Thursday, November 11, 2004

Petroleum Club • 800 Bell (downtown)
Social 11:15 a.m., Lunch 11:45 a.m.

Cost: $30 with advance reservations, $35 for walk-ins, space available

Register on-line : http://www.spegcs.org/en/calendarevents/registration/add.asp?calendareventid=516
or call Lizbeth Ortiz 713-779-9595 x. 613
All reservations must be received before November 8!!

Joint HGS/SPE/HEC/SIPES General Luncheon Meeting

*by **Roy K. Dokka***
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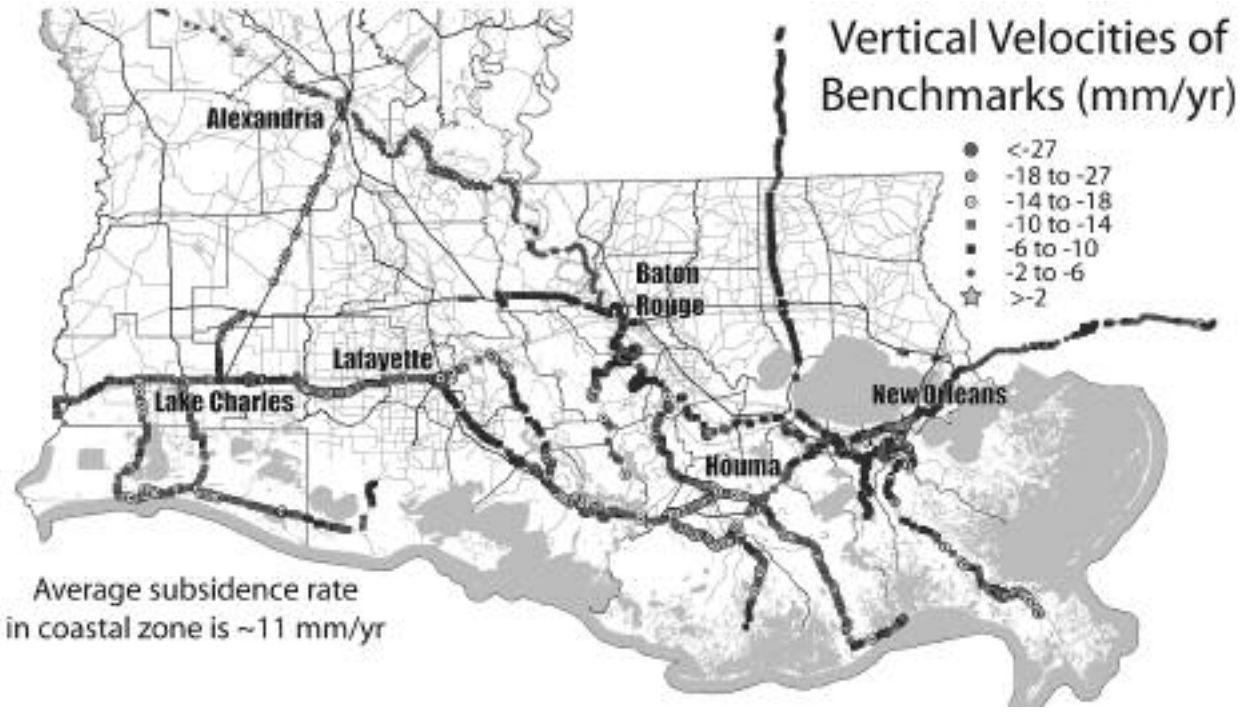
Baton Rouge, LA

The Anatomy of a Silent Disaster: Ongoing Subsidence and Inundation of the Northern Margin of the Gulf of Mexico Basin

Coastal areas of the south-central USA are the site of America's greatest wetland, the gateway to America's energy heartland, and home to over 10 million people. This area is being increasingly threatened by progressive inundation by the relative rise of the Gulf of Mexico. Inundation has been linked to several causes including subsidence of the land, eustatic sea level rise, erosion, and canal dredging. The lack of precise rates on processes has prevented the development of a theory that can explain inundation. Subsidence, however, is suspected by most workers to be the dominant factor based on: 1) the region's deltaic geologic setting; and 2) the observed magnitude of subsidence implied by a few marine tide gauges along the coast (relative sea level rise minus the eustatic component).

…substantial portions of the Gulf Coast (primarily Louisiana) will lie below sea level and be inundated by end of this century.

Recent analysis of NOAA/National Geodetic Survey (NGS) 1st order leveling data produced vertical velocities for over 2700 benchmarks in Louisiana, Mississippi, Alabama, Texas, Arkansas, Florida and Tennessee. Motions were related to the North American Vertical Datum of 1988 (NAVD88) and show that subsidence is not limited to coastal wetland areas, but rather includes the entire coastal zone as well as areas several hundred kilometers inland. Regionally, vertical **HGS General Luncheon** *continued on page 21*



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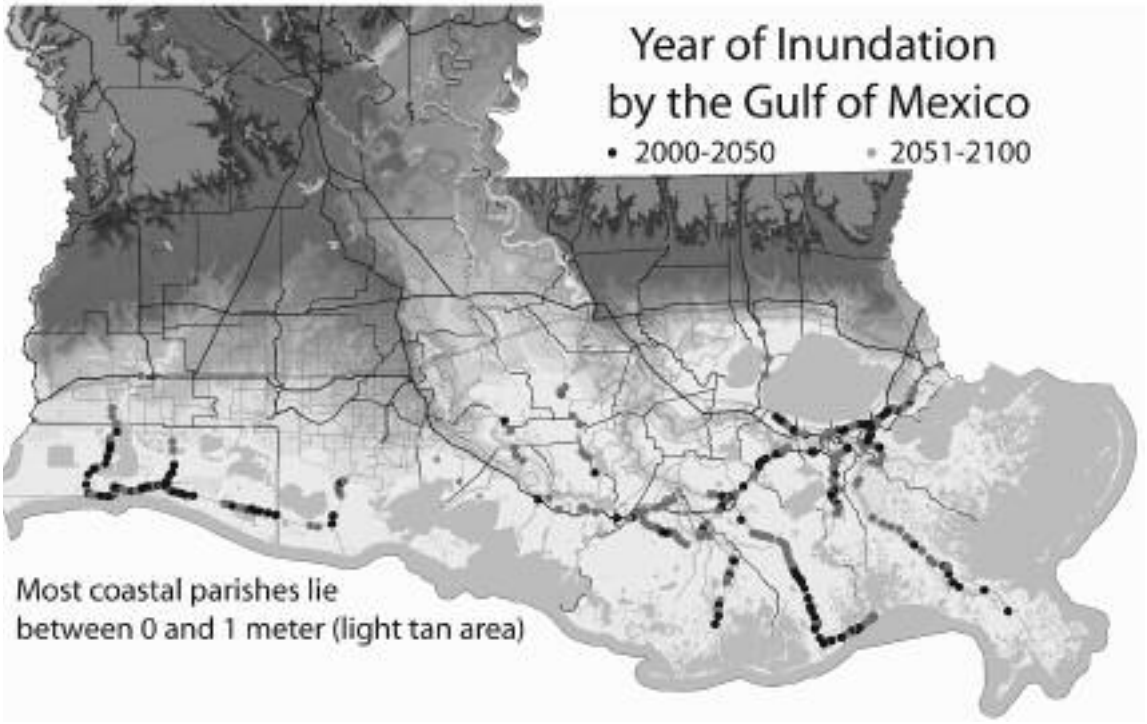

velocities range from less than –30 mm/yr along the coast to over +5 mm/yr in eastern Mississippi-Alabama. The mean rate is ~11 mm/yr in coastal Louisiana. In the Mississippi River deltaic plain, subsidence was significantly higher than previous estimates based on long-term geologic measurements. The data also indicate that adjacent alluvial ridges where the population is concentrated have been similarly affected. The Chenier Plain and Cajun Prairie of southwest Louisiana, areas previously thought to be only slowly sinking, are actually subsiding at rates similar to those of the deltaic plain.

Recognition that all areas of the coast as well as inland areas are sinking implies that subsidence recorded by benchmarks is not just due to local sedimentary processes and/or the activities of humans. Geodetic data when combined with subsurface geologic information suggest that subsidence includes a large tectonic component due to lithospheric flexure and normal faulting. Tectonic effects can be attributed to late Quaternary sediment loads such as the modern Mississippi River delta and Pleistocene deposits offshore. Previous models of simple flexure are inadequate, however, to explain the regional component of subsidence. Instead, it is proposed that active faulting in coastal areas influences regional subsidence by episodically weakening the lithosphere, which in turn changes the way that the lithosphere bears the load of sediments over time. Evidence also suggests that substantial subsidence in southwest Louisiana is due to salt intrusion/evacuation induced by sediment loading (active minibasin formation).

It is likely that the natural processes that have caused subsidence of benchmarks over the past 50 years will continue into the near future and at similar rates. Thus, if eustatic rise continues (or increases) and humans fail to build protection levees to appropriate heights, substantial portions of the Gulf Coast (primarily Louisiana) will lie below sea level and be inundated by end of this century. In Louisiana, this will result in a loss of ~$140B of land and property, as well as the land, jobs, homes, and cultural heritage of over 2 million people. ■

Biographical Sketch

Dr. Roy K. Dokka is the Fruehan Endowed Professor of Engineering at Louisiana State University. He also serves as Executive Director, Center for GeoInformatics and is Director, Louisiana Spatial Center (LSRC). The LSRC is a partnership with the National Geodetic Survey-NOAA focused on creating a state-of-the-art positional infrastructure for the region. Dr. Dokka is a Fellow of the Geological Society of America and was awarded a lifetime honorary membership in Alpha Lambda Delta, the National Freshman Honor Society. He is currently Past-President of the South-Central Section of the Geological Society of America.