Multidecadal OSCAT Calibrated σ^o database using the Amazon

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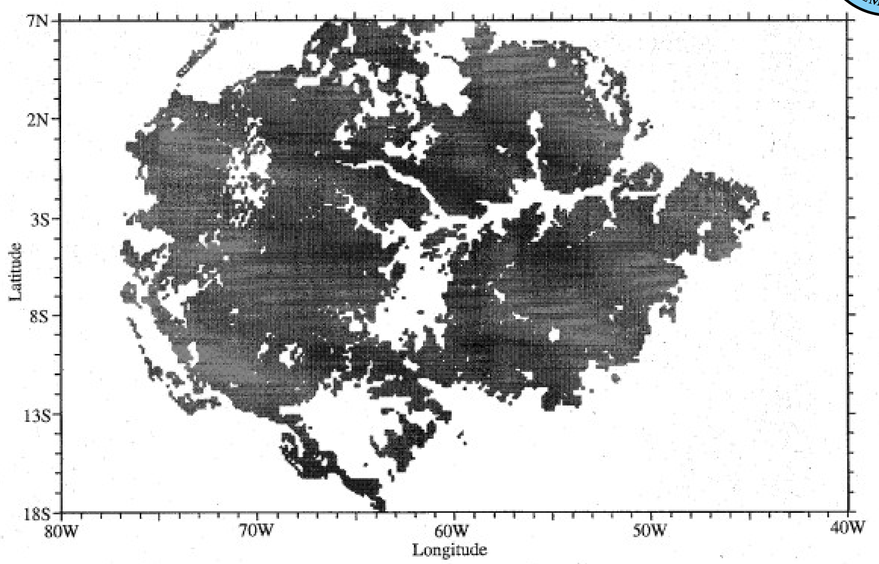
In late 2022, the Indian Space Research Organization (ISRO) launched the OceanSat-3 which aimed to "provide service continuity for OceanSat-2 data" [1]. The OceanSat-3 scatterometer (referred as OSCAT-3) has two beams with incidence angles of 48^o and 57^o and operates at 13.515 GHz Ku-band, which are similar operating characteristics to the previous two scatterometers launched by ISRO. The first, launched in 2009 and operated until 2014, is OSCAT-1 [2]. The second, launched in 2016 an operated until 2021, is OSCAT-2 [3].

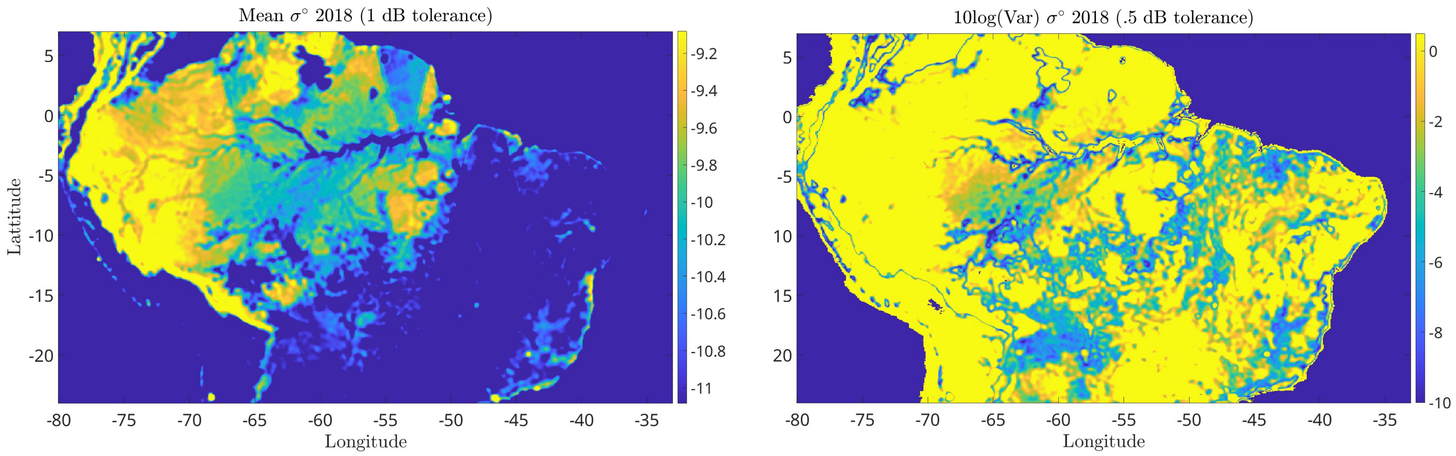
Although each OSCAT (1-3) has similar operating characteristics, there are some differences that can lead to unique σ^o response for similar geographical areas. For example, OSCAT-3 antenna rotation rate is slightly higher (20 rpm compared to 16 rpm for OSCAT-1 and OSCAT-2) [4]. The effects of these differences need to be identified and modeled for each version of OSCAT to create a consistent σ^o dataset for climate studies.

We are performing an intra-calibration between σ^o measurements for the three OSCAT sensors [5] for land and ice imaging using the Amazon rainforest. The Amazon is used because the vegetation has a sufficiently random orientation distribution to cause the look direction of radar measurements to have minimal effect on σ^o measurements [6, 7]. This means that measurements from azimuthal look directions can be analyzed together increasing the number of measurements.

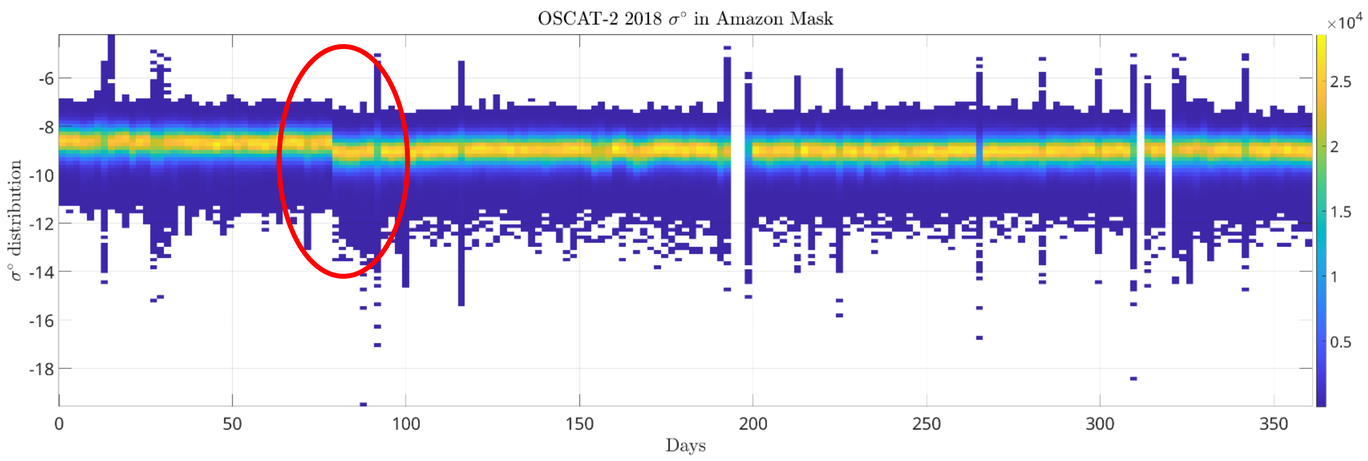
An area of the Amazon that is relatively constant over time is found by binning σ^o measurements by latitude and longitude. In each bin, the variance of the σ^o values is calculated. A binary mask is made for areas where the variance in below a certain threshold (in the past 1 ~dB has been used [7]). The work-in-progress calibration is performed using a statistical analysis on the measurements in this area.



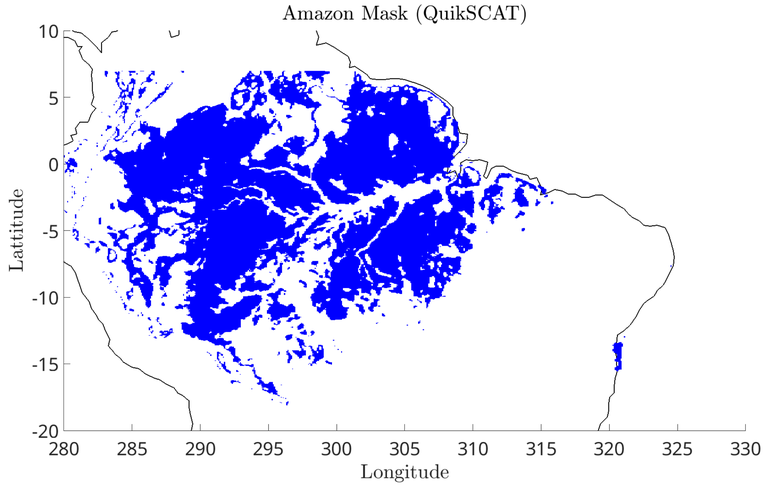
Binary mask of latitudes and longitudes over the Amazon Rainforest whos mean σ^o for SASS vary by less than 1 dB [7].



OSCAT-2 measurements taken during January 2019, (left) the σ^o mean and (right) the σ^o variance at each latitude and longitude over the Amazon Rainforest for V-pol Egg measurements.



A time series of mean OSCAT-2 σ^o measurements over the Amazon Rainforest from 2018. There is a clear step around day 75.



Binary mask of latitudes and longitudes over the Amazon Rainforest whos mean σ^o for QuikSCAT vary by less than 1 dB.

[1] eoPortal, "Oceansat-3," 2023. Available at:https://www.eoportal.org/satellite-missions/oceansat-3 [Accessed: 2025-02-25].
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[4] A. Verhoef, Z. Li, and A. Stoffelen, "Initial Assessment of OSCAT-3 Scatterometer Data by KNMI," November 2023. Presented at the International Ocean Vector Winds Science Team Meeting.
[5] F. T. Ulaby and D. G. Long, Microwave Radar and Radiometric Remote Sensing. Ann Arbor, Michigan: University of Michigan Press, 2013. Available: Artech House and Amazon.
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[7] D. Long and G. Skouson, "Calibration of Spaceborne Scatterometers Using Tropical Rainforests," IEEE Transactions on Geoscience and Remote Sensing, vol. 34, no. 2, pp. 4 1995.