C- AND KU-BAND ENHANCED-RESOLUTION RADAR BACKSCATTER IMAGE PRODUCTS

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ABSTRACT **Long-term studies of global climate can benefit from a retrospective analysis of past satellite missions. To facilitate such studies, we have developed new C- and Ku-band enhanced-resolution radar backscatter σ° image products that are derived from five satellite scatterometry missions: (1) the ESA European Remote Sensing (ERS) mission in scatterometer-mode (ESCAT) (1992-2001); (2) the NASA Quick Scatterometer (QuikSCAT) and SeaWinds (1999-2010) missions; (3) the NASA RapidScat (2014-2016) mission; (4) the ESA Advanced SCATterometer (ASCAT) mission (2008-present), and (5) the NASA/JAXA Tropical Rainfall Measuring Mission (TRMM) Precipitation Radar (TRMM-PR) (1997-2014). Operating at 5.3 GHz (C-band), 13.995 GHz (Ku-band), 13.6 GHz (Ku-band), 5.225 GHz (C-band), and 13.88 GHz (Ku-band), respectively, these multi-frequency satellite scatterometry missions provide global σ° spanning more than three decades that are unique benchmarks for studying climate change over the Earth's surface, particularly over rapidly warming ice-covered surfaces, such as Greenland, Antarctica, and High Mountain Asia. The new enhanced-resolution σ° image products are consistently-processed and compatibly-gridded with existing enhanced-resolution σ° and microwave brightness temperature (T^B) image products that date as far back as 1978.**

This project develops new ESCAT, QuikSCAT/SeaWinds/RapidScat, ASCAT, and TRMM-PR conventionally gridded (GRD), averaged (AVE), and enhanced-resolution (SIR) σ° image products that are currently in data accession at the NASA National Snow and Ice Data Center Distributed Active Archive Center (NSIDC DAAC). The enhanced-resolution σ° image products include complete Algorithm Theoretical Basis Documents (ATBDs). The enhanced-resolution σ° images are generated using the iterative Scatterometer Image Reconstruction (SIR) algorithm (Long and Daum, 1998; Early and Long, 2001). The map projections and gridding are designed to be compatible with the following data sets: (1) the SASS Twice-Daily SIR-Enhanced EASE-Grid 2.0 Radar Backscatter Data Set (Long and Miller, 2024); (2) the NSCAT Twice-Daily SIR-Enhanced EASE-Grid 2.0 Radar Backscatter Data Set (Long and Miller, 2024); (3) the SMAP Radar Twice-Daily SAR and SIR-Enhanced Scatterometer EASE-Grid 2.0 Radar Backscatter Data Set (Long et al., 2024); (4) the SMAP Twice-Daily rSIR-Enhanced EASE-Grid 2.0 Brightness Temperature Data Set (Brodzik et al., 2021); and (5) the MEaSUREs Calibrated Enhanced-Resolution Passive Microwave Daily EASE-Grid~2.0 Brightness Temperature ESDR (Brodzik et al., 2016) that are also available from the NSIDC DAAC.

Examples that illustrate the coverage of the newly-developed enhanced-resolution σ° image products are shown in **Figure 1** (QuikSCAT) and **Figure 2** (ASCAT) below. The enhanced-resolution σ° images generated using the SIR algorithm provide a finer effective resolution as compared to conventional-gridded σ° images which enables more detailed studies of climate-sensitive geophysical parameters over land and ice-covered surfaces.

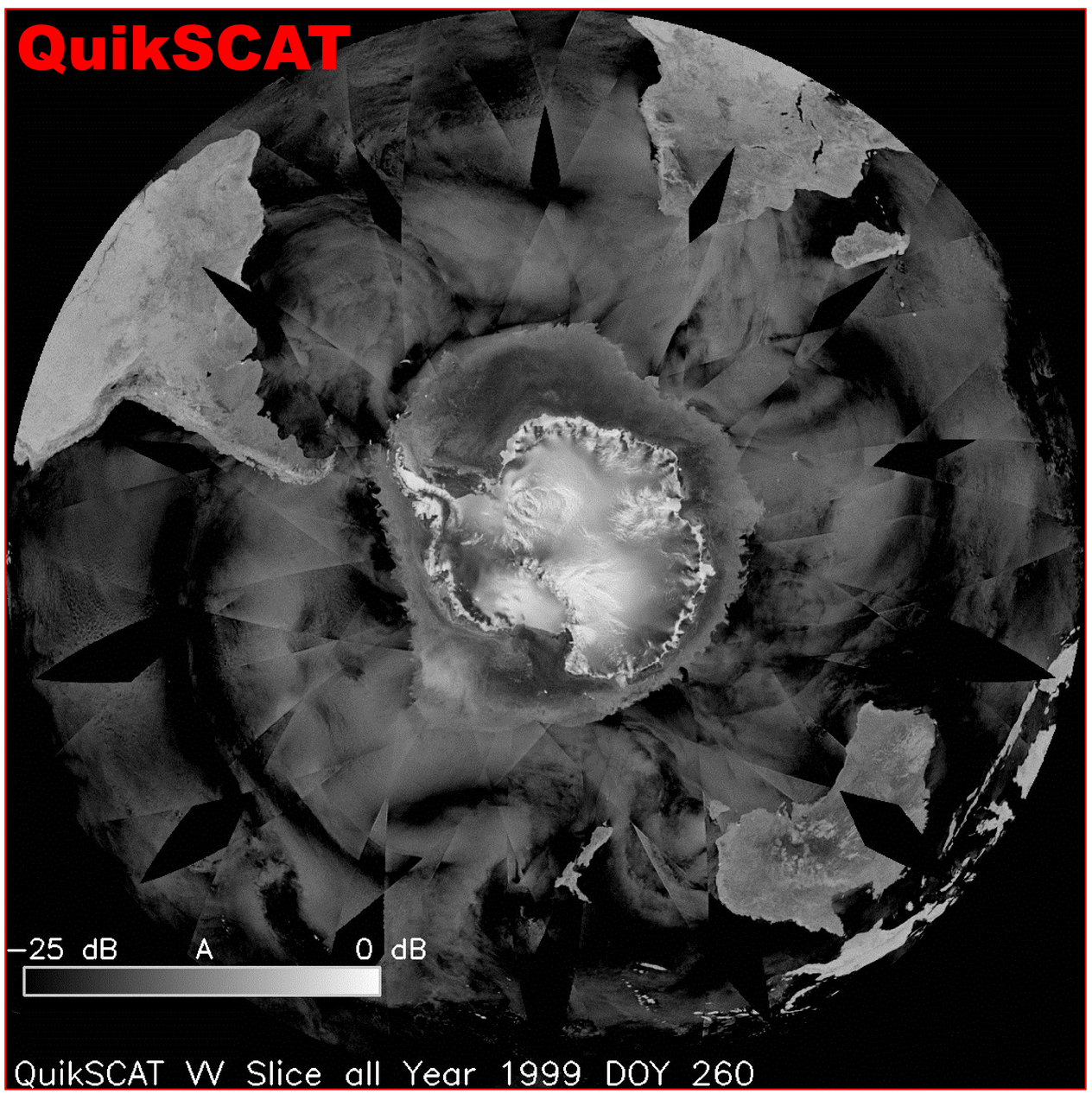

Figure 1: Visualization of an example VV-polarization QuikSCAT image of the Southern Hemisphere created from one day of QuikSCAT slice measurements collected on DOY 260, 1999.

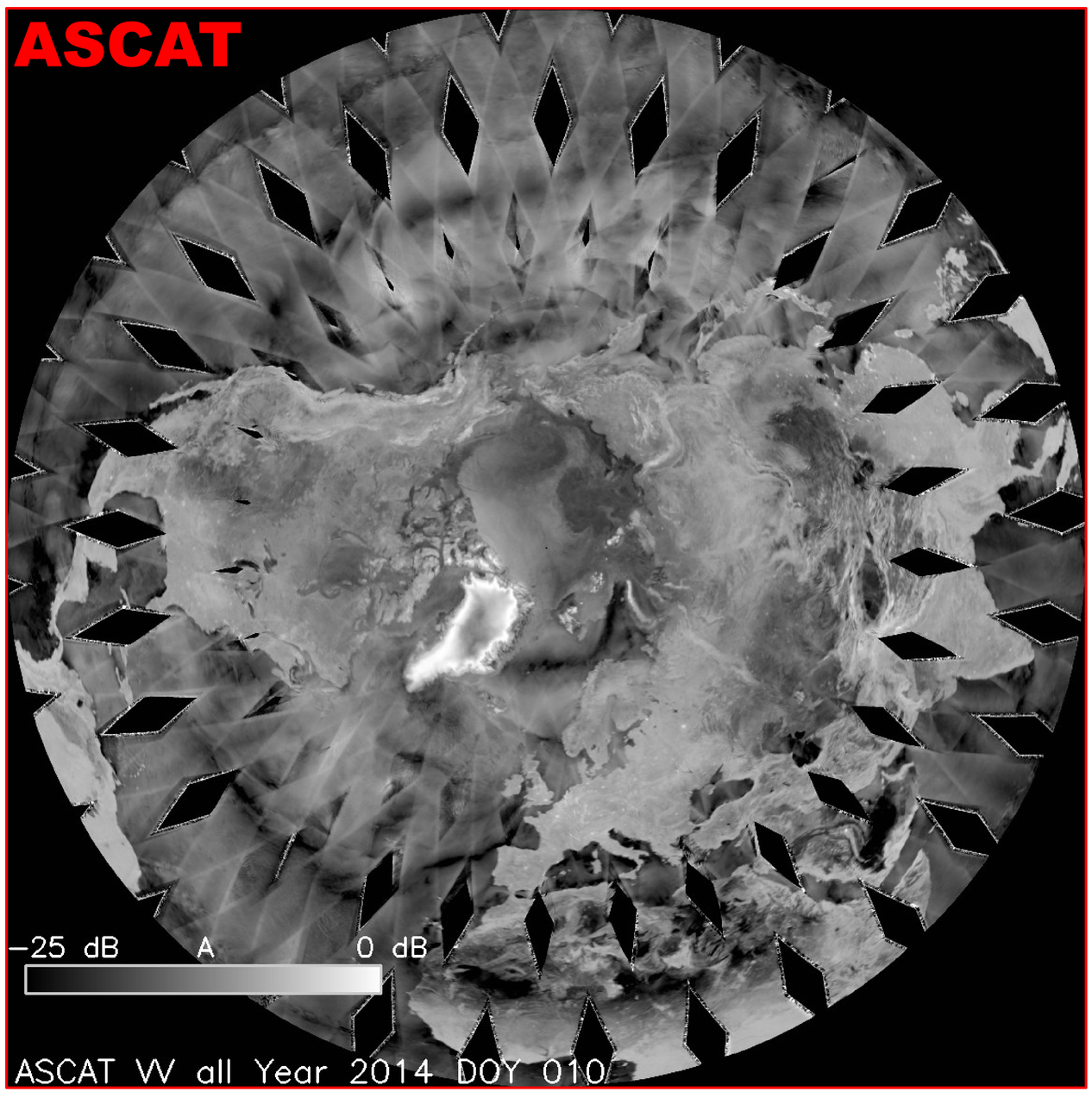

Figure 2: Visualization of an example VV-polarization ASCAT image of the Northern Hemisphere created from one day of combined ASCAT-A and ASCAT-B measurements collected on DOY 10, 2014.

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