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Monitoring of sea currents and waves in Spitsbergen fjords

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Investigation of sea currents and waves in Spitsbergen fjords has both pure scientific and practical value. It allows to understand the processes in the fjords and to get idea about functioning of World Ocean. From practical point of view such measurements can give information about sediment transport, coastal erosion processes and sea ice behavior in winter, which is important for port construction and industry in shore zone. It has special meaning for Adventfjorden, because of Longyearbyen, a town with 2,500 citizens, with large tourist, scientific and economic activities and growing importance as base for rescue and pollution preparedness for significant part of Arctic.
UNIS researchers and colleagues have performed studies of sea currents in fjords over several years. Field investigations in Adventfjorden (ADCP, drift trackers) in 2012-2013 are in the center of the presentation. Adventfjorden is a rather small (7x4 km) side-fjord on the south of Isfjorden, directed 135° (NW-SE). Isfjorden is second longest (107 km) fjord of Spitsbergen, influenced by West Spitsbergen current.
The ADCP AWAC (producer Nordtek) was installed and collecting data 10.09.2012-25.10.2013 in a point of Adventfjorden and Isfjorden connection; 563 m from shore line, 16 m depth. One year of data collection for waves and currents parameters, pressure, temperature and salinity and comparison with meteodata has allowed to compose the picture of water movement. Data had been processed in AWAC, Storm and Origin software.
Studying surface water flow in Adventfjorden was performed by using GPS transmitters “Garmin DC40” and receiver “Garmin AstroDog 320". To avoid effect of wind and wave motions, GPS transmitters had been mounted on PVC frames with 4 textiles sails (1mx0.5m). Floating rings was used for buoyancy. 3 such devices freely moved/sailed following the currents during 3 days in October 2013. It allowed covering all tidal variations and some weather changings.
To analyze resulted tracks and velocity distribution all measurements were mapped on bathymetry map. The plots, calculation of velocities (shown by color of the track lines) and current directions (shown as arrows) are performed in Matlab, ArcGIS software.
The general circulation pattern in Adventfjorden has been found on the base of field measurements. Main circulation is not associated with tides and wind and possibly is determined by the drain water from the glaciers and rivers. High, persistent winds create surface currents. In average current speed was 10 cm/s for both steady currents and wind induced currents. Generally wind does not impact to the current velocity.
Monitoring of coastal erosion on the site near ADCP installation showed that the main factors here are melting permafrost and wave action. The waves with periods of 4 h, 25 min and 150 s have been observed. Even if the effect of melting permafrost dominates, currents and waves carry sediments out and do not allow them to accumulate near the shore. Although pressure data show the tide height of 1-2 m, tidal currents in the component is negligible.
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