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Forest Fire Detection with Weather Radars

V. Santalla del Rio*, R. Nocelo-López , M. Vera-Isasa, M. García-Sánchez, I. Cuiñas, A. Vazquez-Alejos, P.Torío and E. de Lorenzo
Universidad de Vigo, Vigo36310, Spain, e-mail: veronica@uvigo.es

Forest fires threaten human life and properties, endanger the biodiversity, increase the risk of desertification and impoverish the atmosphere quality as the emissions of carbon and greenhouse increase.

The incidence of forest fires is much greater in Southern European countries compared to Northern, as well as in other similar climatic areas in other continents, (e.g. California). These are more sensitive to global warming and are at a higher risk of desertification.

In the fight against forest fires, early detection is critical. A fast and efficient intervention means a lower risk for human life, to reduce the burned forest area and a decrease of carbon and greenhouse gases emissions. Weather radars are continuously operated. If they can be used for fire detection, they will provide continuous monitoring, day and night, with very short revisit time.

Weather radars transmit electromagnetic pulses and receive the waves backscattered from the elements in the surroundings. Measurements of the variations of the phase of backscattered waves from stationary targets allow to estimate the variations in the refractive index and henceforth the changes in temperature and humidity [1].

Forest fires cause a sudden drop of the humidity and a high increase of the temperature. These changes on the atmospheric conditions cause a variation of the refractive index of the atmosphere that affects the propagation of electromagnetic waves.

Estimation of the refractive index from weather radar measurements has already been proved in flat areas where negligible differences between the heights of the radar and the stationary targets can be assumed. To extend the estimation of the refractive index to any area, flat, hilly or mountainous, the algorithms for refractive index estimation are generalized to take into account the different heights of the stationary targets and the vertical gradient of the refractive index. A least squares approach is considered for the joint estimation of the refractive index and its vertical gradient. Results based data collected during the Refractivity Experiment for H2O Research and Collaborative Operational Technology Transfer (REFRACTT_2006) held at the base of the Foothills of the Rocky Mountains in Boulder (Northeast Colorado, USA) [2] will be presented.

This work is being developed within LifeTec, a coordinated project with participation of Universidad de Vigo, IPMA (Instituto Português do Mar e da Atmosfera), Meteogalicia, Amtega and Retegal. For the project demonstration data will be acquired with the weather radars at Cuntis (Galicia, Spain) and Arouca (Portugal) radars, operated by Meteogalicia (Spain) and IPMA (Portugal).

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