SYNERGY OF DATA OF BARE SOIL, SNOW, ICE AND WAVED WATER SURFACE MICROWAVE REFLECTION AND EMISSION ACQUIRED BY C AND Ka-BAND COMBINED SCATTEROMETER-RADIOMETER SYSTEMS

Artashes K. Arakelyan, Hrant G. Muradyan, Astghik K. Hambaryan, Vanik V. Karyan,
Gagik G. Hovhannisyan, Melanya L. Grigoryan, Arsen A. Arakelyan and Sargis A. Darbinyan

ECOSERV Remote Observation Centre Co. Ltd.
2 G.Njdeh Str., #24, Yerevan, 0006, Armenia
Phone: (374 10) 421 877 / 425 088; Fax: (374 10) 421 877 / 440 566;
E-mail: arakelyanak@yahoo.com, ecoservroc@yahoo.com

In this paper a measuring complex of C-band (5.6GHz) and Ka-band (~37GHz), dual polarization, combined scatterometer-radiometer systems is described. The complex allows carry out dual frequency, polarimetric (vv, vh, hh, hv), simultaneous and coincident microwave active-passive measurements of the observed surface (soil, vegetation, snow and water surface) parameters. The originality of the developed systems is in the spatial-temporal combination of microwave active and passive channels of observation and their possible application for short distance sensing (the minimum operational range for each scatterometer is ~5m) from low altitude platforms under far field conditions for both radar and radiometric observations.

The main characteristics of used C- and Ka-band, combined scatterometer-radiometer system are:

Central Frequencies -	5,6 GHz and ~37GHz;
Radar Pulse duration –	~25ns
Radar pulse power –	50mW-1W and 30mW
Radar receivers' bandwidths -	~40MHz;
Radiometer receivers bandwidths -	~600MHz;
Parabolic and Horn antenna with a beamwidths –	5^0 and $7,5^0$;
Radar receivers noise factor -	~2dB and ~3dB;
Radiometer receiver's noise factor -	~250K and ~600K;
Radar channel's sensitivity at 1s -	~0.1dB;
Radiometer Channel's sensitivity at 1s -	~0.15K and ~0.35K.

The principal peculiarities of the utilized device are its originality in spatio-temporally combining of functionality of microwave active-passive channels of observation under short range sensing application condition. The minimum operational range for the system's scatterometer is 5m, at a far zone condition of sensing.

The measurements of soil, snow and experimental pool water ice and waved surface microwave emission and reflection characteristics were carried out in the ECOSERV ROC

Company's experimental site, from a stationary, quarter-circle shaped measuring platforms of 6.5m of radius, one over soil and another one over the pool water surface. This measuring complex allows to carry out multi-frequency and polarimetric measurements of the observed surfaces microwave active and passive characteristics under quasi-field, controlling laboratory conditions. The measuring platforms allows simultaneously research angular dependences of microwave reflective and emissive characteristics of the same area of the observed surface, at various frequencies and under various polarizations of scatterometric and radiometric signals. The measurements were curried out under various snow and soil moistures, snow, soil, ice and water surface temperatures, snow and ice thickness, air temperatures, soil and water surface roughness and wave parameters, snow and ice melting parameters, snow and ice cowers' densities, etc.

The methodology of experiments' performance and field calibration of the measuring system and the measured results will be discussed in this paper too. Relationships between soil, snow, ice and waved water surface radar backscattering coefficients, brightness temperatures at two various frequencies will be built, under various conditions of observation (angles of incident and polarization), and the observed surfaces parameters, such as: moisture, surface and air temperatures, density and thickness, surface roughness and wave parameters, etc. As well as correlative properties between soil, snow, ice and water surface radar backscattering coefficients and brightness temperatures due to the change of observed surface structure, density, moisture, surface and air temperatures, roughness and melting parameters will be presented.