CryoSat-2 significant wave height and dynamic ocean topography for polar regions

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The Arctic Ocean has seen rapid changes in climate over the past decades resulting in the reduction in summer sea ice extent. This reduction has resulted in a greater expanse of open ocean potentially driving changes in the atmosphere and ocean interaction in this region and globally. The CryoSat-2 satellite with its SAR (Synthetic Aperture Radar) Interferometric Radar Altimeter (SIRAL) instrument and polar orbit gives us state of the art near pan-Arctic data to investigate the Arctic ocean for this decade. The radar echoes are analysed with semi-analytical waveform model of the echo power convolution in open ocean conditions in both SAR and LRM modes to retrieve along-track amplitude, epoch, surface elevation deviation, and significant wave height. Over the ice-covered ocean in SAR and SARin modes, sea surface elevation is retrieved using the CPOM 70% leading-edge threshold retracker. The surface elevation from the open ocean and from leads, cracks in the sea ice cover, can be combined with Earth geoid data to give the dynamic ocean topography and geostrophic ocean surface currents for the entire Arctic Ocean. Here we present data for the entire CryoSat-2 record to date, showing the changes and average climatology of ocean surface waves and surface geostrophic currents. We compare our open ocean SAR and LRM significant wave height data to existing datasets and focus on the role of SAR and LRM modes and the improvements of a full echo power convolution. We use our novel extended dataset to illustrate (i) the key role that geostrophic currents play in modulating momentum transfer in the Arctic and North Atlantic Oceans; (ii) the importance of ice-waves interaction and floe breakup in the increasingly important Arctic marginal ice zone.