



GROUND SUBSIDENCE MEASURING, MONITORING AND MODELING IN THE COSTA ORIENTAL OILFIELDS IN WESTERN VENEZUELA: THE LAST FIFTY YEARS

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ABSTRACT

Oil production from shallow (300 to 1000m), unconsolidated reservoirs in the Costa Oriental (Eastern Coast) of Lake Maracaibo in western Venezuela has caused significant ground subsidence over an area of more than 2.000 km². Subsidence has been monitored since the late 1920's and has reached, as much 6,4 m in areas of intensive oil production as of April 2006 with rates as high as 0,26 m in areas of intensive oil production.

The topography of the area (low laying, swampy ground barely above Lake level) has resulted in the need of progressively building earthen coastal protection dikes which, together with inner (diversion) dykes and an elaborated drainage system.

A leveling network was established in Lagunillas in 1929 and later extended to other oil fields. To date network covers an area of about 1.600 km² and comprises 1.889 bench marks in land as well as 329, in the lake in near shore oil well platforms. The subsidence monitoring surveys are conducted at two-year intervals. In 1988 GPS (Global Positioning System) techniques were incorporated in the leveling campaign with encouraging results | ere are more than 60 years of subsidence history, a significant treasure from a scientific point of view.

Three subsidence prediction programs (HUNDCALC, SINK and SUB 3D) have been developed in recent years however, due to their inherent complexity, the SINK and SUB 3D models are only used for specific areas whereas the HUNDCALC model is used for more general prediction requirements.

At the time of the writing of this paper consideration is being given for the possible use of InSAR and other novel technologies for ground subsidence measurements.

This paper will describe in detail the subsidence measuring and prediction and give an account of the experiences of the author who, for more than 50 years, has been involved with subsidence measuring, monitoring and prediction activities.