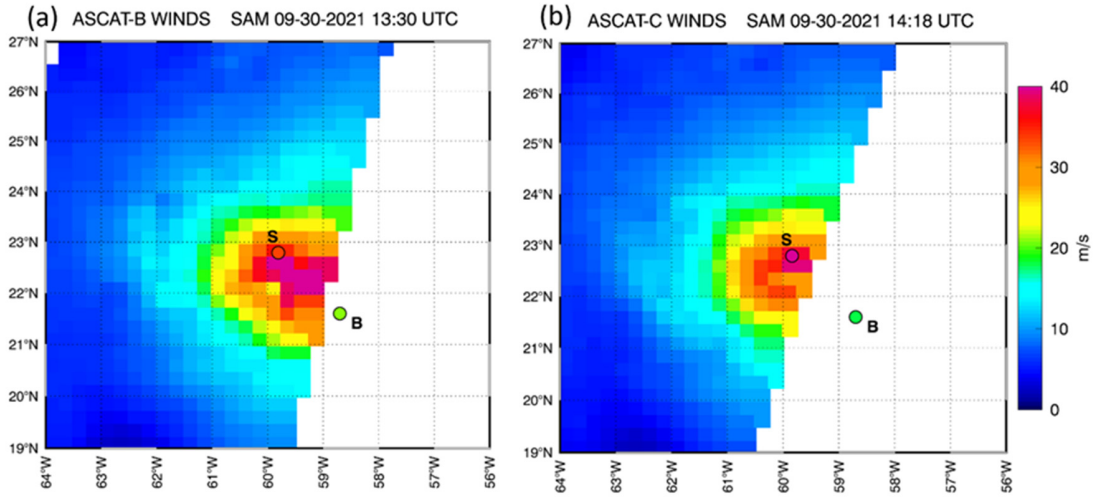

Figure S1: ASCAT-B (**a**) and ASCAT-C (**b**) 10 m wind field from the 13:30 UTC and 14:18 UTC passes, respectively, over Hurricane Sam on 30 September 2021. Overlaid are the color-coded 10 m winds (10-minute averages) from SD-1045 and the buoy at the corresponding times. The SD wind speeds (33.7 and 40.4 m/s, in panels a and b, respectively) compare well with the ASCAT-B and -C colocations (35.8 and 37.4 m/s).

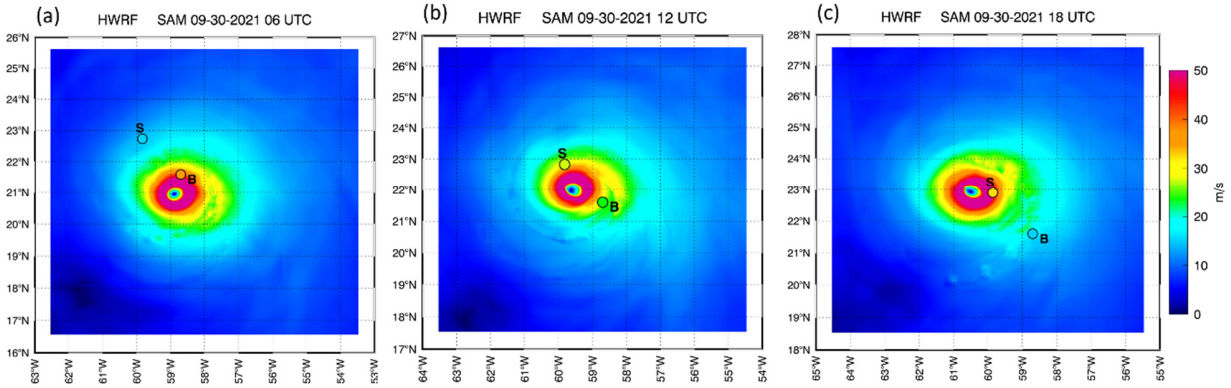

Figure S2: HWRF model scenes for the surface wind field in Hurricane Sam on 30 September 2021, for the 0-hour analyses at 06Z (**a**), 12Z (**b**), and 18Z (**c**). The SD-1045 and buoy locations and corresponding 10 m wind speed are overlaid on the model wind field, all displayed within a common range of 0-50 m/s. The SD values for 6,12, and 18Z (16.6, 26.3, and 33.4 m/s) can be compared to the HWRF winds at the SD location (14.5, 31.7 and 55.5 m/s, respectively). The buoy winds in panels (a,b,c) are (37.2, 24.2, and 15.6 m/s), and can be compared to the HWRF fields at the buoy location (43.7, 28.3, and 18.4, respectively).

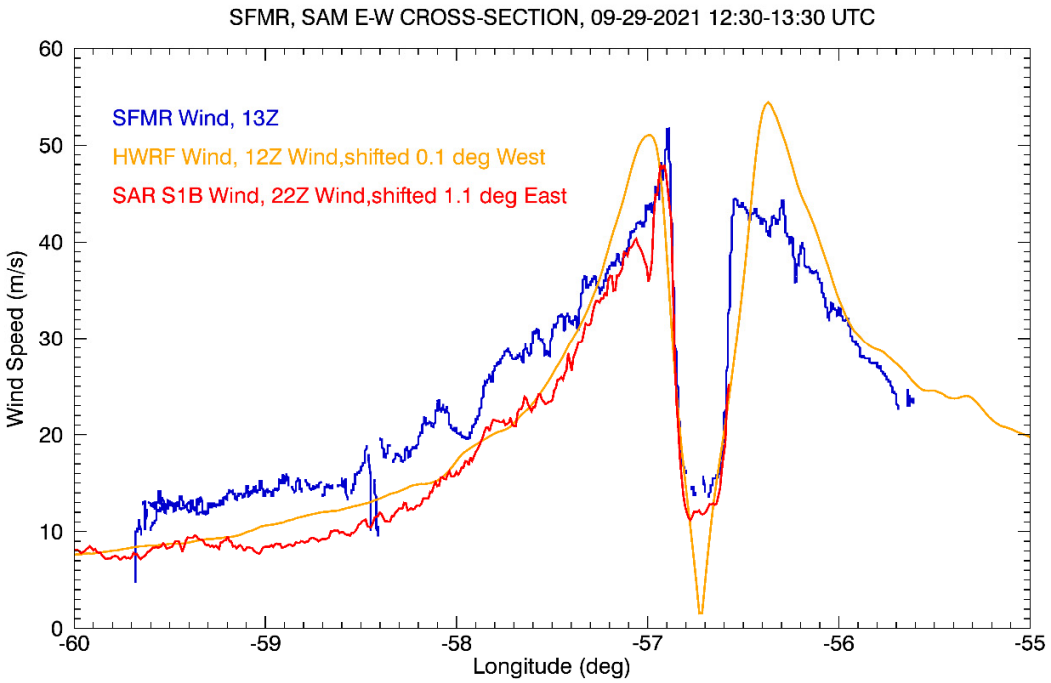

Figure S3: Surface wind speed (blue) from the Stepped Frequency Microwave Radiometer (SFMR) onboard the NOAA P3 reconnaissance aircraft that flew into Hurricane Sam on 29 September 2021. The figure displays one of the passes through the eye as a function of longitude, as the aircraft flew in the East-West direction between 12:30 and 13:30 UTC. A cross section through the center of the storm from the HWRF model 0-hr analysis at 12Z is shown in yellow. The red curve displays the cross-section through the storm's center as seen by the SAR onboard Sentinel 1B, which occurred at 22 UTC, several hours after the aircraft pass. The storm was only partially sampled by the SAR S1B, with the storm center located at the right (East) edge of the SAR swath. In this figure, the cross-sections from HWRF and SAR have been shifted in longitude by 0.1 deg west and 1.1 east, respectively, in order to align their storm centers with the location of the storm center at the time of the SFMR observation.