

Supplementary Materials:

- List of acronyms and instruments
- Supplementary Figures S1-S3

Acronyms:

CDR: Climate Data Record

GCOS: Global Climate Observing System

EUMETSAT: European Organisation for the Exploitation of Meteorological Satellites

GDAS: Global Data Assimilation System

GMF: Geophysical Model Function

GPM: Global Precipitation Mission

JPL: Jet Propulsion Laboratory (NASA)

KNMI: Royal Netherland Meteorological Institute

LTAN: Local Time of Ascending Node

MEDS: Canadian Marine Environmental Data Service

MetOp: Meteorological Operational satellite

MLE: Maximum Likelihood Estimation

MW: Microwave

NCEP: National Center for Environmental Prediction

NDBC: National Data Buoy Center

NWP: Numerical Weather Prediction

OISST: Optimum-Interpolated Sea Surface Temperature

OVW: Ocean Vector Wind

OVWST: Ocean Vector Wind Science Team

PDF: Probability Distribution Function

PIRATA: Pilot Research Moored Array in the Tropical Atlantic (buoy array)

PMEL: Pacific Marine Environmental Laboratory

RAMA: Research Moored Array for African-Asian-Australian Monsoon Analysis (buoy array)

RMS: Root Mean Square

RSS: Remote Sensing Systems

RTM: Radiative Transfer Model

SST: Sea Surface Temperature

STAR: NOAA Center for Satellite Application and Research

TAO: Tropical Atmospheric Ocean (buoy array)

TC: Tropical Cyclone

TRMM: Tropical Rain Measurement Mission

UTC: Coordinated Universal Time

WMO: World Meteorological Organization

WVC: Wind Vector Cell

Instruments:

ASCAT: Advanced Scatterometer (ESA/EUMETSAT)

AMSR-E: Advanced Microwave Scanning Radiometer for EOS (NASA/JAXA)

AMSR-2: Advanced Microwave Scanning Radiometer-2 (Japan, JAXA)

ERS: European Remote Sensing Satellite (ESA)

GMI: GPM Microwave Imager (NASA/JAXA)

OceanSat (ISRO, India)

QuikSCAT: Quik Scatterometer (NASA)

TMI: TRMM Microwave Imager (NASA/JAXA)

SCA: Scatterometer planned on Metop-SG (ESA/EUMETSAT)

ScatSat: Scatterometer Satellite (ISRO, India)

SMAP: Soil Moisture Active Passive radiometer (NASA)

SSM/I: Special Sensor Microwave Imager (US Defense Meteorological Satellite Program)

SSMIS: Special Sensor Microwave Imager Sounder (US Defense Meteorological Satellite Program)

WindSat: Wind Satellite polarimetric radiometer (U.S. Navy and the National Polar-orbiting Operational Environmental Satellite System NPOESS)

Supplementary Figures:

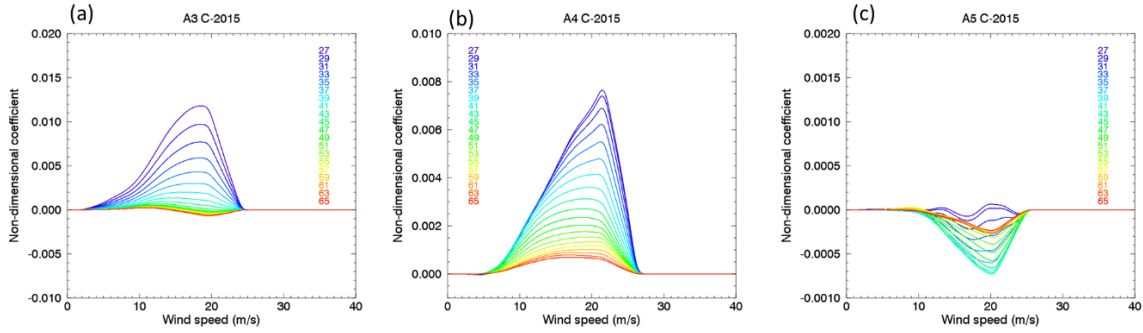


Figure S1: Similar to Figure 2, but for the higher order C-2015 GMF coefficients A_3 (panel a), A_4 (b), and A_5 (c), in non-dimensional units, (not dB). The coefficients are displayed as a function of wind speed w , and for selected incidence angles Θ (degrees), as indicated by the colored lines.

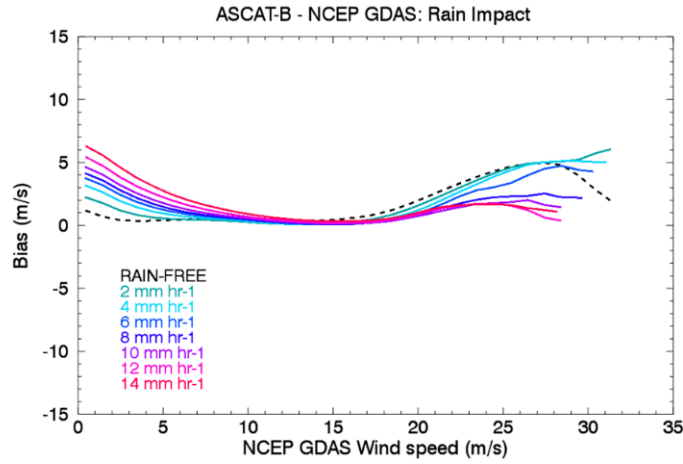


Figure S2: Similar to Figure 14, but for the bias as a function of wind speed for ASCAT-B versus NCEP GDAS winds interpolated in space and time to the ASCAT observations. The bias is stratified as a function of collocated rain rates from the radiometer which is closest in time to ASCAT-B (typically GMI or WindSat). The statistics here refer to collocations from 2016 to 2020, for wind bins of 0.1 m/s with at least 10 observations.

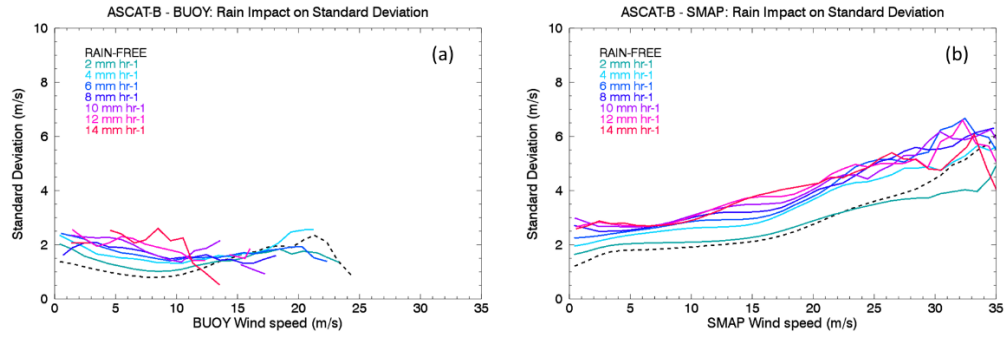


Figure S3: Similar to Figure 14, but for the standard deviation as a function of wind speed for ASCAT-B versus buoys (a) and SMAP (b). The standard deviation is stratified as a function of collocated rain rates from the radiometer which is closest in time to ASCAT-B (typically GMI or WindSat). The statistics here refer to collocations from 2016 to 2020, for wind bins of 0.1 m/s with at least 10 observations.