Influence of sedimentary gas bubble ebullition on interfacial transport in permeable marine sands

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In the uppermost centimeter of shallow, permeable sediments, photosynthesis by microalgae causes oxygen supersaturation, leading to the formation of oxygen bubbles. Ebullition is one of several processes that affect circulation and exchange of water into and out of the sediment, yet is not well understood. It occurs when these gas bubbles are released due to growth in size or waves and tide-induced pressure oscillations, and may enhance the release or exchange of solutes. In sandy, coarse-grained sediments bubbles occur mostly as small inconspicuous interstitial bubbles, in contrast to larger formations of free methane gas in deeper layers of muddy sediments. Laboratory ebullition experiments utilizing inert dye showed the effects of the sediment depth of ebullition and the volume of sediment affected by the bubble flow. Compared to sediment cores, where diffusion was the sole transport mechanism for the dye, flux in the ebullition experiments was enhanced 5-23 fold. Analyses of the sediment cores revealed a distinct pattern of pore water flow as a result of ebullition, where circulation that was effective in vertical and horizontal mixing of pore fluids. In field experiments using bromide as intert tracer, bubble ebullition caused an enhancement of pore water exchange and thus benthic pelagic coupling.

Water table fluctuations with soil temperature changes in a laboratory experiment

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A New Observation about Water Table Fluctuation

A phenomenon of the diurnal water table fluctuations with soil temperature changes was derived from a laboratory experiment on soil (eolian sand) evaporation. The water table rise with the soil temperature increase in daytime and it declined with the soil temperature decrease in nighttime. In 10-day time scale, the water table also exhibited the same variations with temperature changes. The influence of temperature on diurnal water table fluctuation was considered ignorable and only exhibited in long-term changes in previous studies [1,2]. However, our experiment results showed it is notable.

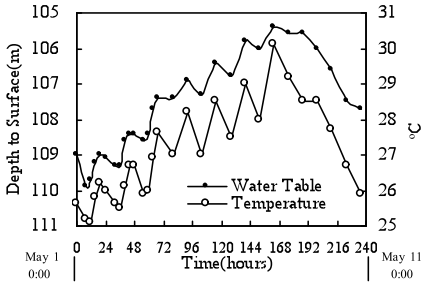

Figure 1: Water table fluctuations with soil tempeture changes

Discussions of Results

In our experiment, the groundwater evaporation was not effect on the water level due to the depth to water table (about 1.1 m) was much less than the extinction depth of water evaporation in the eolian sand media (about 0.5 m), as well as the barometric pressure change. Traditionally the water table fluctuations due to temperature changes were interpreted using the Muskat equation [3,4]. However, it only reasonable to explain the water tables rise due to temperature rise. The Influence of temperature on the soil capillary pressure of soi is probably main factor for water table fluctuation. a completely discussion of these results will be presented in the conference.

[1] Loheide (2005) *Water Resour. Res.* **41**, W07030 doi:10.1029/2005WR003942. [2] Hare *et al.* (1997) *Ground Water* **35**, 667-671. [3] Constantz (1994) *Water Resour. Res.* **30**, 3253-3264D. [4] Meyer (1960) *J. Geo. Res* **65**, 1747-1752 .