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IONOSPHERIC TOMOGRAPHY BY OVER-THE-HORIZON RADAR

Soutenance de thèse de Corinna ROY
Jeudi 27 novembre 2014 à 14h00
IPGP Amphithéâtre, 1 rue Jussieu – 75005 PARIS

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Résumé

Most recent methods in ionospheric tomography are based on the inversion of the total electron content measured by ground-based GPS receivers. As a consequence of the high frequency of the GPS signal and the absence of horizontal ray paths, the electron density structure is mainly reconstructed in the F2 region (300 km), where the ionosphere reaches the maximum of ionization, and is not sensitive to the lower ionospheric structure.

To overcome these limitations, a new tomographic method of the lower ionosphere, based on the full inversion of over-the-horizon (OTH) radar data has been developed in this thesis.

This method takes into account the effect of the electron density perturbation on the velocity of the electromagnetic waves, as well as the ray-path deflection. This last point is extremely critical for OTH radar inversions as the emitted signal propagates through the ionosphere between a fixed starting point (the radar) and an unknown end point on the Earth surface where the signal is backscattered.
The first part of this work is based on the theoretical development of the tomography method of Over-the-Horizon radar, as well as the validation on synthetic benchmark tests and resolution analysis.
After validation, the method has been applied to real data from the Over-the-horizon radar Nostradamus, showing the potential of a 3D ionospheric tomography over Europe.