Seasonality of Arctic Mediterranean Exchanges
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Research Questions
1) What is the seasonal cycle at every passage and how does its amplitude and phase vary with time?
2) What is the seasonal budget for the Arctic Mediterranean?

Background
- The Arctic Mediterranean (Arctic Ocean + Nordic seas) communicates with the Atlantic and Pacific Ocean through Bering Strait, the Canadian Archipelago and across the Greenland-Scotland Ridge.
- Most volume exchange happens at the Greenland-Scotland Ridge: warm saline Atlantic water flows in at the surface, cold dense Overflow Water flows back at the bottom and fresh, cold Polar Water flows out along the East Greenland coast.

Data
Monthly averaged volume transport estimates measured with ADCPs and satellite of the following ocean currents are used:
- Bering Strait Inflow (BS in)
- Canadian Archipelago Outflow (CA out)
- Denmark Strait Overflow (DS over)
- Denmark Strait Inflow (DS in)
- Faroe-Shetland Inflow (FS in)
- Faro-Bank Channel Overflow (FB over)
- Greenland Current: no transport time series at Greenland Ridge (67°N), which is in agreement with other studies.

Conclusions
1) The amplitude of the seasonal cycle is modulated. Also the phase of the seasonal cycle varies with changes of +/- 1.5 months relative to a regular cycle. An exception is the IF in, where the phase is 5 months greater than on average for a period of 4 years.
2) The seasonal budget can only be closed if the East-Greenland Current has a seasonal cycle with a strength of about 1.2 Sv, which is in agreement with other studies.

Results
- Seasonal Inflow must be compensated for by a seasonal outflow
- An imbalance of 1 Sv gives a sea level increase of 4 cm within a week over the region
- Net Inflow in summer and Net Outflow in winter: imbalance about 1.2 Sv
- 2 transport time series are missing in budget:
  - East-Greenland Current: no transport time series at Greenland-Scotland Ridge (67°N), but studies north and south of Denmark Strait e.g. transport at 67°N from NEMO model which is validated with Microcat data: 3.8 Sv in Feb. and 1.9 Sv in Aug. (Bacon et al. 2014, J. Geophys. Res.: Oceans)

Method
The seasonal signal is extracted by first removing low frequency variations from the time series. This approach is based on the idea of time series decomposition: time series = low frequency + seasonality + intrannual variations. The transport time series without low frequency variations is then sampled with a 12 month wide window. A sine function with fixed period, but variable amplitude and phase is fitted into the moving window. The resulting time series of amplitude and phase are then used to reconstruct the seasonal signal (average amplitude and phase for each year). The shadowed area behind the seasonal signal stands for the intrannual variability of the time series.