RADAR SIGNAL RETRODIFFUSION BY WATER SURFACE

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1. INTRODUCTION

To prepare the future altimetry space missions at Ka band, the objective of this work is to consolidate common background and hypothesis concerning the radar signal retrodiffusion by water surface, which is a key point for power budget in spatial altimetry applications.
To better estimate the backscattering coefficient in Ka band altimetry configuration, we developed a dedicated measurement campaign using the ONERA BUSARD platform. On board this carrier, we use a Ka band radar sensor developed to operate in several configurations, including nadir looking geometry.

2. KA BAND RADAR SENSOR

For the last few years, the Electromagnetism and Radar Department of ONERA (DEMR) has been leading an experimental program focusing on new concepts of EM payloads. To prove their feasibility a demonstrator named DRIVE has been designed and developed. This demonstrator can be operated with two dedicated operation modes: As a classical side-looking SAR sensor, and as a nadir-looking radar sensor.
It is this last innovative configuration that we plan to use for a dedicated measurement campaign to estimate accurately the backscattering coefficient at Ka band in altimetry configuration. This campaign will involve BUSARD test bench (S10-VT motorglider) operated by ONERA.

3. CAMPAIGN DESCRIPTION

3.1. Radar parameters

To characterize the radar signature of water surfaces at Ka band, we planned to fly over three areas around Fos sur Mer, in south of France. Typically, 3 flights will be performed to study the Ka retrodiffusion under three wind conditions: null wind, low wind (about 10 km/h) and medium wind (about 30 km/h). Areas of interest are the Berre lake, sea surface south of Fos sur Mer and the Camargue region. Two polarization states will be studied, Vv and Vh. Finally, main radar parameters are provided in following table.

PARAMETER	VALUE
Central frequency	35 GHz
Bandwidth	480 MHz
PRF	1250 Hz
Altitude	From 200 to 2000m
Antenna aperture	4°x27°
Spatial resolution	30 cm

3.2. Calibration issue

Calibration is a key point as this experiment concerns water surface accurate backscatter coefficient estimation. We proposed to use a three step calibration scheme.
Preliminar calibration : the radar sensor will be fully characterized in the laboratory to identify precisely the transmit and receive channels gains. Some additional tests with on ground trihedral calibrators will be done for power budget estimation.
In flight calibration with steep incident angles: We will fly with steep incident angles, centered around 75°. During this flight, we will fly over a dedicated calibration region where trihedral calibrators are installed. Objective of this second step is to determine precisely the calibration coefficients to be applied to the radar data.
In flight calibration with nadir geometry: This third step is about the real measurement flights. We will fly over regions of interest and apply calibration coefficients estimated at previous steps.

The radar definition and specifications will be detailed, together with the campaign description. First acquisition results to be obtained on spring 2009 will be presented and analyzed.