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Sea ice thermodynamics and high latitudes freshwater forcing developments in a global operational oceanographic context.

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Mercator Ocean, the French operational oceanography center (www.mercator-ocean.fr), developed several real time forecasting and reanalysis systems of the 3D-Ocean. In the framework of the Myocean EU (FP7 and Horizon 2020, www.myocean.eu.org) funded projects, Mercator is principally in charge of the development of real time analysis and forecasts for the global ocean at the 1/12° horizontal resolution. It has also already produced global eddy-permitting (1/4°) reanalysis over the altimetry years (1992-2013)
With a large freshening of the upper Arctic Ocean, the thinning of the Arctic sea ice cover and the large melting ice caps, high latitudes are presently facing substantial changes. The needs of improving the sea ice representation and the fresh water forcing and assessing the dynamical and thermo-haline equilibrium of the water masses are growing in terms of hindcasts, nowcasts and forecasts in these rapid changing areas. Two main developments have been implemented and tested in the NEMO-based model component of the global 1/4 ° reanalysis system:

- A new version of Louvain-La-Neuve sea ice model, e.g. LIM3, available in the last $NEMO_3.6$ release has been tested in an interannual experiment driven by the 1979-2013 ERA-Interim atmospheric at the surface. Compared to the previous version LIM2 which includes the basic mono-category and 3-layer thermodynamics, LIM3 is a multi category and multi layers sea ice model together with an explicit sea ice salinity evolution. Compared to available data sets, the LIM3 model gives a better representation of the Arctic sea ice thickness distribution. Representation of the sea ice thermodynamics and of the upper layers water masses at high latitudes are discussed and compared to a similar LIM2 experiment.

- Based on Altiberg icebergs project dataset (Tournadre et al., 2012, [1]),Gravity Recovery and Climate Experiment (GRACE)-based ocean mass signal and the IPCC's Fifth assessment Report (AR5) estimations, an interannual freshwater forcing from the Greenland and Antarctica ice caps have been also developed over the altimetry era. Comparisons between experiments performed with and without this freshwater forcing and show a large local upper layers freshening, a thickening of the Antarctica sea ice and a weakening of the large scale circulation in the Atlantic Ocean are discussed. .