C07-P02

12 YEARS' CHANGES OF THE TERRESTRIAL WATER STORAGE IN THE LENA RIVER BASIN, EASTERN SIBERIA DETECTED BY GRACE

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Velicogna et al. (2012) showed that the terrestrial water storage (TWS) in the Lena River basin observed by GRACE (Gravity Recovery and Climate Experiment) had an upward trend throughout the whole basin, primarily due to the increase in groundwater in the discontinuous permafrost zone.

Moreover, Vey et al. (2013) showed that there was no trend in TWS in the Lena River basin when results were extended to 2011. A decrease began in 2008 and continued afterwards, which was unlike the tendency in the amount stored before 2007. No trend in TWS in the same basin was observed over the period of 2003 - 2011.

These changes in the TWS in the Lena River basin have been interpreted as being in accordance with changes in the active layer and groundwater. However, because the analysis period was short, the primary factor controlling the changes in TWS in the Lena River basin is not yet clear. To determine this, further data accumulation is necessary, and the analysis of data for a long time period is required.

In this research, we extended the period of the TWS anomaly in the Lena River basin untill March, 2014. Then, we analyzed the factors leading to variations in the TWS, using re-analyzed data from the Global Land Data Assimilation System (GLDAS).

Our results indicated a trend for an increase of about 4 mm per year in the western Lena. The location of this positive trend was similar to that identified by Velicogna et al. (2012), although the trend itself was smaller than their values, probably because our analysis period (2002-2014) was longer than theirs (2002-2010). Although Velicogna et al. (2012) identified a positive trend of the TWS anomaly in the Lena River basin, the results of our study revealed that a large negative trend existed in areas downstream of the Lena and at the Arctic Ocean coast. To better understand this negative trend of TWS anomaly, we considered two possible explanations. First, Günther et al. (2013) showed that the permafrost layer, which contains ice from the Arctic Ocean coast, melted and eroded in response to heat from the ocean, which caused a retreat in the coastline. The trend for a reduction in the TWS at the Arctic Ocean coast or in the downstream area of the Lena River, as revealed by GRACE, suggests a possible influence from the ocean as well as the atmosphere. Second, a decrease in the area of lakes and wetlands, or the melting of ice-rich permafrost can affect, but thoese changes were not clear.

When the basin average TWS values from GLDAS and GRACE results were compared, a very high correlation (correlation coefficient = 0.73) was recorded. From this relation, it was considered that it was possible to interpret the TWS anomaly at the basin-scale using GLDAS, and that the primary factor controlling the changes in TWS could be analyzed. The details will be given in our presentation.