



# Helicopterborne EM thickness measurements in the Transpolar Drift

## HEM system

- Dedicated for science
- Designed to be launched from any helicopter based on any icebreaker, or from land



Length	3.4 m
Weight	103 kg
Frequency	3.68 kHz (f1) 112 kHz (f2)
Coil separation	2.77 m (f1) 2.05 m (f2)
Sampling frequency	10 Hz (100 Hz for laser altimeter)
Towing cable length	20 m
Operation speed	60-80 knots (30-40 m/s)
Operation altitude	10-15 m above ice surface



## Summary & Conclusion

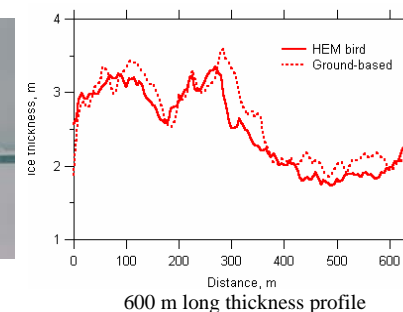
- New HEM system yields accurate, high resolution ice thickness profiles
- Pack ice in the Transpolar Drift is composed of 1.9 m thick large MY/SY floes and 1.2 m thick small FY floes (August 2001)
- MY/SY ice 20% thinner in 2001 than in 1991

## Validation

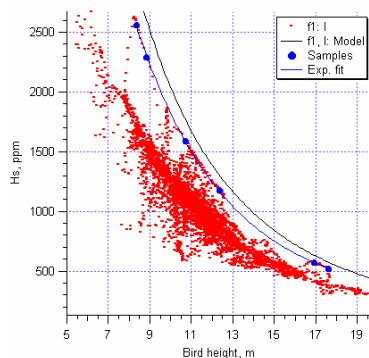
- Comparison with coincident ground-based EM31 measurements



Amphibic sledge for ground-based thickness profiling



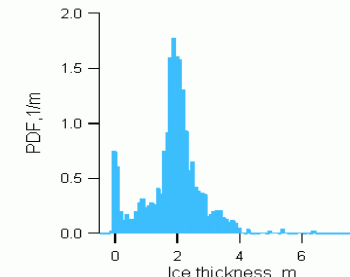
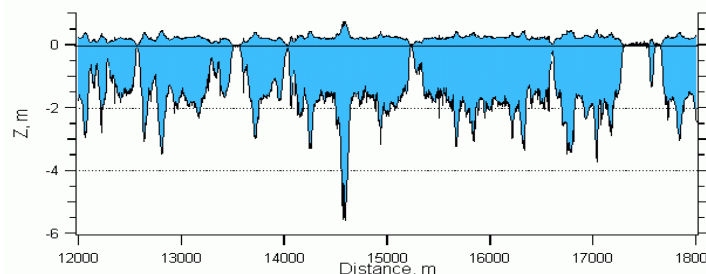
## Thickness retrieval



- Hs not yet fully calibrated
- Open water measurements provide calibration at ice thickness 0 m
- Transformation equation retrieved from fitting exponential curve to open water measurements

Typical scatter plot of InPhase secondary field strength Hs versus bird height. Two data clusters can be seen, resulting from ice floes and from open water leads.

## Results (from Polarstern Ark 17, Aug./Sept. 2001)

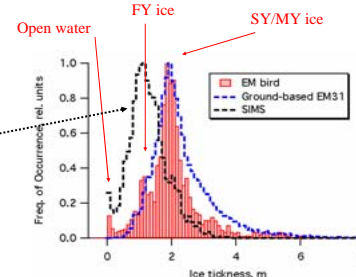


Typical 6 km long section of a 20 km profile and derived thickness distribution. Single ice floes and different thickness classes can be identified.

- Different thickness classes retrieved by different surveying techniques (ground, shipborne, airborne)



SIMS: Sea Ice Monitoring System



- Only airborne data comprise of all thickness classes

- 20% thinning in Transpolar Drift between 1991 and 2001

