

ASSW 2014 (Helsinki, Finland)

KOPRI's On-going and Planning Activities on Sea Ice-related Physical Processes

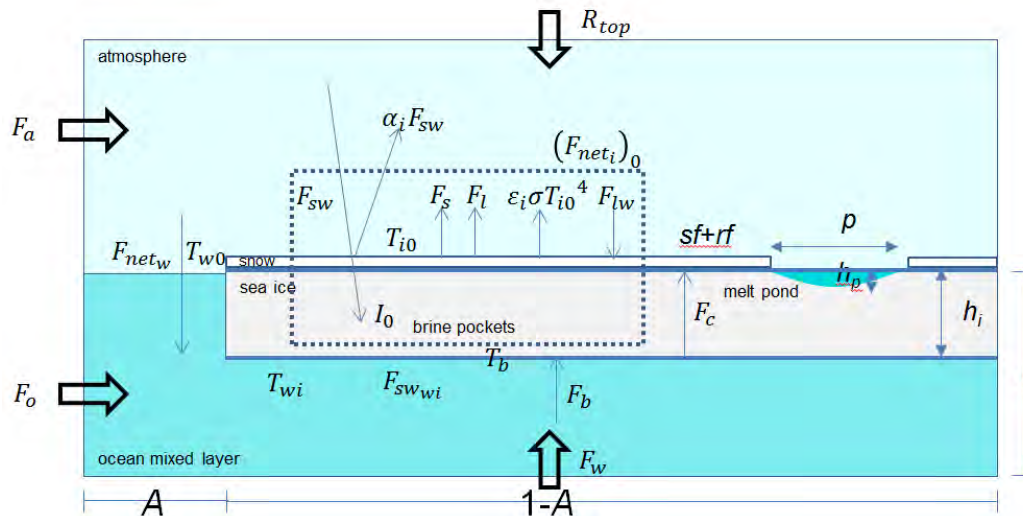
Joo-Hong Kim
Division of Climate Change
KOPRI

Researches on Sea Ice-related Physical Processes

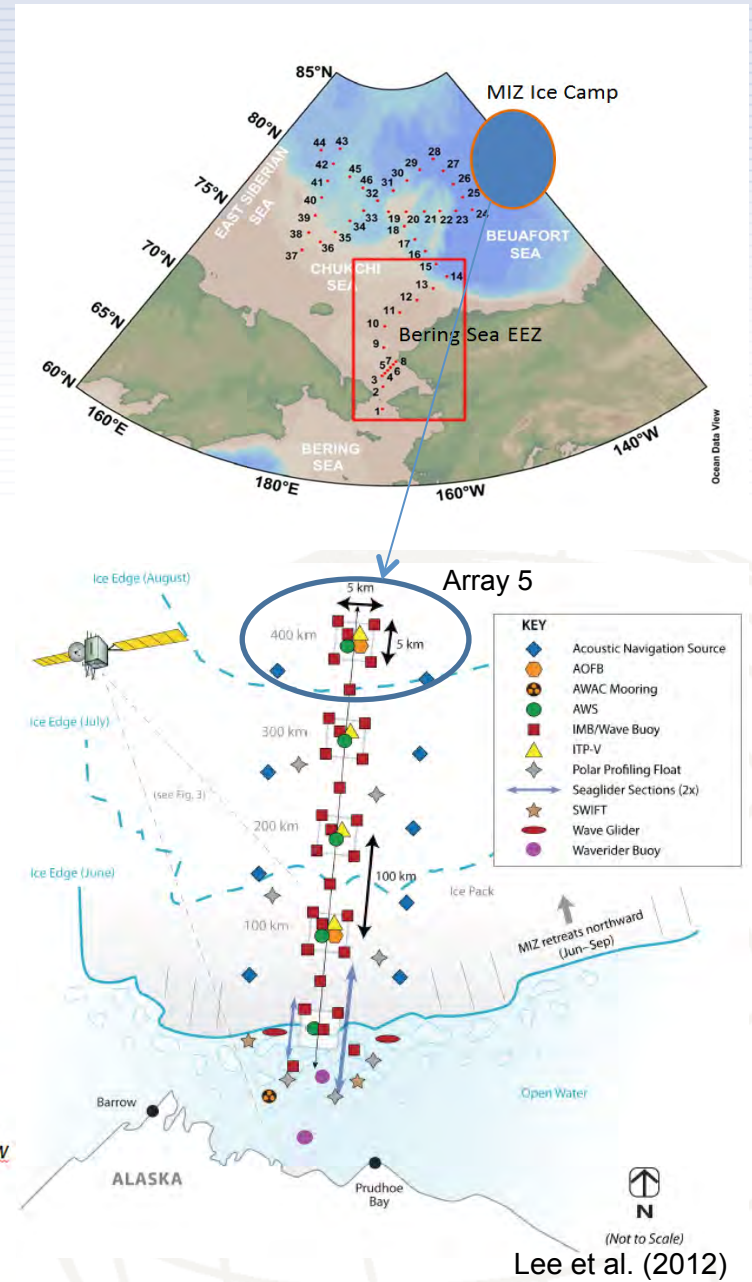
- Observing plans
 - 2014 ARAON Marginal Ice Zone (MIZ) activities in collaboration with the ONR-MIZ Program (August 2014) and regular every year Arctic excursion to Chukchi, Beaufort and East Siberian Seas
 - “Norwegian Young Sea Ice Cruise 2015 (N-ICE2015)” in collaboration with Norwegian Polar Institute (NPI) and Alfred-Wegener-Institut (AWI) (early January – late June 2015)
- Research plans with collected observations and models with varying degree of complexity
 - Arctic amplification: Arctic atmospheric response to heat fluxes over open Arctic seas (w/ N-ICE2015)
 - Ice energy budget: Ice thickness evolution (w/ ONR-MIZ and N-ICE2015)
 - Ice-albedo feedback: Role of early summer cloud-controlled albedo
 - Dynamical sea ice forecast: Pan-Arctic and northeast sea route regions

Observing Plans

- IB “ARAON”: MIZ Ice Camp 2014
 - Period: 4-11 August 2014
 - Our observational interests
 - Ocean-to-ice heat fluxes
 - Meteorological variables
 - Radiative heat fluxes
 - Snow and ice thickness, ice temperature
 - Planning of our research subjects
 - Ice energy budget and thickness evolution
 - Sea ice energy budget
 - Sea ice model to simulate ice thickness evolution
 - Ice-albedo feedback

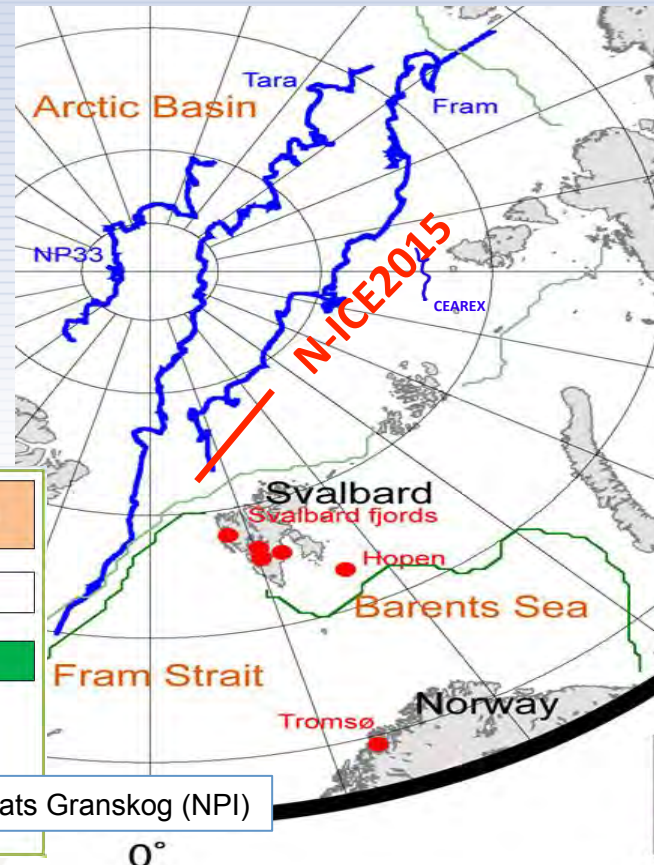
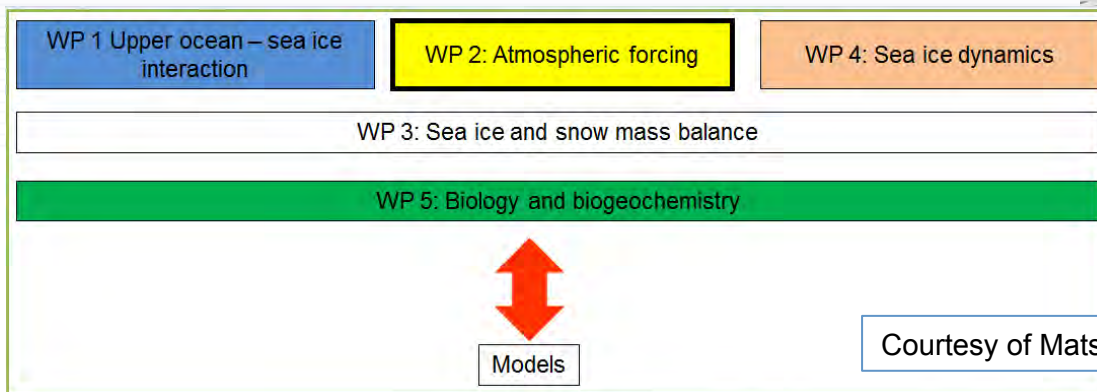


2014 “ARAON” Arctic Cruise Plan (Leg I)

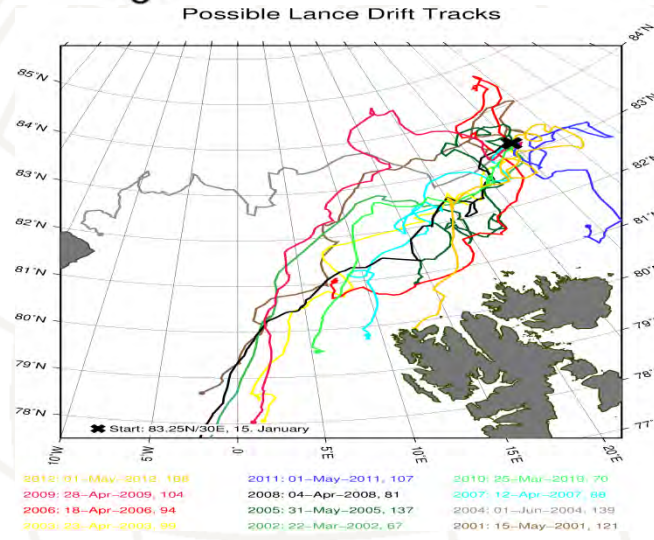


Observing Plans

- RV “Lance”: Norwegian Young Sea Ice Cruise 2015 (N-ICE2015)
 - Primary objective: To understand the effects of the new thinner first-year sea ice on energy fluxes, ice dynamics and the ice associated ecosystem, and local and global climate
 - Period: early January to late June 2015



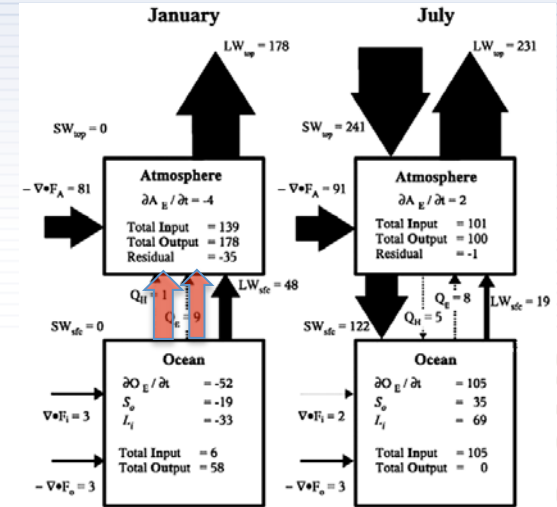
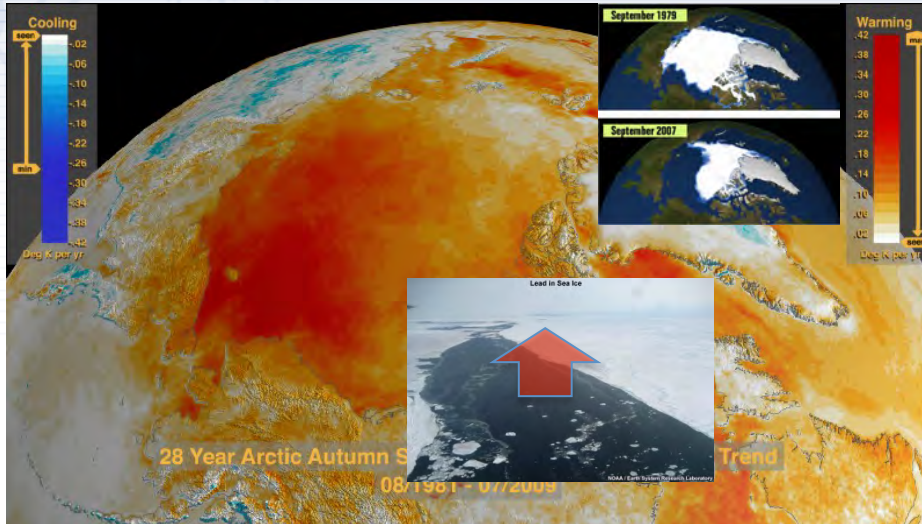
Courtesy of Mats Granskog (NPI)



- Our actual contribution
 - For work package 2 (WP2) “Atmospheric forcing”
 - Equipment: radiosonde, tethered-balloon sonde, eddy-covariance, thermal camera, AWS, radiometer
- Our interests
 - WP1: heat fluxes in the ice-ocean boundary layer
 - WP2: atmospheric boundary layer eddies, heat fluxes (radiative & turbulent), albedo, clouds
 - WP3: snow and ice thickness, ice temperature

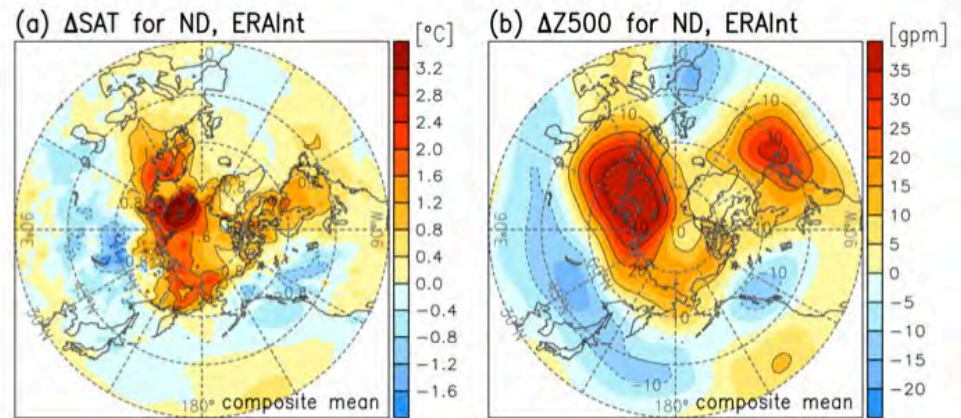
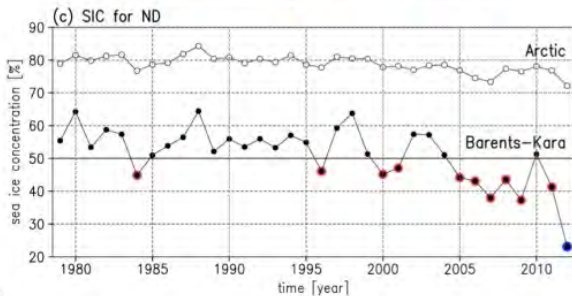
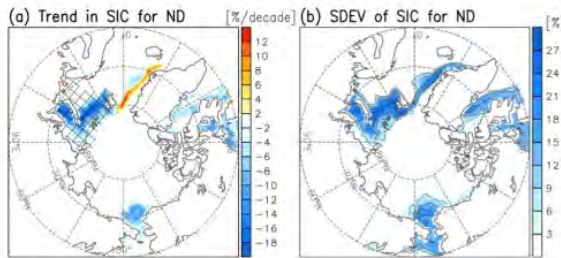
Research Plans

- Winter atmospheric response to heat fluxes over open Arctic seas
 - Physical understanding of Arctic amplification



Serreze et al. (2006)

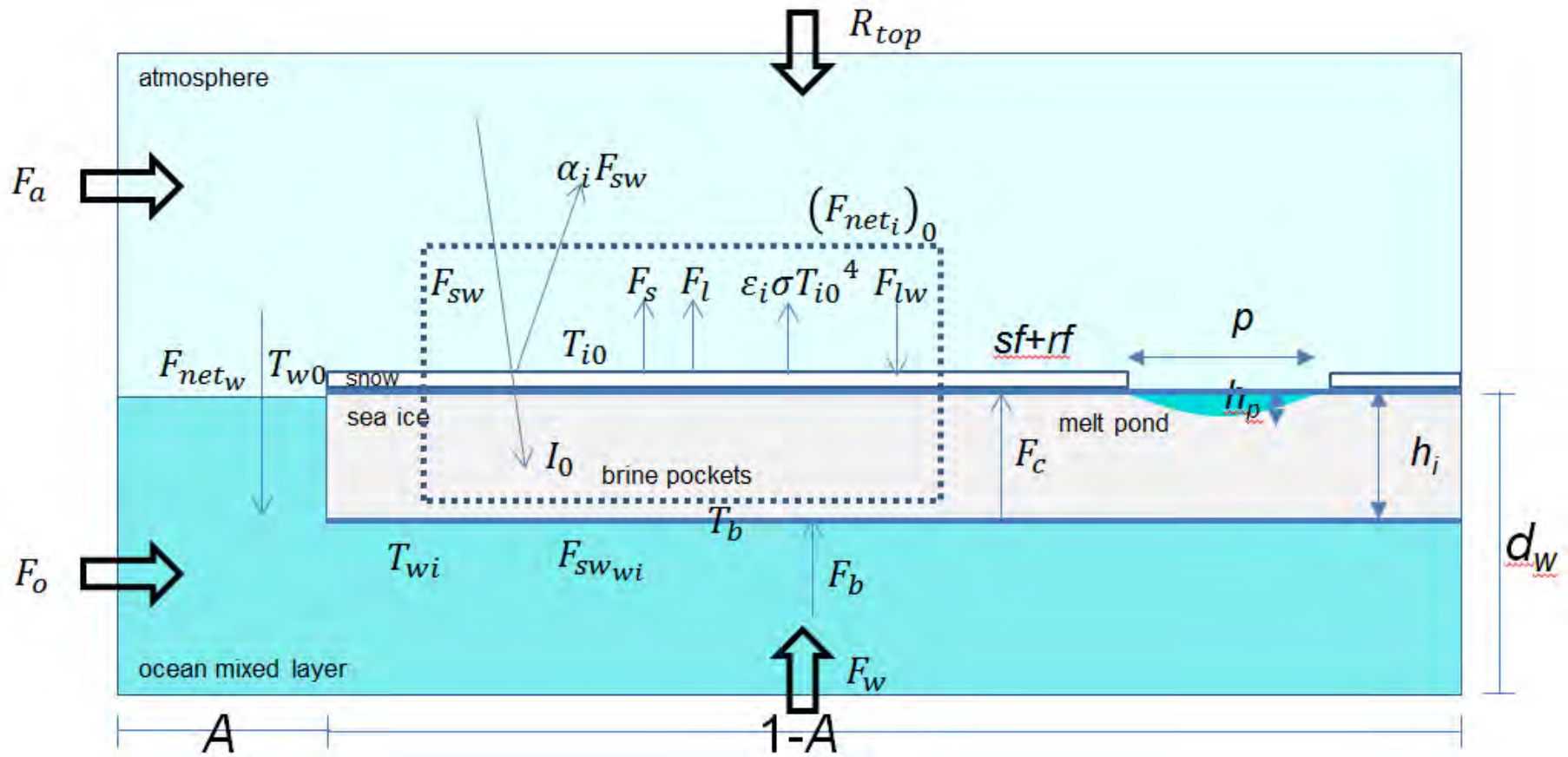
Atmospheric data: ERA40 (1979-2001)



Baek-Min Kim et al. (2014, revised)

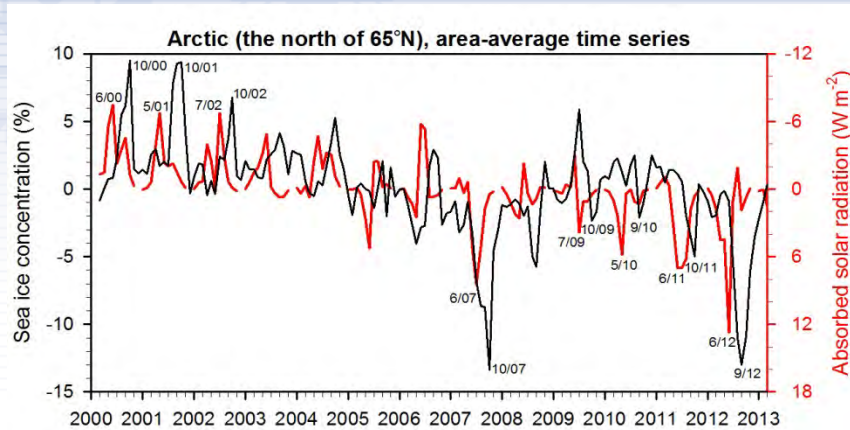
Research Plans

- Ice energy budget: Ice thickness evolution

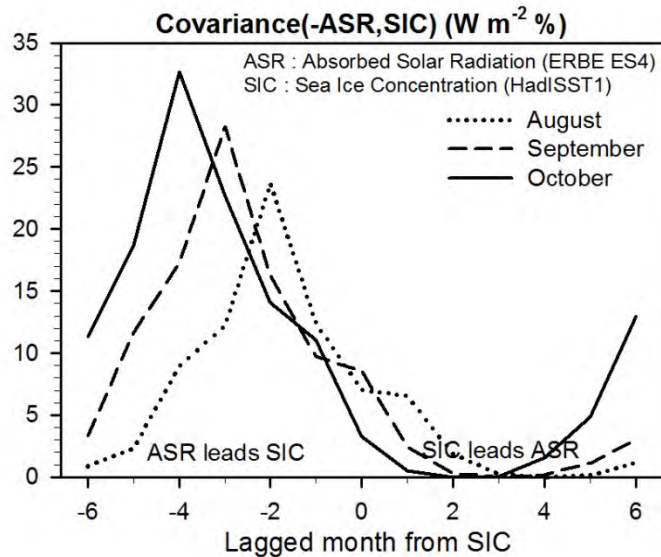


Research Plans

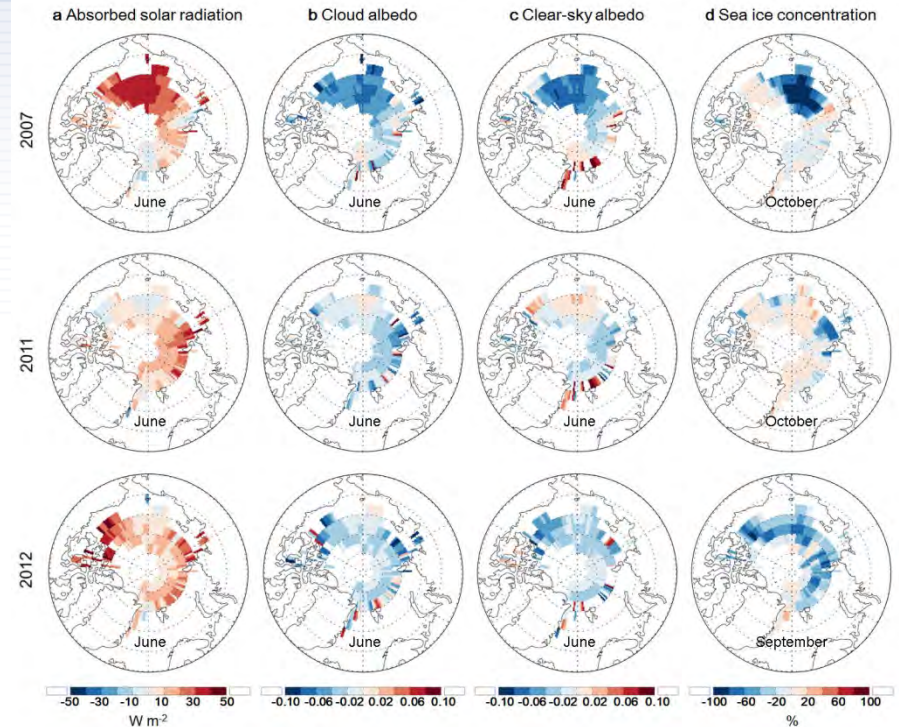
- Ice-albedo feedback: Role of early summer cloud-controlled albedo



Time series of **monthly anomalies** of sea ice concentration (SIC) (in %; black) and TOA absorbed shortwave radiation (ASR) (in $W m^{-2}$; red) area-averaged over the Arctic Ocean ($65^{\circ}N-90^{\circ}N$) from March 2000 to March 2013. The months and years when distinctly high or low values appear are noted.



Lagged covariances of $-ASR$ (TOA) and SIC ($W m^{-2} \%$). The results for SICs only in August, September, and October are shown.



Regional distribution of the anomalies of ASR (a), the cloud albedo (b), and the clear-sky (surface) albedo (c) for June 2007, 2011, and 2012, and (d) SIC for October 2007, 2011 and September of 2012. During Junes of these years, record-breaking minimal SIC were observed. Note these figures do not include the regions with the total value of SICs for August, September, and October $< 15\%$, and the regions with permanent SIC throughout the year.

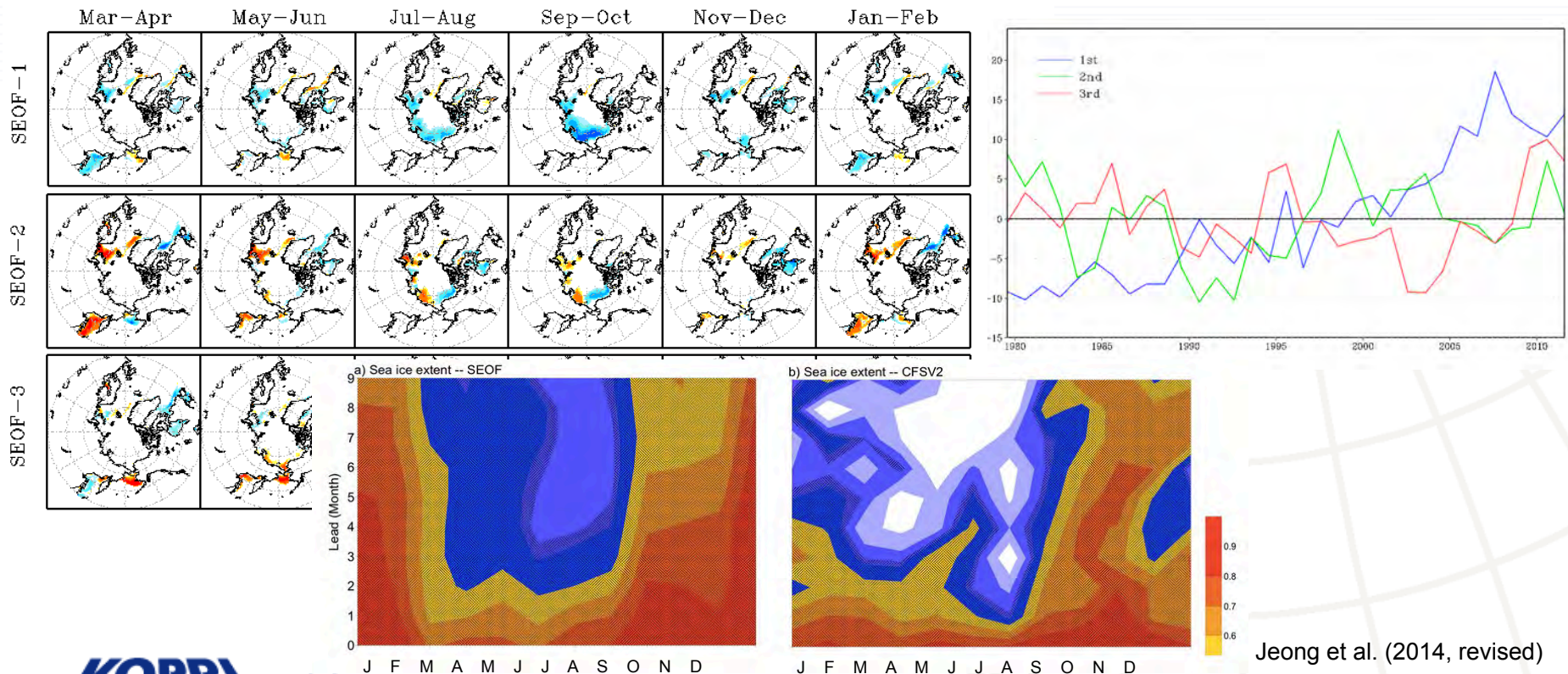
Choi et al. (2014, revised)



Research Plans

- Dynamical sea ice forecast: Pan-Arctic and northeastern sea route regions
 - Ice and ocean initialization
 - Regional sea ice simulator (with a data assimilation system)
 - Global model-based future projection under global warming

* Current activity: development of a statistical sea ice forecast model



Jeong et al. (2014, revised)