**Work package 2.1**

**Partner**

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**Summary of progress**

A summary of progress towards deliverables/milestones and details for each task. Please, highlight clearly significant results. This must follow the WP 2.1 work description.

***Task 2.1.1:*** Regional sea level data based on Topex, Jason and Envisat altimetry will be delivered by MyOcean for the recent period (1992-2008). Monitoring sea level variations in the Arctic region (regional mean and its contribution to the global mean, as well as the regional variability) and understanding its causes (estimates of the steric and ocean mass contributions, as well as other non climatic factors –e.g. GIA- ) ) is a challenge for climate research .With the much longer period of 50+ years that is considered in this project, there is a need for including other data than altimetry, e.g. tide gauge data from the Global Sea Level Observing System (GLOSS) and the Permanent Service for Mean Sea Level (PSMSL), as well as from other non global data bases. The tide gauges data will be corrected for crustal motions using GNSS data (when available) and GIA modeling . Most of the data will be incomplete in both spatial and temporal coverage, so it will be important to use ocean circulation models as well. Such models are derived from previous analyses of the ocean circulation, e.g., those from ECCO, GECCO, MICOM and BCM. The compilation of those data into 30-50 years time series will be carried out in this task. In addition, past sea level reconstruction methods that combine altimetry, tide gauges and ocean circulation model outputs will be adapted to the Arctic Ocean region to provide past 50+ years regional sea level variations. (month 16)

***Task 2.1.2:***For sea ice data MyOcean and the EUMETSAT OSI SAF will be the important sources. The observed sea ice parameters from satellites are primarily ice area, ice concentration and ice drift. Ice buoys also provide drift data at scattered locations across the Arctic, while moorings provide ice drift and thickness data in a few locations such as the Fram Strait. Ice thickness data for the Arctic Basin are obtained primarily from submarine cruises and scientific expeditions. Of particular relevance are the Russian expeditions, including the North Pole Drifting stations, which provide thickness and drift data over six decades starting in the 1930s. Additional data will be obtained from GLOBEICE and national archives, including those available in Canada and the US. Also in this case the challenging compilation of data incomplete data coverage into 30-50 years time series will be carried out using sea ice models to bridge those gaps. (month 16)

***Task 2.1.3:***In order to characterise the steric and ocean mass variations of the observed sea level variability, the regional contributions for steric variations and land ice and continental fresh water input will be estimated using different data sets, in particular in-situ hydrographic profiles and space gravimetry data from GRACE. Steric sea level regional variability will also be estimated from the difference between altimetry and GRACE ocean mass.   (month 16) - **DTU Space**

Using GFZ RL05 data from the the GRACE twin satellite gravity mission, a time-series of mass variation will be calculated for the arctic ocean with a resolution of one month in the time-domain. The data will be provided as a spatial grid of mass variations as well as a total ocean mass variation for the entire area. GRACE solutions of the harmonic coefficient C2,0 are known to be inaccurate, which is of particular importance for determining mass balance in the polar regions. Therefore, a time-series of C2,0 determined by satellite laser ranging (SLR) will be used.

A well known characteristic of the GRACE monthly gravity solutions are the elongated north-south error patterns (stripes). In order to filter these out to retreive geophysical signal, an approximate decorrelation and smoothing method will be used. In cooperation with users of the delivered data, a filtering method will be chosen so as to provide a compromise between spatial smoothness of the gridded solution and accuracy of the total mass variation over the entire area.

As there is a known post-glacial rebound (GIA) signal present in northern Canada, stretching into the arctic sea, a global GIA model will be used to remove this from the GRACE data to prevent GIA effects from leaking into the ocean mass variation estimation. Because of the limited spatial resolution of the GRACE data, special care has to be taken when interpreting data in near coastal areas. Apart from the previously mentioned GIA signal, a strong hydrologial signal can be expected due to snow accumulation on land. It will be investigated, how best to prevent strong on-land snow accumulation to leak into ocean mass variation, either by modelling or by ignoring the GRACE results from a narrow band around the coast.

**Impediments to progress**

If applicable, explain the reasons for failing to achieve critical objectives and/or not being on schedule and explain the impact on other tasks as well as on available resources and planning

**Outlook**

Please outline the future for your activity and in particular deviations to plans to future deadlines

**Resources**

In particular outline and explain deviations between actual and planned person-months per work package and per beneficiary described in “Annex 1 - Description of Work”

**List of related publications**