Geophysical Research Abstracts
Vol. 21, EGU2019-4262, 2019
EGU General Assembly 2019

Measurements of sea ice drift and dynamics using an open source instrument

Jean Rabault (1), Graig Sutherland (2), and Atle Jensen (1)
(1) University of Oslo, OSLO, Norway, (2) Environment and Climate Change Canada, Montreal, Canada

Sea ice is a major feature of the polar environments. Both sea ice drift and the interaction between waves and sea ice are key mechanisms that shape the Arctic and Antarctic, for example by breaking the ice and changing fetch parameters. Therefore, detailed understanding of these phenomena is required in a number of applications, from climate predictions to risk assessment for human activities. Unfortunately, these are also complex phenomena for which the understanding is still, on many aspects, at large. To further develop theories and models, more field data need to be collected at a reduced cost.

However, performing measurements of ice drift and dynamics is challenging, due to harsh environmental conditions and remoteness. So far, the development of instruments surviving to these environmental conditions has been scattered across companies and research groups. In the present work, we develop an open source, flexible instrument that can be used for remote sensing in difficult conditions in general, and is adapted to monitor sea ice in particular. Similarly to many remote sensing tasks, our requirements are to provide a versatile, cost and power-efficient instrument, which can perform measurements, process the data obtained on-site, and transmit relevant, compressed information by satellite.

To answer this need, we have integrated a power management unit (battery, solar panel, and microcontroller), a logger (microcontroller and Inertial Motion Unit - IMU), a GPS, an on-board computer, and a satellite modem to collect information about both the sea ice position and drift, and the wave dynamics in the ice. The design is modular and based on well-known and available components, so that the instrument can be adapted to different remote sensing tasks in a flexible way. In our case, the wave dynamics are measured at a high frequency by the on-board IMU, and processed on-board so that only reduced spectra of limited size need to be transmitted by satellite. We show through two deployments, the first one on landfast ice in Tempelfjorden, Svalbard, the second one in the Marginal Ice Zone (MIZ) in the Barents sea, that our instrument functions satisfactorily and can provide valuable scientific data such as ice drift, significant wave height, wave period, wave spectrum and directional wave spectrum. These data are further analyzed, so that information such as ice drift and wave damping is obtained.

Moreover, as all our designs are released as open source, this work opens for the creation of a community sharing designs of flexible, affordable remote sensing instruments. This may allow to drastically reduce costs and development time, and we hope that this effort may help collecting the scientific data that the community needs to better understand waves in ice.