DELAY-DOPPLER MAPS STUDY IN SPACE SCENARIOS: OCEAN, LAND AND ICE

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1. INTRODUCTION

The use of GNSS-R techniques in remote sensing is currently growing. A number of studies have used these techniques over the ocean to retrieve altimetry and sea state information [1-5], over land to retrieve soil moisture [6, 7], and over the ice to retrieve altimetry and ice age [8].

The main objective of this work is the analysis of the Delay-Doppler Maps (DDM) [9], which are the power distribution of the reflected signal coming from the GPS satellites over a two-dimensional space of delay offsets and Doppler shifts with respect to those at the specular reflection point. Space-borne scenarios will be studied in view of its potential application to the SMOS follow on mission (SMOSops) or Seosat/Ingenio [10].

Publicly available data from the GPS bistatic remote sensing experiment onboard the UK Disaster Monitoring Constellation satellite (UK-DMC) [11] have been analyzed. The UK-DMC uses the Surrey Satellite Technology Limited's Space GPS Receiver [12]. The Daaxa software, developed by Scott Gleason under GNU GPL Surrey Satellite Technology Limited [12], is a C++ code that processes the raw data providing DDMs products. Not happy with a blind processing, Daaxa code has been carefully analyzed, and some improvements have been implemented

2. RAW SATELLITE DATA PROCESSING

The publicly available raw data corresponds to three different types of scenarios: sea, land and ice measurements, which have been analyzed. The analysis is made in two main parts:
Firstly, it is necessary to determine the basic DDM unit, or the minimum number of incoherent integrations needed to obtain a good-quality DDM. Two criteria have been established to consider a DDM as a good-quality DDM. One is the study of the evolution of the DDM volume vs. time [9], that should increase and stabilize when computed as the volume below the DDM and above a given threshold. The second way to proceed consists of performing histograms and analyzing the statistics of the pixels of the DDMs to study the nature of the signals. When the signal statistics become more Rise-like, the basic unit is found. Then, a comparison between the two criteria is performed and discussed.

Secondly, the 12 seconds of available raw data have been processed providing different DDM which are the result of the incoherent integration in terms of the basic unit. All of them have been processed in order to analyse their general statistics, media and variance.

3. CONCLUSIONS

The results of this analysis will be compared to the theory. This is an initial study on real data from space-borne scenarios, that should help defining the optimum receiver to infer sea state from DDM parameters.

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