OTHR-SW Coordinate Registration method based on Sea-Land Transitions: Clutter Model Definition

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***Abstract*— In previous works we proposed a Coordinate Registration (CR) method of the received echo by pulsed, monostatic Over The Horizon Sky Wave Radar (OTHRsw). This method takes advantage from the *a priori* geo-morphological knowledge of the surveillance area (especially the coastline profile) and from the pronounced difference between the sea and land normalized backscattering coefficients.**
In this paper we present a model of surface clutter, its software implementation and its role in the simulation tool under development intended to recreate the complex OTHR scenario in order to analyze the performances of the proposed CR method.
A brief introduction about the radar scenario is given; the main clutter model hypotheses are outlined; the adopted space-time distributions processes are motivated; the key-parameters for the model configuration are described; some examples of simulated clutter scenarios are proposed; the achieved results are finally shown.

I. INTRODUCTION

By exploiting the propagation characteristics of the ionosphere, the OTHR-SW system is able to achieve a surveillance area whose extension is comparable to that of satellite constellations or airborne radar networks.

Unfortunately the spatially non-homogeneous and time-dependent ionospheric propagation channel leads to evident uncertainties in the received radar echo.

The coordinate registration procedure is needed to associate the received data to coordinates that determine univocally its position on the Earth surface. In other terms, the purpose of any CR procedure is the georeferentiation of the radar echo.

The proposed CR method relies on the localization of a sea/land transition within the radar footprint by processing the echo power profile. The method is totally independent of any external information source (e.g.: ionospheric soundings; presence of beacons/transponders or passive receivers in the surveillance area; fusion with external sensors; etc ...) [1,2].

The processing procedure required by the proposed CR method is basically a correlation between the reference binary clutter mask of the surveillance area and the power signature (in the time domain) of the returned echo.

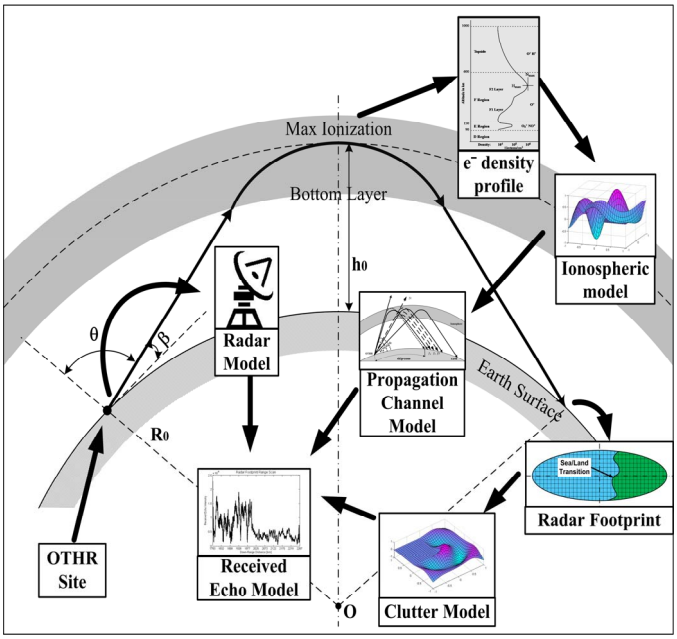

Fig. 1. Block diagram of the proposed OTHR-SW scenario model.

Moreover, no coherent integration is required and the time-computational costs are really reduced.Thanks to its peculiar geomorphological structure, the East Mediterranean area (Fig. 2) offers a perfect scenario for the application of the proposed technique.

Because of the difficulty in gathering real-time ionospheric information and the basic lack of surface clutter statistics in HF band, we are currently developing a composite model of the complex OTHR scenario (Fig. 2). The model includes three main blocks: radar system; ionosphere and propagation channel; clutter area and radar footprint. Its purpose is to simulate a plausible OTHR echo in different operating scenarios to be used in the correlation with the reference clutter mask of the surveillance area, in order to provide a reference performance basis of the proposed CR method.