Geophysical Research Abstracts
Vol. 18, EGU2016-5630, 2016
EGU General Assembly 2016

On the interpretation of millennium-scale level variations of the Black Sea during the first quarter of the Holocene

Alexander Kislov
Moscow State University, Meteorology & Climatology, Moscow, Russian Federation (avkislov@mail.ru)

Introduction. During the first quarter of the Holocene, the Black Sea (BS) experienced large changes: amid the gradually rising water surface, Black Sea level (BSL) fluctuations occurred. We calculated based on records (e.g., Balabanov, 2007) that the standard deviation is $\sim 3.5 \div 5$ m. Their typical duration was $\sim$1000 years. Time of occurrence of positive and negative anomalies of the BS is different in different reconstructions. The source of these discrepancies could be tectonically induced vertical motions. Before $\sim$7 ka BP the BSL was higher than the level of the World Ocean. The rising BS spilled over a rocky sill at the Bosphorus (Chepalyga, 2007).

It is clear that if the water discharge were quite large, the long-term BSL anomalies could not be. This study focuses on the quantification of this concept.

Methodology. I use the equation of the water balance of the BS in term of the annual averaged level anomalies. Time scales of the BSL fluctuations were determined based on the BS basin morphology and averaged volumes of rivers runoff and water discharge via the Bosphorus Sill. The short-term (1-2 year) contribution (like random white noise) to level changes are due to variations of river runoff and precipitation mines evaporation. From this perspective, the water balance equation is represented as a stochastic Langevin equation (Kislov, 2015).

In another case, the BSL anomaly could be destructed due to relation “BSL anomaly – value of water discharge via the Bosphorus Sill” which acts as a negative feedback.

Results. To quantify the parameters, I use the present day information about hydrological regime of the BS. It should not lead to serious errors, because the first and last quarters of the Holocene exhibit similarity in their hydroclimatic regimes (Panin, Matlakhova, 2014). As well, the paleohydrological data about dynamics of the Dnieper River runoff was used (Swetc, 1978).

It was found that the time scale of the BSL fluctuations due to water discharge via the Bosphorus Sill were estimated as $\sim 10 \div 30$ years or less, using values of reconstructed and calculated water flow crossing the Bosporus Sill (Chepalyga, 2007; Esin, 2014). It means, that millennium-scale BSL anomalies could not occurred.

However, in the case of absence of water flow via the Bosphorus, the variance of the BSL fluctuations can be calculated as solution of the Langevin equation. It was found that sea level fluctuations during the first quarter of the Holocene are characterized by the standard deviation $\sim$4 m, close to the abovementioned empirical values.

Conclusions. The theoretical analysis showed that the empirical data are controversial: mentioned long-term BSL fluctuations and large water discharge value via the Bosphorus Sill could not occurred simultaneously. This fact creates problems in interpreting the BSL fluctuations. The possibility of a "self-development" effect as a source of growth in sea-level anomalies is not prohibited in the case if the discharge of water via the Bosporus Sill was small.