Measuring Snowfall in the Amundsen and Bellingshausen Seas, Antarctica

Katherine Leonard and Richard Cullather
Lamont-Doherty Earth Observatory of Columbia University
Precipitation on West Antarctic Seas & Sea Ice

- High (and increasing) precipitation from models
- Not much validation data
- Observer data (ASPECT snow depth on sea ice) suggests less precipitation
- First year ice has high freeboard (thick snow cover)
- “snow ice” formation as ice growth mechanism?
- Seasonal loss of precipitation due to summer sea ice melt
- Stormy region with high winds and blowing snow
- Loss of snow into leads?
York University particle counter
- Lower size threshold
  ~30 microns
- Custom build for snow measurement
  (following Brown & Pomeroy 1989)

Wenglor photoelectric sensor YH03NCT8
- Lower size threshold
  ~100 microns
- Inexpensive, sturdy
If this is a representative size distribution*

69% of particles may be visible to the York snow counter

Approximately 9% seen by the wenglor

* average radius of precipitation at South Pole is 24 microns (Walden et al. ‘03)

* Average radius of Antarctic surface snow is 100 - 200 microns (Gay et al. 02)
Spatial & Temporal Variability of Precipitating Snow

Time 1: no snow
Time 2: heavy snow
Time 1: light snow
Time 2: heavy snow
Time 1: heavy snow
Time 2: no snow
ECMWF Precipitation

- Operational forecasts (hours 12-36)
- 6-hourly temperature, pressure, winds
- High resolution (1.125 by 1.125 degree)
- Gridpoint collocated with 12 hr ship position
- Ship’s data averaged about noon (or midpoint of 6-hour bin)
ECMWF Forecast Precipitation 17 Oct 2007 [cm/day]
ECMWF forecast precipitation, cm weq / day

Shipboard snowflake count per day
Challenges

- Ship and relative wind heading often aligned, preventing counting of snow particles passing parallel to the beam. (solve with multiple particle counters)
- Icing and riming over of detector, etc. (requires vigilance / oversight)
- Particle size distribution of snow is poorly known, but extremely important (Looking for solutions to this question)
NBP07-02

February - March 2007

Ross, Amundsen, and Bellingshausen Seas

NBP07-09

“SIMBA”

September - October 2007

Bellingshausen Sea & environs