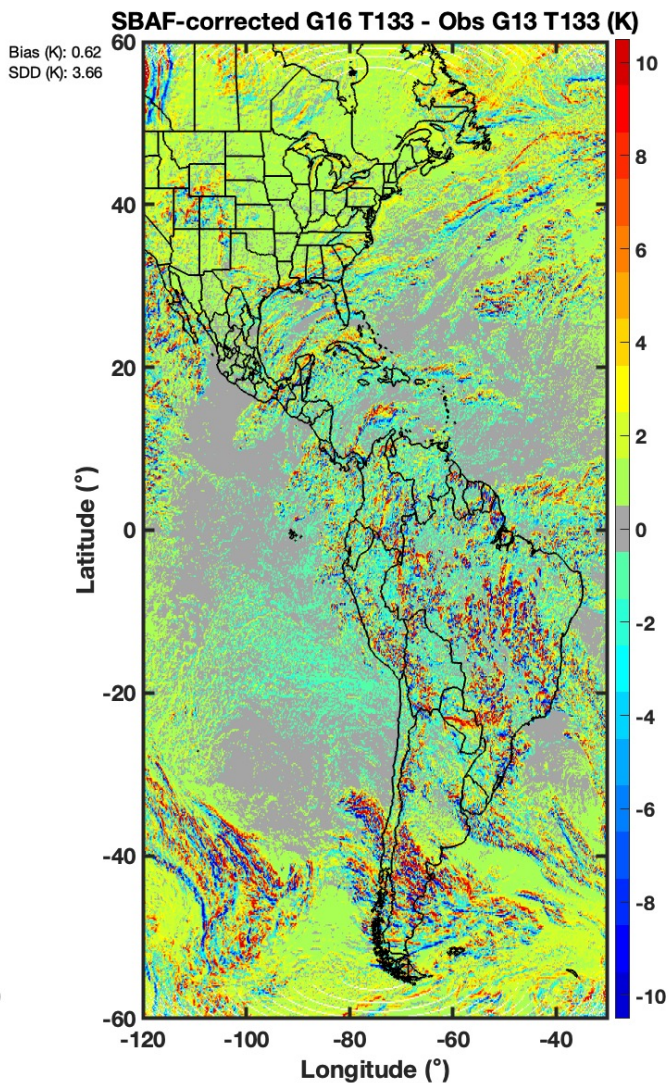
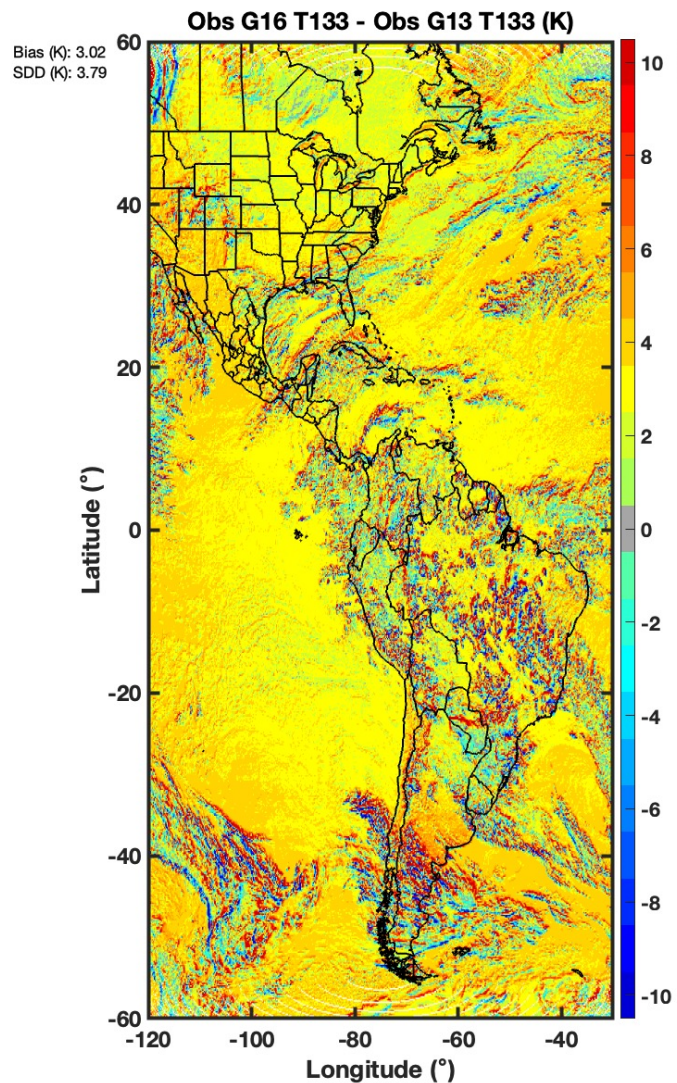
GOES-16 – GOES-13 13.3- μm

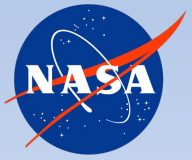


Original

With SBAF
2018.001.1745

With Neural Net





Summary

- The DNN accounts for non-linear spectrally induced bias and absolute radiometric bias
- The is demonstrable only where G13 and G16 matching is highly certain
- Not meant to and impossible to account for time difference/advection
- Testing in cloud code is underway
 - Run G13 cloud code with G13 imager data
 - Run G13 cloud code with G16 imager data + DNN
 - Will not be instantaneously perfect because of advection – better to try aggregate approach



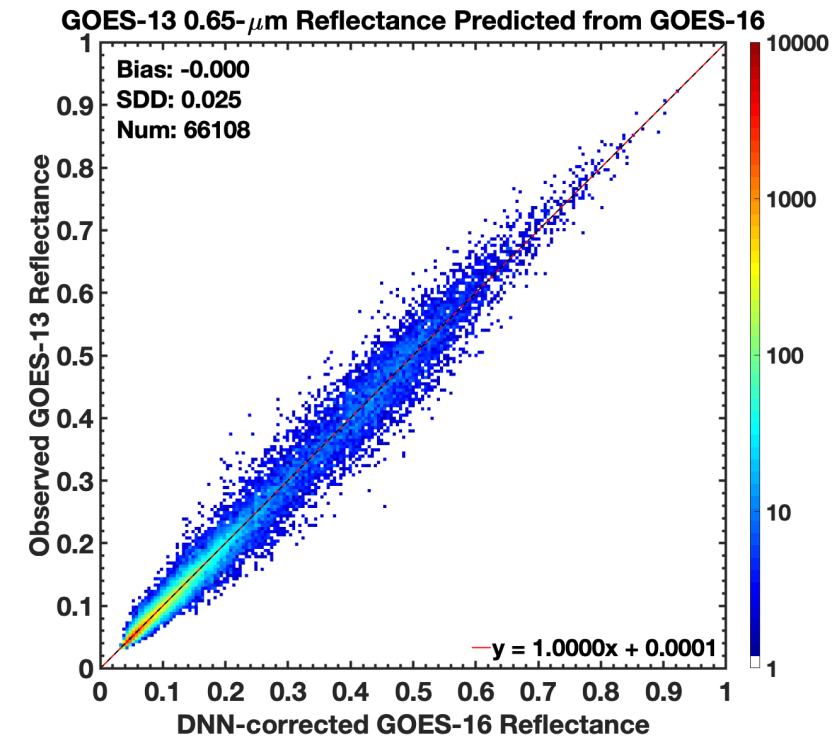
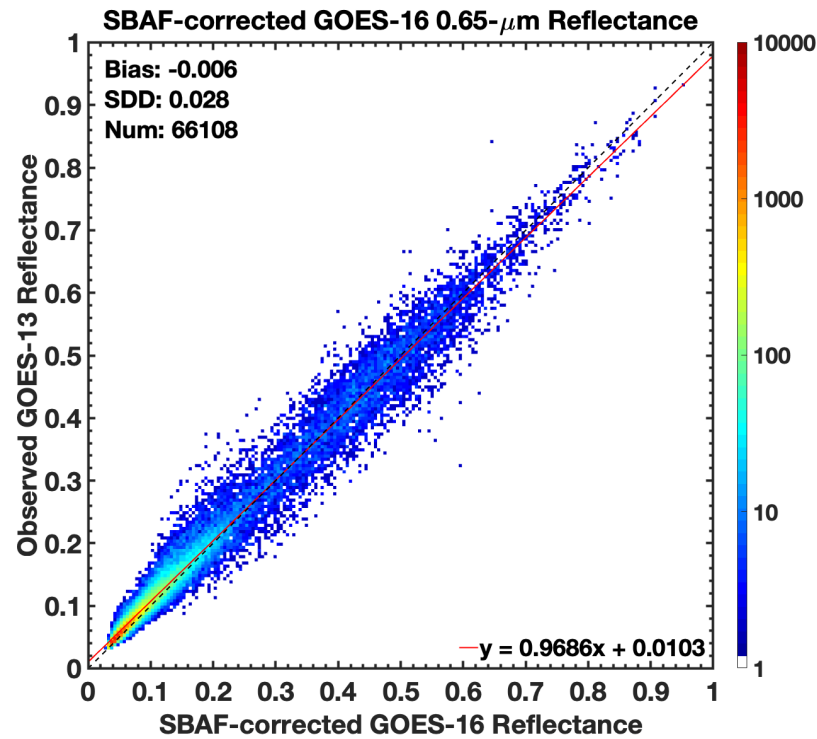
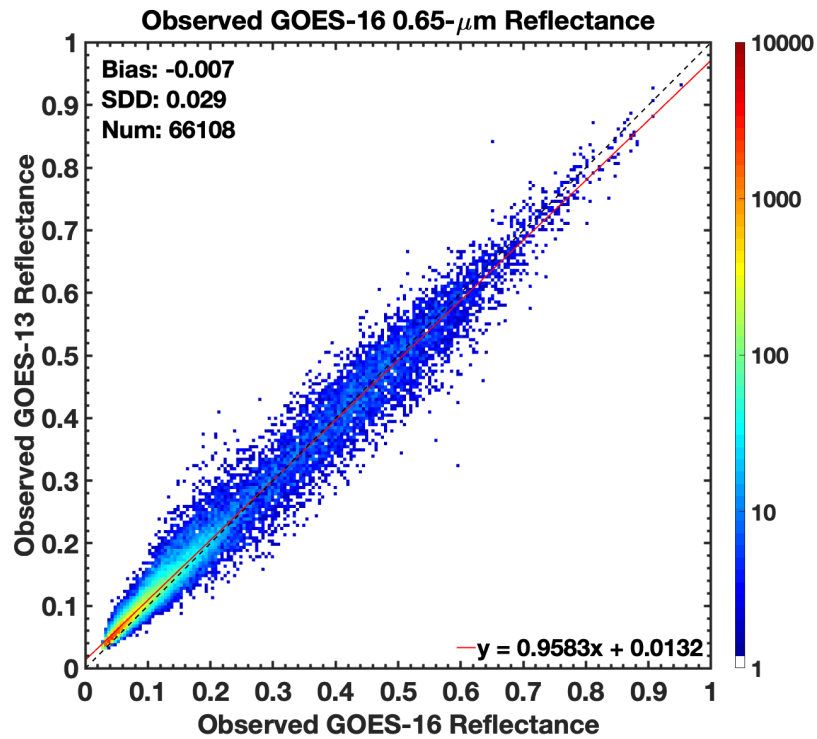
Validation + Testing Sets 13.3- μm



Original

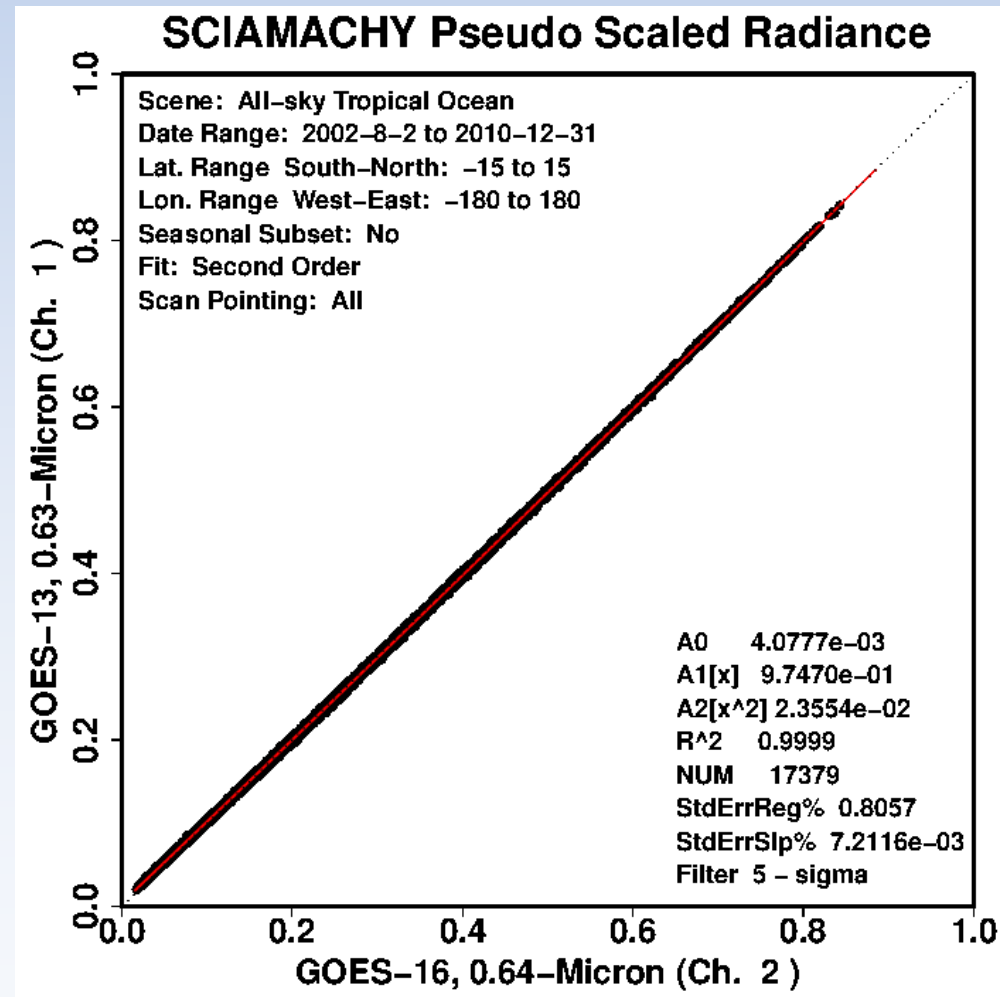
With SBAF

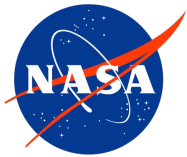
With Neural Net





Spectral Band Adjustment Factor (SBAF)





GOES-16 – GOES-13

0.65- μm



Original

With SBAF
2018.001.1745

With Neural Net

