

Preface

Synthetic aperture radar (SAR) is a high-resolution (<100 m spatial resolution) and large swath (450 km) microwave radar that can image the ocean surface under all weather conditions, day and night. The first spaceborne SAR on board the National Aeronautics and Space Administration (NASA) SEASAT was launched in 1978. Since then, tropical cyclones have been observed on many SAR images. However, utilization of SAR imagery is a relatively new tool for hurricane research and forecasting due to its limited temporal and spatial coverage, lack of operational analysis tools and high cost. All these impediments are in the process of being swept away. National Oceanic and Atmospheric Administration (NOAA) is implementing an operational SAR wind operational processing system. European Space Agency (ESA) launched the first operational SAR satellite, Sentinel-1A, in 2014, and then the Sentinel-1B in 2016. Canadian Space Agency (CSA) will launch the RADARSAT Constellation Mission SAR missions in 2018 time frame. Currently, the Sentinel-1 SAR data are freely available on ESA's internet hub at near real time. Other SAR data are available either through commercial purchase or research proposals from the CSA RADARSAT-2, the Japan Aerospace Exploration Agency (JAXA) ALOS-2, the German DLR TerraSAR-X and TanDEM-X, Italian COSMO-SkyMed, among others.

Unlike conventional polar-orbiting and geostationary weather satellite hurricane images, which are acquired by passive remote sensing instruments operating in the visible and infrared channels and show the spiral cloud patterns, SAR images provide information of the intense air-sea interaction right at the ocean surface with much higher spatial resolution since the active microwave SAR signal penetrates the clouds. Information of sea surface wind, swell wave, boundary layer roll, eye structure, mesovortices, rainbands, and arc clouds can all be retrieved from SAR with some uncertainties. Due to SAR's great imaging capabilities, the numbers of SAR-based research and the scientists have been growing exponentially in the past decade. In addition, weather forecasters are able to look at hurricanes in such fine scale on SAR imagery for the first time. A lot of researches are devoted to developing new capabilities to use SAR data for hurricane research as it reveals fine-structure of micro- and meso-scale features within a hurricane system.

The book is based on many cutting-edge researches that the chapter authors contributed to SAR hurricane research in recent years. The targeted readers include oceanographers, meteorologists, remote sensing scientists, and graduate students in these subject matters.

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