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Polynias seen with different eyes

Classification of sea ice zones around polynias, using data from multiple sensors.

The combination of data from different satellite sensors contribute to a better understanding of polynia evolution and reduce uncertainties in satellite data interpretation and geophysical parameter retrieval. Infrared sensors like Envisat AATSR provide temperature and hence indirect information on the ice thickness (thin ice and open water will show higher surface temperatures than thick ice). SAR images offer insights into the structure of the sea ice: ridges and deformation zones will be highlighted in L band images; C-band images provide a better representation of individual thinner level floes. Optical images from RapidEye, Modis or Landsat are close to human perception. They allow identifying snow covered regions and help to improve the interpretation of data from other sensors. By taking into account velocity information derived from a satellite image time series it is possible to identify e.g. fast ice and the polynia outlet region.

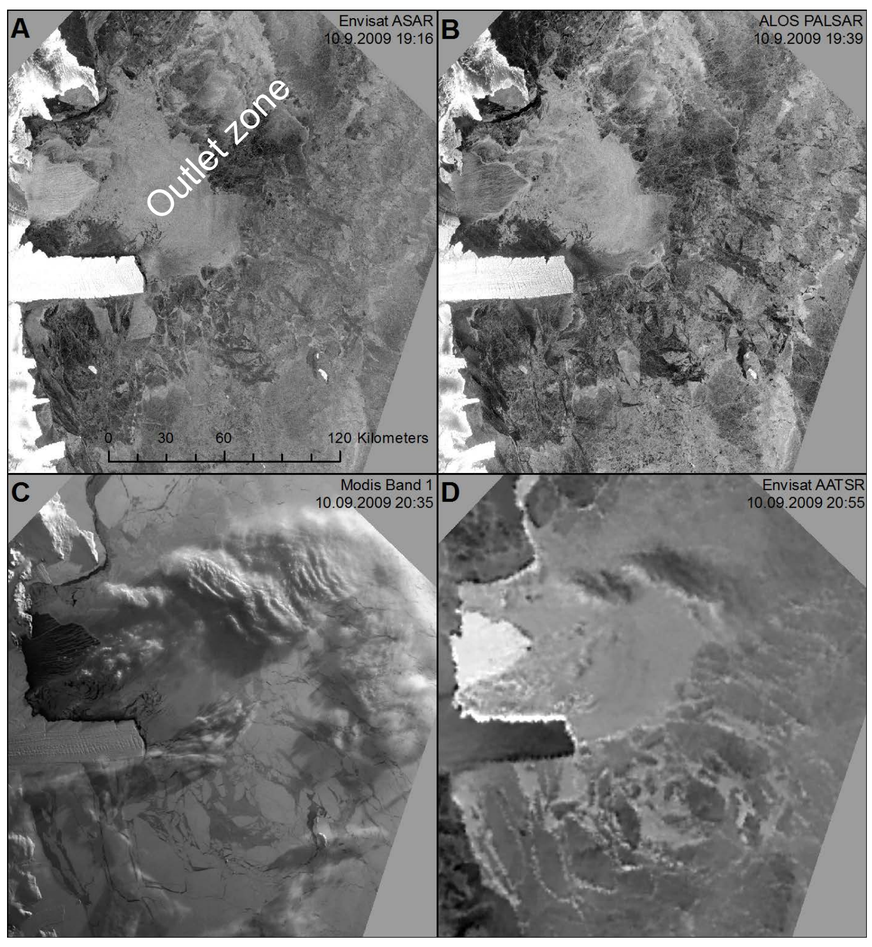

Fig. 1: Appearance of the Terra Nova Bay Polynia in different sensors at 10.09.2009. The appearance of sea ice varies between the different sensors. The outlet zone shows brighter parts with higher backscatter, where the ice is more deformed due to stronger polynia activities, and darker zones from periods of weak polynia activity, when the formation of level ice is possible. Also the AATSR image allows a distinction of the newer sea ice in the outlet zone from the surrounding thicker and older ice.

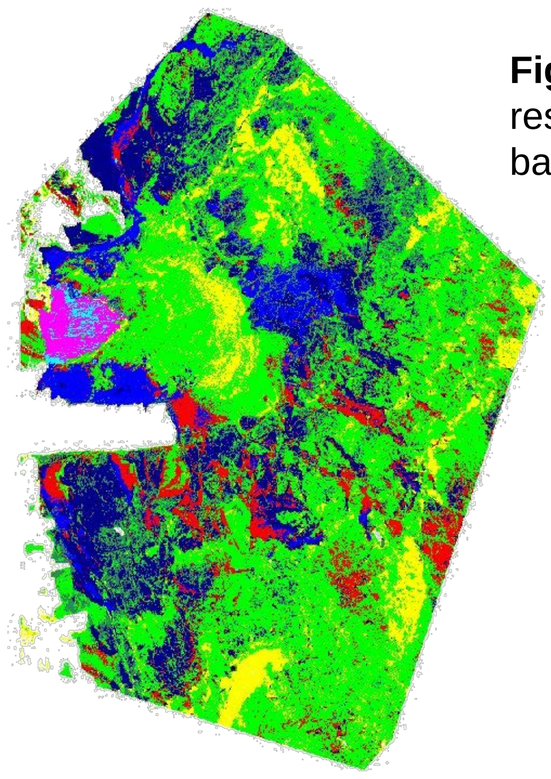

Fig. 3: Classification result 10.09.2009 based on Fig. 2

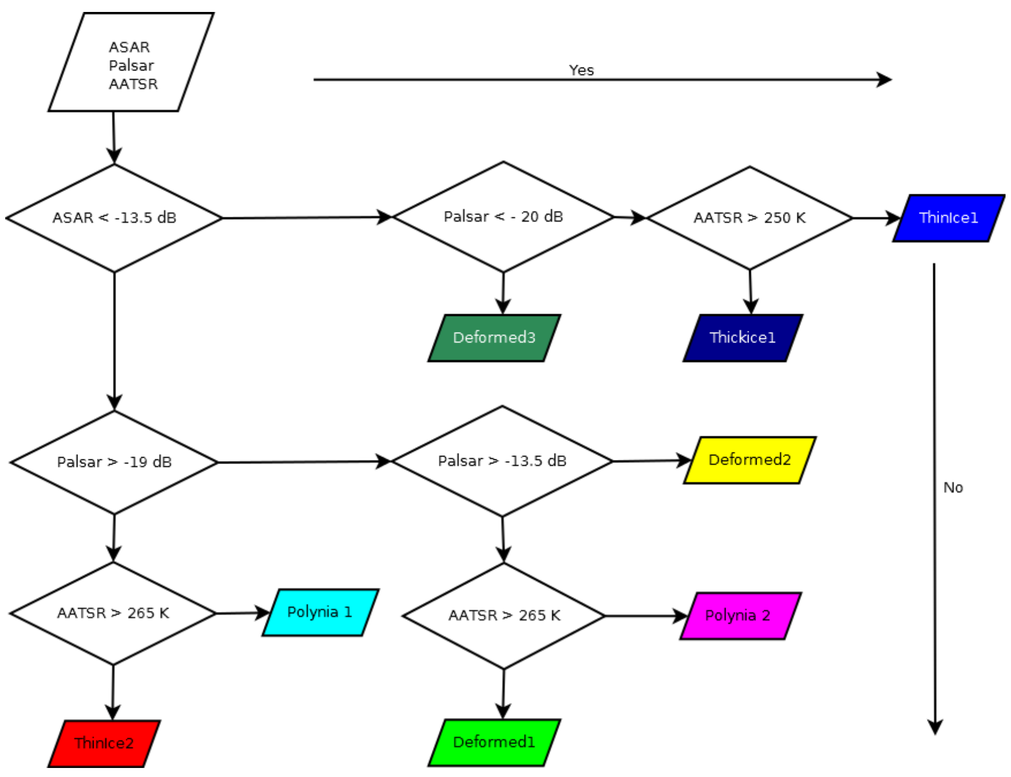

Fig. 2: Classification scheme: a hierarchical multi-sensor approach allows a flexible adaption to the research question, to new sensor constellation, and the optimization of the spatial resolution (e.g. comparably coarse AATSR data on the last stage only)

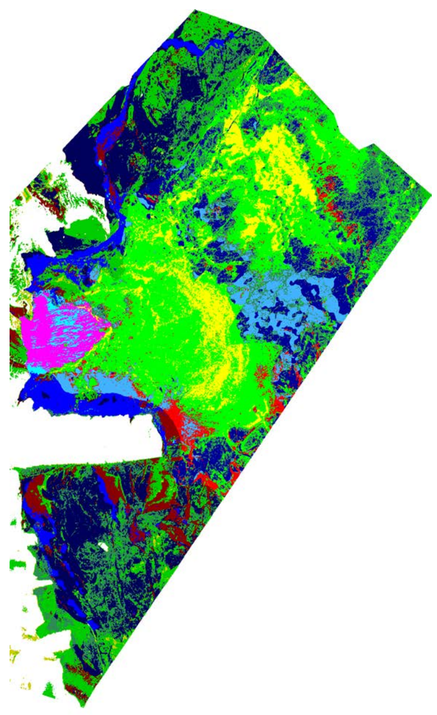

Fig 4: Classification that takes dynamics of ice into account. By combining Fig. 3 with drift information derived from time series of SAR images (Hollands and Dierking 2011, Hollands et. al. 2013), an additional criterion is at hand which e.g. allows to differentiate between different drift regimes in the Terra Nova Bay polynia region (e.g. fast ice, influence of Ross sea and McMurdo polynia, …)

Outlook

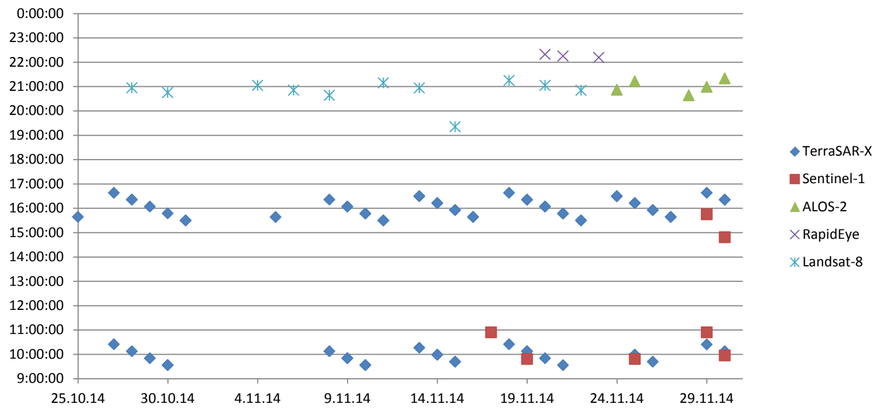

Fig. 5: Time series of different sensors acquired in Nov. 2014 will be used for further studies

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