TITLE:

3D High Resolution Imaging of the Earth Using Radar Technology for Engineering, Environmental, Geological and Archaeological Applications

ABSTRACT

We are daily interacting with the surface and subsurface of the outermost part of the earth's crust, where we live, drill, excavate, construct structures, utilize its groundwater and mineral resources and store our wastes. This part of earth is extremely dynamic and needs proper non-destructive technology to image it. A high resolution subsurface imaging reconstruction using a non-destructive probing technique is needed in many fields of applications; engineering, environmental, geological and archaeological.

On the other hand, radar waves have the capability of penetrating deep into vegetation, snow and soil and reveal, thus, information about the dielectric and geometric properties of the target surface and subsurface. In this presentation, two different radar sensors, namely space-borne synthetic aperture radar (SAR) and ground penetrating radar (GPR), will be presented to show their ability to image the surface and subsurface at different scales and platforms. The SAR satellites with its multi-frequency and multi-polarization features are a very effective method for exploring large-scale and difficult-to-access areas, revealing the surface and underneath structures. Such large scale imaging from space can definitely provide useful information for further field work. The GPR can be used not only to verify and to interpret the resulting image products of space-borne SAR sensors but also to illustrate the geometry of the subsurface layers, structural framework and the accurate depth to targets. SAR and GPR are operating in a relatively same microwave range of the electromagnetic spectrum and controlled by the same electromagnetic wave propagation theory as well.

In addition, the 3D high resolution image reconstruction of the subsurface is useful to identify the depth, shape and size of targets from which the end-user can easily extract quantitative results. Thus a new 3D GPR system which consists of a combination between the Rotary Laser Positioning System (RLPS) with the commercial GPR system will be introduced here in this presentation. Many experiments and real field measurements were conducted using this system setup to test its effectiveness in showing high performance for detecting all targets especially the small ones with high resolution. Some of these measurements will be demonstrated in this presentation.