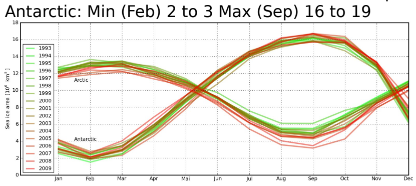
Exercise 29.Okt:

1) Components: Snow, Glacier, Land ice, Shelf ice, Sea ice
2) Sea ice extent: Complete area within the ice edge
   Sea ice area: Considers ice free areas within the ice edge
   Observed by Satellite, Ship, Airplane, Buoy
3) Carbon cycle: Chemical processes (e.g. Calcium Carbonate crystals that form in winter months) more effective as removing CO2 from atmosphere than biological processes.
   Melting of sea ice enhances CO2 – absorption atmosphere. Ice drift leads to carbon redistribution.
4) Mercury sink: Rising temperature unfreezing permafrost and glacierrelease of mercury
   "Bromide-Explosion", Bromide makes mercury more reactive
5) Sea ice extent area in 10^6 km: Arctic, Min (Sep) 5 to 6,5 Max (Mar) 14 to 15
   Antarctic: Min (Feb) 2 to 3 Max (Sep) 16 to 19



6) Ice zones: marginal ice zone: Dominated by open ocean processes.
   Shear ice zones: Shear deformation has been concentrated.

Exercise 05.Nov:

1) See exercise 29.Okt - 5)
2) Sea ice terminology: Marginal ice zone: Dominated by open ocean processes. Fast ice: Sea ice that has frozen along the coast, little movement. Perennial ice: Multiyear ice. Lead: Passage through the sea ice that is too wide to jump across. Polynya: Opening enclosed in ice (See exercise 26.Nov.
3) Isostatic equilibrium: $\rho_w g(h-f) = \rho_{fy} gh$

   First year: $h_{fy} = f / \left(1 - \frac{\rho_{fy}}{\rho_w}\right) = 0.9\,m$, Muti Year: $h_{my} = f / \left(1 - \frac{\rho_{my}}{\rho_w}\right) = 0.75\,m$

4) Latent heat of fusion: a) $L_f = \frac{Q}{m} = 330\,J/g$ $Q = L_f\, m$ = 330 J/g*1000g = 330 KJ

   b) $\Delta T = \frac{\Delta Q}{Cp*m} = \frac{330000}{4000*1} = 82{,}5\,K$

5) Sea ice growth: With constant energy flux FL, ice thickness after 24 hours.

   Thickness of the end of the day $h = \frac{Fl*t}{L_f*\rho} = \frac{330\,\frac{J}{m^2 s}*86400\,s}{330\,\frac{J}{g}*920*10^3\,\frac{g}{m^3}} = 0.094\,m$

5) Deposition of salts from sea water by frigid concentration: Precipitation of Na2SO4 at T<-8.2° leads to removal of sulfate from the solution.

Exercise 19.Nov.

1) Energy imbalance: $F = \frac{\Delta V*Q}{A*\Delta t} = \frac{\Delta h*Q}{\Delta t}$, F=Energy Flux, h=Sea Ice Growth
2) Radiative fluxes: Wavelength bands a) Solar radiation $\lambda_{max} = 0{,}5\,\mu m$ (incoming), earth radiation $\lambda_{max} = 12\,\mu m$ (outgoing)
3) Earths radiative energy budget: Jan 351 W/m² , Jun 330 W/m² Maximum: 40°N and > 75°N (North pole)
4) Radiative energy balance: $(1-\alpha)S = \sigma*\varepsilon*T^4$, $\sigma = 5{,}67*10^{-8}\,\frac{W}{m^2 K^4}$
5) Thermal emission: $F_{Lw} = \varepsilon\sigma T_{0^4}$, $T_0 = radiative\ Temperature$

   Emissivity cloud cover: ¿ $0{,}7855(1+0{,}2232*C^{2{,}75})$, C=Cloud Cover (Clear Sky C=0)

Exercise 26.Nov.

Polynyas: - costal: formed by coastal winds
-open-ocean: upwelling of warm water (convection)

Where? -often in relation to fast ice

Open-ocean	**Coastal**
Weddell Sea	St. Lawrence Island

Ice produced per season: Arctic: about 5m, Antarctic: about 10m
Sediment transport: sediment incorporated in frazil ice transport to open ocean
Upwelling of sediments by: river deltas, strong winds, tidal movement
Biological Importance: high primary production in summer feeding place, breathing holes for mammals important for survival in winter
Influence of the ocean: large heat souce, forming large amount of ice, freeing salt creates a barrier to protect ice from warm Atlantic water.
Size of Polynyas based on a Balance of: temperature, wind speed

Exercise 03.Dez

1) Major arctic water layers:
2) Equilibrium sea ice thickness and oceanic heat flux:

$F = \frac{k*\Delta T}{H}$, $\frac{H}{k} = \frac{Hs}{ks} + \frac{Hi}{ki}$, k=thermal conductivity , F=heat flux , H=height

$Hi = \left(\frac{\Delta T}{F} - \frac{Hs}{ks}\right) ki = 0{,}84\,m$, $\Delta T = 28\,K,\ ks = 0.2\,\frac{W}{mK},\ ki = 2{,}1\,\frac{W}{mK},\ Hs = 0{,}2\,m,\ F = 20\,\frac{W}{m^2}$

Typical ocean heat fluxes: Arctic $F_o < 5\,\frac{W}{m^2}$, Antarctic $F_o = 25\,\frac{W}{m^2}$