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Characterization of the presence of free gas in sediment from long term pore pressure monitoring

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Quantifying the distribution and content of free gas in surficial sediments can have profound engineering, scientific and environmental significance. Yet this approach is often hindered by difficulties in preserving samples under in situ conditions before laboratory analyses while remote sensing techniques are of too low resolution to allow for fine-scale studies. In this context, the use of in situ pore pressure measurements has been proposed as a potentially efficient means of overcoming these difficulties. Efforts have been oriented in this direction off the Nice airport where the presence of free gas in sediment has been inferred from core analysis, seismic data and in situ acoustic measurements. In this area, concerns over slope stability of the shelf edge have motivated the deployment of piezometers providing real-time pore pressure data via the EMSO Ligure Nice cabled observatory. Monitoring over a period of four years revealed that pore pressures have consistently fluctuated with tide, exclusively in depth intervals where seismic data suggested the presence of free gas. This motivated the use of a double compressibility model with pore pressure and tide gauge data as input parameters to estimate gas contents at different depth below seabed. The model results indicated that the content of gas within the upper 20 m of sediments varies from 8 to 12% without showing a vertically-ordered pattern. This has been taken to suggest that free gas might have been locally produced from organic-rich sediment intervals rather than originating from a deep-seated source layer.