

Fig. 2. X-POD block schematic.

Antenna	Size	1.2m
	Beamwidth	2.0deg
	Gain	36dB
	Antenna rotation rate	1-4rpm (PPI and RHI)
Transmitter	Peak transmitted power	40kW
	Pulse width	0.2/0.5/1.0μsec
	Range resolution	30/75/150m
	Frequency	9810MHz
	Maximum unambiguous velocity	±27ms ⁻¹
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. Example of observations

In mountainous regions, stationary radar observations are usually affected by beam blockage, which makes it nearly impossible to interpret the wake structures. Even if unobstructed radar data are obtained, the high-resolution observations would be precluded due to radar beam spreading because radar deployment is forced to relatively far from the mountain ridge. X-POD can deploy close to ridges and observe modification of the precipitation pattern by the topography. Figure 3 shows a schematic illustration of X-POD deployment on the roof of a building for observations over mountainous area.

In this paper, as an example of observations employed in mountain range, we present the wake observations in the lee of the mountain ridge of the central mountain range of Japan in March 2005. Note that the radar data came from the portable X-band radar which is a different version (i.e., only reflectivity). Figure 4 shows the location of the radar as well as the surrounding terrain. The area consists of mountains, valleys, and dams, and the elevation varies from about 700 to 2000 m. The radar was installed on the roof of a hotel building with eleven floors.

In the reflectivity images, it has been revealed that numerous 1 km-scale wake vortices that were carried downstream by the ambient flow.

Associated with wakes, it is evident that elongated strong reflectivity regions with sharp edges. Two cases provide good examples of wake structures in the lee of the Mt. Tanigawadake (1963-m altitude). In both examples, widespread snow occurred over the western side of the central mountain range of Japan associated with a cold westerly monsoon.

On 1st March 2005, the single line of cells associated with wakes in the lee of the Mt. Tanigawadake was observed. Fig. 5(a) is a typical PPI scan of reflectivity at an elevation angle of 5.5 degree. Usually, wake length exceeded 15 km and 1km-scale cells occurred at intervals of 2 minutes and moved southeastward. It is suggested that relatively weak eddies were generated quasi-periodically in the lee of the ridge and carried directly by the ambient flow. On 3rd March 2005 (Fig. 5(b)), the two lines of cells associated with wakes in the lee were observed. Wake length also exceeded 15 km and 1-2 km-scale cells occurred at intervals of 3 minutes and moved southeastward. Moreover, the vortex street broadens downstream. It is suggested that positive and negative vortices had formed in the lee of the ridge, were shed downstream quasi-periodically, and advected itself into eddies.

4. Concluding comments

The design and development of X-POD and an example of prototype X-POD (previous version) observations have been presented in this paper. It is expected that X-POD will increase opportunities to observe more cases than would result if only stationary radars are used.

As a near future mission, the GUSTEX [Gunma Storm Observation with Topography Experiment] will be conducted in the summer of 2006 to produce high-resolution observations of thunderstorms in the northern Kanto Plain of Japan. Observations with the X-POD will be used to examine the effect of topography on thunderstorm initiation and evolution.

Fig. 5. Reflectivity PPI patterns in the lee of the Mt. Tanigawadake (triangle; 1963-m altitude). The elevation angle is 5.5. (a) 0028JST on 1 Mar 2005. (b) 0208JST on 3 Mar 2005.

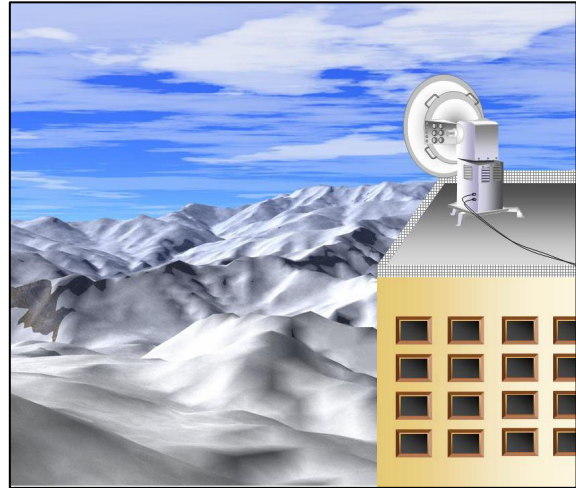


Fig. 3. Schematic illustration of X-POD deployment on the roof of a building for observations over mountainous area.

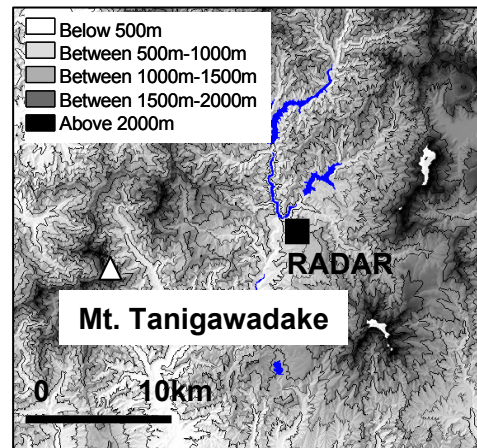


Fig. 4. Topographical map around the study area and the location of the radar site (square).

