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ABSTRACT TITLE:

"Single-Pass" High Resolution Scatterometery by Simultaneous Range/Doppler Discrimination

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ABSTRACT TEXT:

Current spaceborne wind scatterometers, such as the ERS-2 AMI and SeaWinds on QuikSCAT, are contributing greatly to the study of the Earth's climate and marine weather systems. In addition to winds, scatterometer backscatter data has been applied in number of other research areas including polar ice mapping and classification, snow coverage and depth analysis, vegetation studies, and soil moisture retrieval. Indeed, as a low-cost, multi-purpose, global climate remote sensing device, the scatterometer is emerging as an important complement to the more established passive microwave radiometer and visible/IR imager data sets. As a result of these successes, follow-on missions to continue and improve upon the current scatterometer data are being planned both in the U.S. and Europe.

Current scatterometers obtain backscatter at relatively low resolution (20-50 km) which is unsuitable for many applications, particularly those involving land processes. Because of this, one significant focus of follow-on scatterometer design is spatial resolution improvement. Although "multiple-pass" resolution enhancement techniques have been successful employed, the non-stationary nature of many terrestrial targets dictate the utilization of a more direct, "single-pass" resolution approach.

In this paper, a methodology to apply simultaneous range and Doppler discrimination to obtain single-pass, high-resolution scatterometer measurements is presented. The unique aspects of the scatterometer scan geometry, relative to that of SAR, in obtaining range/Doppler resolution are addressed. Issues discussed include: continuously variable squint angle, scanned swath continuity, range/Doppler ambiguities, limited azimuth dwell times, and measurement variance. A fundamental, theoretical limit on the achievable azimuth resolution for a conically scanning scatterometer is derived. It is shown that, with straightforward extensions of current scanning scatterometer technology (such as that employed by SeaWinds), a system capable of 1-5 km resolution over an 1800 km swath can be achieved. At Ku-Band, it is further shown that this system is accommodatable on small, low-Earth orbiting satellites. The utility of this technique in the study of meso-scale oceanic winds, as well as a variety of land and ice applications, will be discussed.

TOPIC PREFERENCE: F.1 Advanced Passive and Active Sensors, or F.11 New Instrumentation and Future Techniques