Modelling the connectivity of Antarctic krill (Euphausia superba) in the Lazarev Sea

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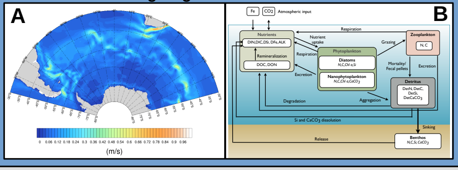
Aims of the Study

Lazarev Sea and its surrounding area are lacking when it comes to research regarding Antarctic Krill. A large biomass of krill is found in the area and this modelling study aims to investigate the possible connection of Lazarev Sea Krill with other Southern Ocean Krill populations via ocean currents and find the source population(s).

This is achieved by combining a physical-biochemical circulation model (FESOM-REcoM2), Lagrangian particle tracking and an individual based modelling (IBM) for Antarctic Krill.

Lagrangian Drifter Simulations



Methods

For this study, the coupled FESOM-REcoM2 model is used to simulate physical and biochemical parameters such as circulation, temperature, sea ice, nutrients, phytoplankton and zooplankton for a ten year period (2001-2010).

Afterwards the Lagrangian particle tracking is run backwards using physical circulation data and food availability along the drifter paths are extracted. These food values are then used as inputs for the krill IBM which simulates the growth of Antarctic krill on the drifter trajectory.

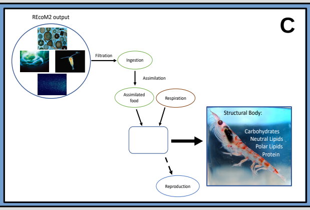


Figure 1: A) Southern Ocean current velocity field simulation output calculated by FESOM. **B)** Work schematic of REcoM2. **C)** Work schematic of the krill individual based model.

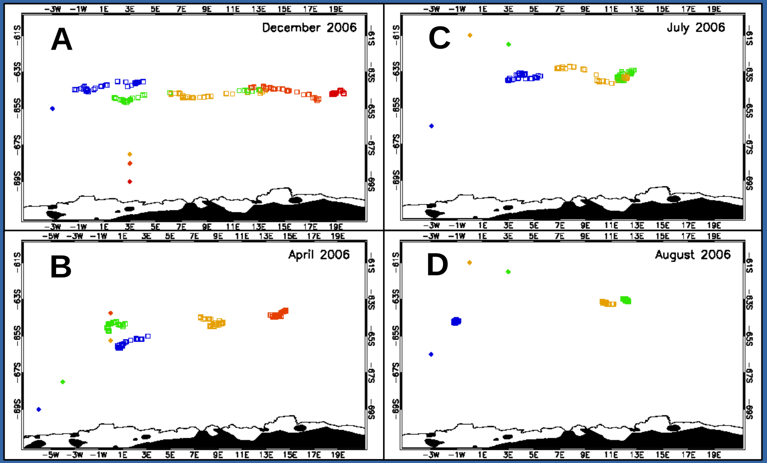


Figure 2: Release points (diamonds) of Lagrangian particles released at different stations where krill was observed (Meyer et al., 2010). Particles were backtracked for 365 days in **A)** December, **B)** April, **C)** July and **D)** August 2006. Hollow squares mark the end locations of 31 particles released on each day of the release month.

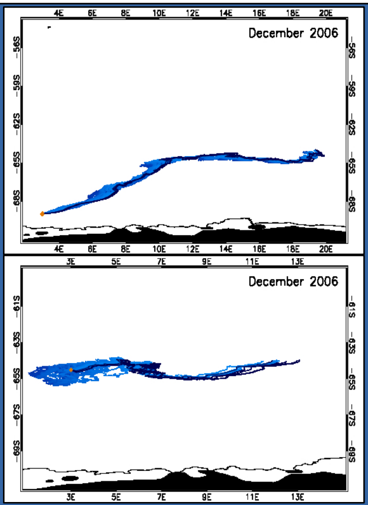


Figure 3: Lagrangian backtracking trajectories (blue lines) of 31 particles released at each day of December 2006 that are backtracked for 365 days. Orange diamond mark station locations of two different stations after Meyer et al. (2010).

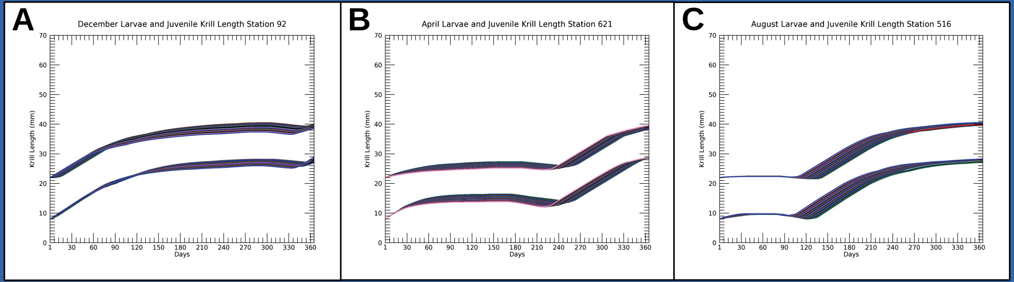


Figure 4: Plots of krill growth for larvae (8mm) and juveniles (22mm) calculated by the krill IBM with food extracted from FESOM-REcoM2 along Lagrangian drifter tracks for 3 different drifter cohorts starting in **A)** December, **B)** April and **C)** August (see **Figure 2**) .

Conclusions

The results obtained by Lagrangian backtracking show a very wide distribution of potential locations of origin for krill within a single month (**Figure 2A** and **B**). But also between months such as July and August where the same end points originate from very different areas (**Figure 2C** and **D**).

Further, transport pathways may show a wide range of particle paths for each station (**Figure 3**). Most likely due to the strong circulation dynamics in the region.

Krill found in the Lazarev Sea may travel a distance of up to 1800 km in one year.

The krill IBM results show that there is sufficient food in the region to sustain both krill larvae and juveniles even on such long transport distances.

Acknowledgements

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