SYSTEM DESIGN FOR A SPACEBORNE CLOUD RADAR

Eastwood Im, Fuk K. Ii, Stephen L. Durden, William J. Wilson
Jet Propulsion Laboratory, California Institute of l'ethnology, USA

Address: M.S. 300-227, JPL, 4800 Oak Grove Drive, Pasadena,CA91109, USA

Fax: (818) 393-4285

E-mail, phone:
castwood_im @radar-email.jpl.nasa.gov (81 8) 354-0492
fuk_li@radar-email.jpl.nasa.gov (81 8) 354-2849
durden@fringe.jpl.nasa.gov (81 8) 354-4719
wilson@merlin.jpl.nasa.gov (818) 354-5699

Submit to the Conference on Microwave instrumentation for Remote Sensing of the Earth (Paola Pampaloni, Chairman)

Presentation: Oral

Keywords: Cloud Radar, GEWEX, TRMM-II

ABSTRACT

An essential component of the Earth's energy budget is the three-dimensional distribution of radiative and latent heating and cooling of the atmosphere. To derive these quantities, it is necessary to know the global, three-dimensional distributions of clouds and precipitation. Thus far, however, information on the distribution of vertical structure of cloud systems is missing from existing observations. Recognizing this deficiency, the World Climate Research Program (WCRP) Global Energy and Water Cycle Experiment (GEWEX) is currently pursuing an approach to acquire such information. The approach entails the development of a spaceborne radar sensor to acquire a near-global data set on the distribution of the three-dimensional structures of the cloud systems. To support this effort, JPL has studied the feasibility of implementing such a cloud radar in the GEWEX era.

The radar design is intended to be accommodated, in a limited resource environment, by a conventional satellite such as the TRMM-II satellite for a near-future launch. As such, the radar is assumed to be placed in an non-sunsynchronous, circular orbit with inclination angle between 50° and 60°, and with a nominal orbit altitude of 400 km. The radar sensor is a 94-GHz, short-pulse, nadir-pointing instrument utilizing the 94-GHz radar technologies which are available either currently or within the very near future. In particular, this strawman design provides a vertical resolution of 500 m and a minimum detectable cloud reflectivity of slightly better than -30 dBZ.

Through our study, we have identified a number of design and technology issues that are unique to the spaceborne cloud radar sensing, such as the surface clutter interference through antenna sidelobes, as well as through pulse compression sidelobes for the coherent detection radars.

In this paper, wc will present the strawman system design for this spaceborne cloud radar, as well as results of the accompanying design and performance trade study.

ACKNOWLEDGMENT

The research described in this paper was performed by the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration.

BRIEF BIO GRAPHY

Eastwood Im received his Ph.D. in Electrical Engineering from the University of Illinois in 1985. He has been with the Jet Propulsion Laboratory since then. His research interests include rain retrieval algorithm development and system conceptual studies on advanced radar remote sensors. He is current] y a member of the TRMM Science Team.