GPS and INSAR Solution - Integrating Deformation data with E&P technologies

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Abstract

The modern geodetic and remote sensing techniques of Global Positioning System (GPS) and Interferometric Synthetic Aperture Radar (InSAR) are emerging as powerful tools to determine deformation patterns of past and present earth surface through recorded digital elevations. In Oil and Gas sector, GPS and INSAR has started to play a very vital role in both G&G and reservoir/field studies. The combination of GPS and INSAR time series data is now actively used at various stages of exploration of new reservoir, development and field evaluation and monitoring the surface impact after reservoir abandonment. The technical structure of the GPS and INSAR can be defined as 4D Layered based data that is comprised of 3D XYZ surface layers at different time intervals (4D Component). The time based data strings are over-layered to evolve a deformation model aiding regional studies of surface dynamics. Additionally, Satellite images and GIS based objects coupled with deformation values as surface elevation provides holistic picture of observation area for visual analysis of surface changes that occurred during recording time frame. In the native format, the management and storage is restricted to specialized surface deformation applications and library based physical/digital structural files repository. Whereas the accessibility is limited to, GIS based shape file images. The database structure to store these data types are missing in most of the known oil and gas interpretation suites thus require a specialized solution and dedicated database structure to preserve and incorporate these details in routine interpretation information to comprehend its value in the surface and surface studies. The customized solution of GPS and INSAR management and accessibility is intended to extend the value of acquired deformation dataset in reservoir monitoring and exploration/development workflows. The solution mainly based on the embedded structure of a corporate database to digitally preserve the XYZ based data strings as surface layers over narrow bin sized survey Grid. By taking advantage of its comprehensive structure (point sets), the complete time series INSAR dataset is stored as a single unit of multiple time layers in their acquired hierarchy. The data type provides advance capabilities of individual layer display on GIS based maps, surface generation at each time instance, and deformation calculation and trend analysis of data on varied recorded time intervals. The storage workflow provides a robust solution that can cater data type management as well as its integration with oil and gas workflows in a very effective manner.