



New Dual Frequency Rotating Fan-beam Scatterometer WindRAD Status

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Abstract

FY-3E is the world's first early-morning-orbit meteorological satellite for civil use. WindRAD is a dual frequency rotating fan-beam scatterometer on board of FY-3E, which was launched on 4th June 2021 by CMA (China Meteorological Administration). WindRAD has two antennas, one operates at Ku-band, and the other operates at C-band, both are emitting HH/VV pulses. The antenna slowly sweeps over the swath and provides diverse geometry distribution depending on the location across the swath. The data are currently in testing period, thus the analysis of the data and wind retrieval will not be presented here and main focus is the status and characteristics of WindRAD.

Introduction

The wind scatterometer has been proven to be a powerful instrument for global sea surface wind measurement. The wind retrievals have a wide variety of applications, including now-casting and assimilation in numerical weather prediction models, as well as oceanography, climate research, and offshore energy applications. The wind retrieval is achieved by inverting a set of radar cross-section measurements at different geometries (incidence and/or azimuth look angles) over a wind vector cell (WVC) through a geophysical model function (GMF) to extract the wind. The more diversity in the geometry, the better wind retrieval will be achieved.

FY-3 series satellites are the second generation polar-orbiting early morning meteorological satellites of China, which is designed for a service life of at least eight years. The orbit specifications are shown in Table 1. WindRAD onboard FY-3E is a dual frequency (C-band and Ku-band) with HH and VV polarizations, which has the objectives to improve the spatial resolution, high wind retrieval capability and nearly all-weather capability specially with rains.

Table 1. Orbit specifications of the FY-3E [1].

Orbit	Sun-synchronous
Orbit Height	836 km
Inclination (°)	98.75°
Local time at descending node	0530–0550 UTC
Quasi-repeat time	5.5 d (design 4 d–10 d)
Eccentricity	≤0.0025
Orbital maintenances	20 min (8 yr) ⁻¹
Satellite life	Design life: 8 yr Assessment life: 6 yr

System and Data Characteristics

Currently there are three types of scatterometer in orbit: fixed fan-beam (ASCAT, etc.), rotating pencil-beam (Oceansat, etc.) and rotating fan-beam (WindRAD, CSCAT). The rotating fan-beam design of WindRAD is similar as CSCAT (onboard CFOSAT) and the main differences are WindRAD have two frequency antennas while CSCAT has only Ku-band. Fig 1. is the illustration WindRAD emits pulses with both channels and the rotation feature. The number of views and the diversity of the geometries are even further improved. Table 2 gives the main parameters/specifications of WindRAD.

The WindRAD data is in early testing phase, the characteristics of the data are currently in assessment and a prototype wind retrieval processor has been developed. The data and wind retrieval results can only be publicly available when the data pass testing phase.

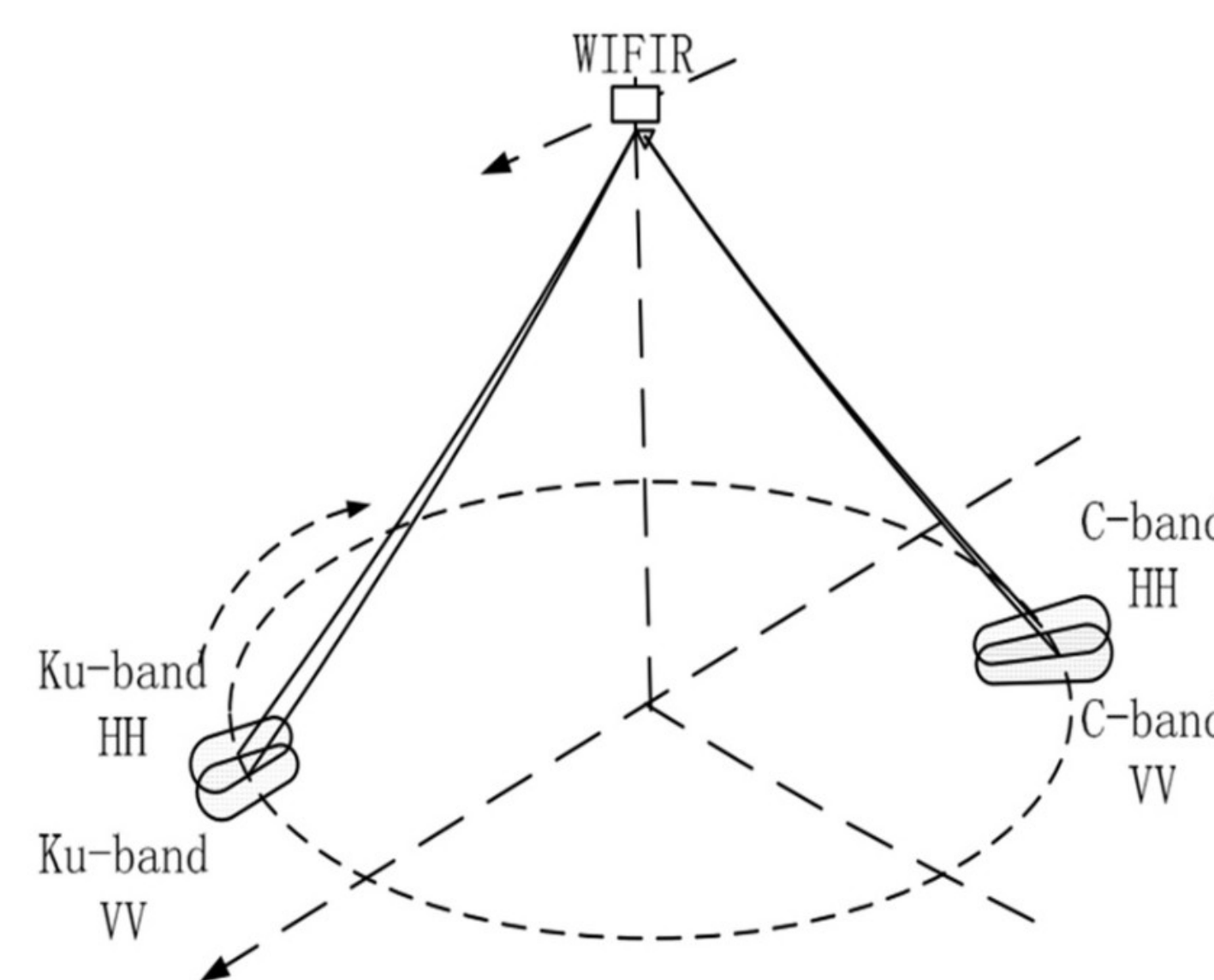


Figure 1. WindRAD illustration [3].

Table 2. Main parameters of WindRAD [2].

Parameters	Value	
	Ku band	C band
Orbit height	836 km	
Swath	1400 km	
Footprint	200 km	
Satellite speed	7.4 km s ⁻¹	
Antenna rotating speed	3.0 rpm	
Polarization	VV and HH alternating	
Incidence angle range	34.7–44.5°	
Antenna pointing angle	34.8°	
WVC resolution	25 km	
Peak transmit power	120 W	100 W
Center frequency	13.256 GHz	5.4 GHz
Duration of transmit pulse	1.8 ms	1.7 ms
Duration of receiving pulse	1.25 ms	1 ms
Pulse repetition frequency (PRF)	208 Hz	104 Hz
Two-way -3 dB azimuth beam width	1.3°	0.52°
Peak antenna gain	37 dB	32 dB
Transmit bandwidth	0.6 MHz	

References

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