

ISO 23032:2022-12 (E)

Meteorology - Ground-based remote sensing of wind - Radar wind profiler

Contents		Page
Foreword	v	
Introduction	vi	
1 Scope	1	
2 Normative references	1	
3 Terms and definitions	1	
4 Symbols and abbreviated terms	2	
4.1 Symbols	2	
4.2 Abbreviated terms	3	
5 Measurement principle	4	
5.1 Spectral parameters of the echo	4	
5.2 Sources of received signals	7	
5.2.1 Turbulent scattering and partial reflection	7	
5.2.2 Echo in precipitation	9	
5.2.3 Clutter	9	
5.2.4 Interference from radio sources	10	
5.3 Methods of wind velocity measurement	10	
5.3.1 General aspects	10	
5.3.2 Doppler beam swinging (DBS)	10	
5.3.3 Spaced antenna (SA)	17	
6 WPR system	20	
6.1 Frequency	20	
6.2 Hardware and software	21	
6.2.1 Principal components	21	
6.2.2 Signal processing	22	
6.2.3 Antenna	24	
6.2.4 Transmitter	29	
6.2.5 Receiver	34	
6.2.6 Signal processing unit	42	
6.2.7 Observation control unit	45	
6.2.8 Consideration on environmental conditions	45	
6.3 Resolution enhancement and clutter mitigation using adaptive signal processing	46	
6.3.1 Range imaging (frequency domain interferometry)	46	
6.3.2 Coherent radar imaging (spatial domain interferometry)	51	
6.3.3 Adaptive clutter suppression (ACS)	54	
7 System performance	57	
7.1 Resolution	57	
7.1.1 Range resolution	57	
7.1.2 Volume resolution	58	
7.1.3 Time resolution	58	
7.1.4 Nyquist frequency and frequency resolution of Doppler spectrum	59	
7.2 Range sampling	59	
7.3 Radar sensitivity and measurement range	60	
7.4 Measurement accuracy	64	
7.4.1 Requirements	64	

7.4.2	Validation using other means	64
8	Quality control (QC) in digital signal processing	65
9	Products and data format	66
9.1	Products and data processing levels	66
9.2	Data format	67
9.2.1	General	67
9.2.2	Operational data format (WMO BUFR)	67
9.2.3	Scientific data format (NetCDF)	67
9.2.4	Data format defined by user and/or supplier	68
9.2.5	Other recommendations	68
10	Installation	69
10.1	General aspects	69
10.2	Land	69
10.3	Licensing of radio wave transmission	69
10.4	Infrastructure	69
10.5	Clutter	70
10.6	Interference from radio sources	70
11	System monitoring and maintenance	71
11.1	General aspects	71
11.2	Operational status monitoring	71
11.3	Preventive maintenance	72
11.4	Corrective maintenance	74
11.5	Measuring instruments	74
11.6	Policy for spare parts	74
11.7	Software	74
	Annex A (informative) Example of parameters can be configured by an operator	75
	Annex B (informative) General representation of the radar equation for monostatic radar	78
	Annex C (informative) Reflectivity of precipitation echo	80
	Annex D (informative) Impacts of assimilating wind products obtained by WPRs in atmospheric models	81
	Annex E (informative) Quality management of the WINDAS (Wind profiler Network and Data Acquisition System) of the Japan Meteorological Agency	82
	Annex F (informative) Example of data processing levels of data other than those typically used by the end users	83
	Annex G (informative) Data format for Japan Meteorological Agency (JMA)'s wind profiler using BUFR4	84
	Annex H (informative) Data format for Deutscher Wetterdienst (DWD)'s wind profiler using netCDF4	87
	Bibliography	92