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The MRI portable X-band Doppler radar (X-POD): Status and Applications

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1. Introduction

In order to better understand various mesoscale physical processes, subkilometer scale measurements to reveal finescale features of these processes are required. However, these are difficult to observe with traditional stationary meteorological radars. The most critical limitation is that stationary radar deployment is usually relatively far from target area. This results in finescale features being unresolvable due to beam spreading, topography, and earth curvature between stationary radars and the targets. It is clear that there is a need for finescale radar observations of these phenomena to examine the mechanisms involved in their formation and maintenance. A portable X-band Doppler radar (**X-POD**: **X**-band, **PO**rtable **D**oppler radar) has been developed as a ground-based radar observation platform to make fine-scale observations of various phenomena (Fig. 1). In this study, the status and applications of X-POD have been presented.

2. System description of X-POD

X-POD has a 60-km observation range, a 2.0 azimuth resolution, and a pulse length of 1.0/0.5/0.2 μs providing independent data points every 150/75/30 m in range. It is operated in both PPI and RHI modes and the velocity dealiasing algorithm (Kusunoki et al. 1996) correctly dealiases velocities even in a complicated circulation including thunderstorm outflows, mesocyclones, and wake vortices.

An important aspect of X-POD is its portability. As shown in the radar block schematic in Fig.2, the microwave and digital electronic circuits including a transmitter and receiver are mounted in the pedestal. Furthermore, X-POD allows its operation by less than 1.5kVA. The X-POD key parameters are summarizes in Table 1.

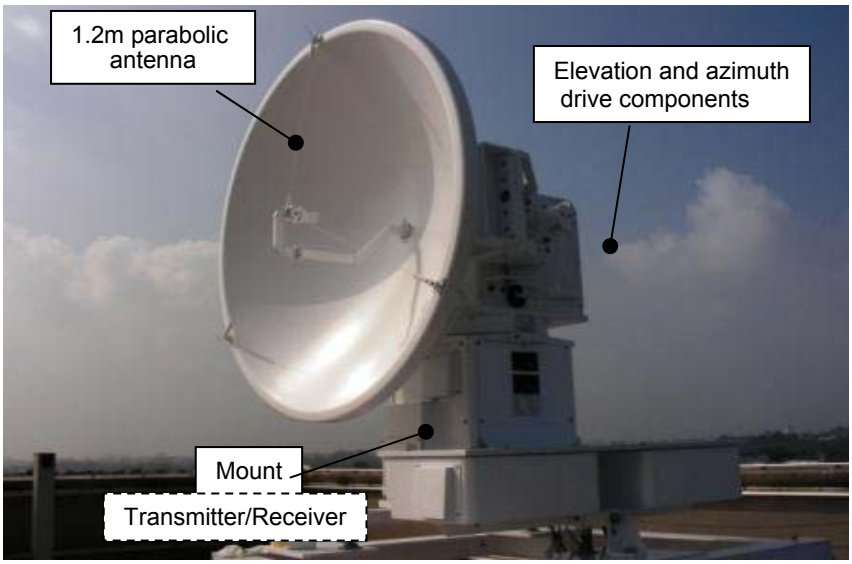

Fig. 1. X-POD antenna system

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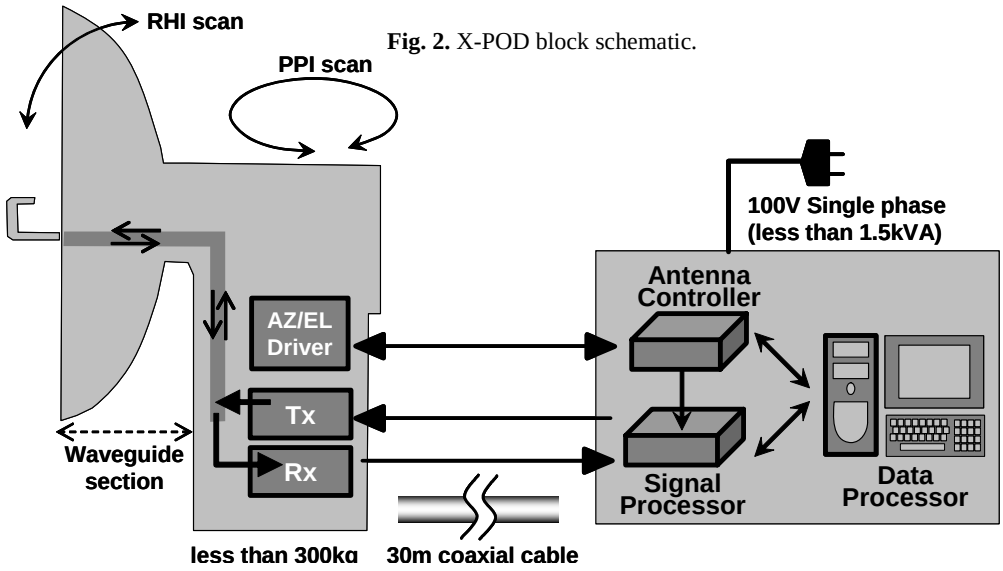

Fig. 2. X-POD block schematic.

Antenna	Size	1.2m
	Beamwidth	2.0deg
	Gain	36dB
	Antenna ratation rate	1-4rpm (PPI and RHI)
Transmitter	Peak tranmitted power	40kW
	Pulse width	0.2/0.5/1.0μsec
	Range resolution	30/75/150m
	Frequency	9810MHz
	Maximum unambiguous velocity	±27ms-1
	Maximum unambiguous range	30/60km
Receiver	Minimum detectable signal	-103dBm
	Dynamic range	60dB
Total weight		less than 300kg
Power consumption		less than 1.5kVA 100V, single phase

Table 1. Characteristics of X-POD.

3. Installation and operation

X-POD is basically truck-mounted radar system. X-POD can travel to regions of interesting weather and approach to a range where fine scale measurements. The height of the radar antenna while running on the roads is about 3.2 m AGL, which is lower than the generally permitted value of 3.8m. After stopping, the antenna can be lifted up to 5.2m AGL by a hydraulic lift in order not to be blocked by the cab (Fig. 3).

Furthermore, in addition to its small-size and low power consumption, X-POD can be easily dismounted from the truck and deployed on top of a tall building for studies of boundary layer circulations over an urban area. X-POD will also play an important role for mountain meteorology research because X-POD can be easily deployed on a steep mountain ridge (Fig. 4). It is expected that X-POD will increase opportunities to observe more cases than would result if only stationary radars are used.

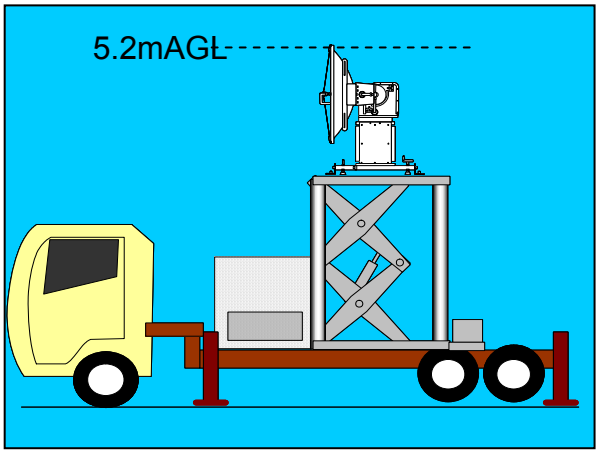

Fig. 3. Schematic illustration of the setup of X-POD.

Fig. 4. Schematic illustration of X-POD deployment on the roof of a building for observations over mountainous area.