Sea Ice Metrics in CMIP5

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Motivation/Goals

• Follow up the Kay & de Boyer & Hunke discussion “On the observational needs for climate models in polar regions”;
• Need to build up NOW an observational based metrics to evaluate sea ice solutions in CMIP5;
• Goal to identify a subset of the most essential sea ice variables with available robust observational records.
Scientific question

• Uncertainty in the
  Sea Ice Volume = Sea Ice Area x Sea Ice Thickness

- The latest IPCC (2007) reported that the Arctic sea ice volume decline will exceed twice the sea ice extent rates by the end of 21st century;

- Schweiger et al., 2011 based on available observations and PIOMAS estimated \(-2.8 \pm 1.10^3 \text{ km}^3/\text{decade}\) Arctic sea ice volume decline.
Outlines

• CMIP5 status
• Sea Ice Observational Data Sets
  • Ice Concentration
  • Ice Thickness
• Fram Strait Ice Export
• Ice Drift
CMIP5 Status

- BADC: [http://cmip-gw.badc.rl.ac.uk/home.htm](http://cmip-gw.badc.rl.ac.uk/home.htm)
- DKRZ: [http://ipcc-ar5.dkrz.de/home.htm](http://ipcc-ar5.dkrz.de/home.htm)
Sea Ice Concentration  
(NSIDC-  http://nsidc.org/)


Total Sea Ice Area [km²] for 1979-2005 period. CMIP5 compared to the NASATEAM and Bootstrap SSM/I observations.
Total Sea Ice Area \([\text{km}^2]\) Annual Cycle. Monthly Climatology for 1979-2005 period.
Total Sea Ice Area \([\text{km}^2]\) Anomaly.
Mean and Annual cycle removed.
SSM/I Sea Ice Concentration
Arctic Sea Ice Concentration (%)
Winter (DJF) climatology for 1979-2005 period.
Antarctic Sea Ice Concentration (%)
Winter (JJA) climatology for 1979-2005 period.
ICESat
Arctic Sea Ice Thickness

http://rkwok.jpl.nasa.gov/icesat/download.html


Arctic Sea Ice Thickness [m].
Mean Oct+Nov+March+April fields for 2003-2005 period.
Antarctic Sea Ice Processes and Climate (ASPeCt) Sea Ice Thickness

23,373 Ship-based observations for 1981-2005 period;

http://aspect.antarctica.gov.au

Antarctic Sea Ice Thickness [m]
Annual fields for the period 1981-2005.
Future plans

- **Fram Strait Ice Export:**
  - Vinje et al., 1998, 2001:
    
  - Kwok, 1999, 2004 :

- **Sea Ice Drift (NSIDC):**
  - IAPB – Arctic
  - IPAB - Antarctic
Suggestions?

• Other observational data sets which can be used as first order metrics for sea ice?
Thank you!