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# Sea Ice Mass Balance Buoys (IMBs):

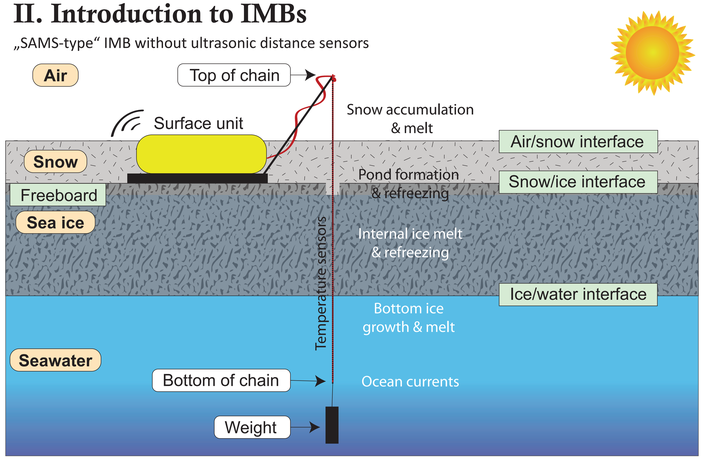
## Introduction to working group and Data Processing Intercomparison Study

### I. „Abstract“

Hey there, nice colourful poster! But what the heck is an IMB?
*Hi, thanks and welcome! An autonomous instrument to monitor sea ice growth & melt.*
Ok, and this is so cool because of...?
*It measures snow & ice temperatures over long periods without any maintenance, and sends the data via satellite. Really useful for remote regions with limited access.*
Impressive! Please tell me how this works!
*Why don‘t you look at section 2 below, it has a nice scheme!*
Ok I partly understand, and how many of those exist?
*This technology is quite new, but a number of these have been deployed in both polar oceans. See section 3 for an overview.*
Wow, quite a lot actually! So how does the data look like?
*It‘s kind of complicated to explain. There is a plot in section 4 which shows the entire output of one unit. There is lots of information hidden in the data, which is rather difficult to extract and interpret.*
Yeah this looks complicated indeed! How do you even get useful information out of this?
*Good question. It‘s quite hard actually. This is why we founded this epic working group with lots of smart IMB experts in it. Together we might eventually be able to tame all this messy data.*
Holy hell, this sound like a big challenge!
*You bet! We got some first results in section 5, which look quite promising. But there is still a lot of stuff to do. We will hopefully have many more contributions in the coming months, which we can then compare, to finally come up with a unified data processing procedure.*
This is really interesting! I think I could also use this kind of data for my project!
*Great? The raw data is freely available. Our aim is to provide the fully processed data within ~two years. We are also open for any collaborations. Maybe you even want to join?*

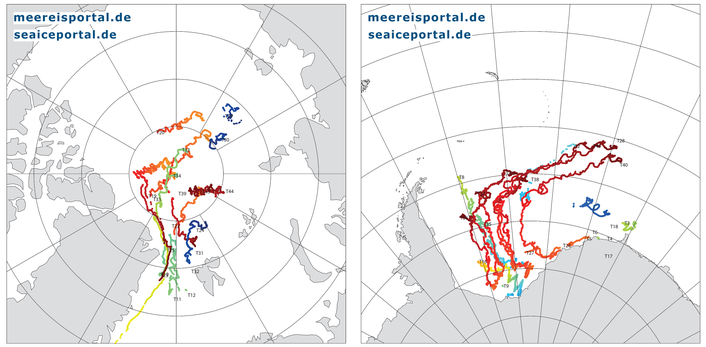
### II. Introduction to IMBs

„SAMS-type“ IMB without ultrasonic distance sensors




IMB consists of control unit (Iridium, GPS) and thermistor chain.
Autonomous operation, no maintenance
↓
Measures temperature profiles through air, snow, ice and water
Some devices also use ultrasonic distance sensors, most use active heating
↓
Extract snow depth & ice thickness evolution
↓
Calculate ice mass budget, validate remote sensing data, process studies...

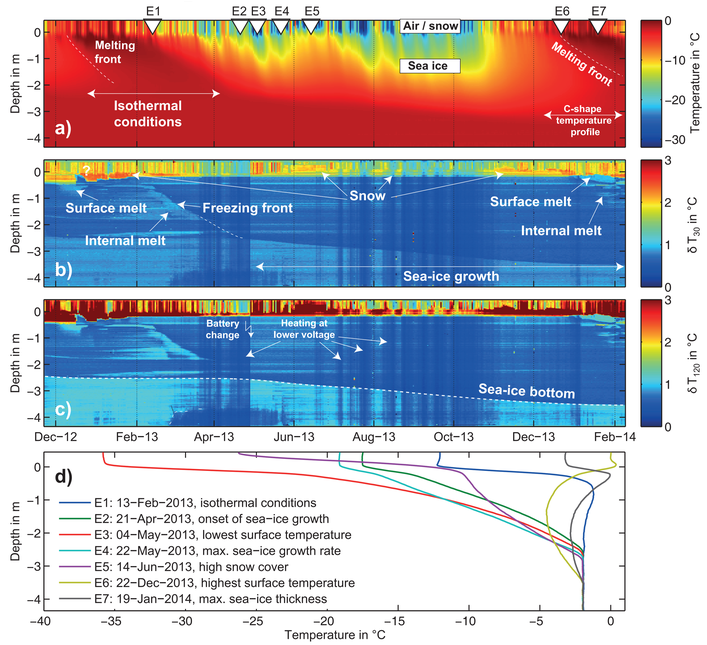
### III. Drift tracks of selected IMBs 2012-2016




Northern Hemisphere Southern Hemisphere

Tasks: • Gather data from all IMBs ever deployed in common database.
• Coordinate future deployments to optimize/extend coverage.
• Optimize deployment strategy.

### IV. Data example & features




IMB (SAMS type) dataset recorded between Nov 2012 and Feb 2014 on landfast ice in Antarctica. a) Time series of temperature profiles; b) temperature rise after 30s of heating (64mW); c) temperature rise after 120s of heating; d) selected individual temperature profiles (according to a). Characteristic features by visual inspection are highlighted. No automatic processing has been performed.

Tasks: • Define common data „levels“ and create unified data products.
• Make these products available to public through web interface.

**Buoy information**
*Buoy name:* 2014T14
*IMEI:* 300234061766880
*Buoy type:* Thermistor Buoy

**Deployment information**
*Date and Time (UTC):* 26.08.2014 13:30
*Position (Lat/Lon):* 89.98223/24.84635
*Region:* North Pole
*Contact:* Anne Bublitz (YorkU)
*Expedition name:* PS87-ARK28/4
*Means of deployment:* Ship - gangway

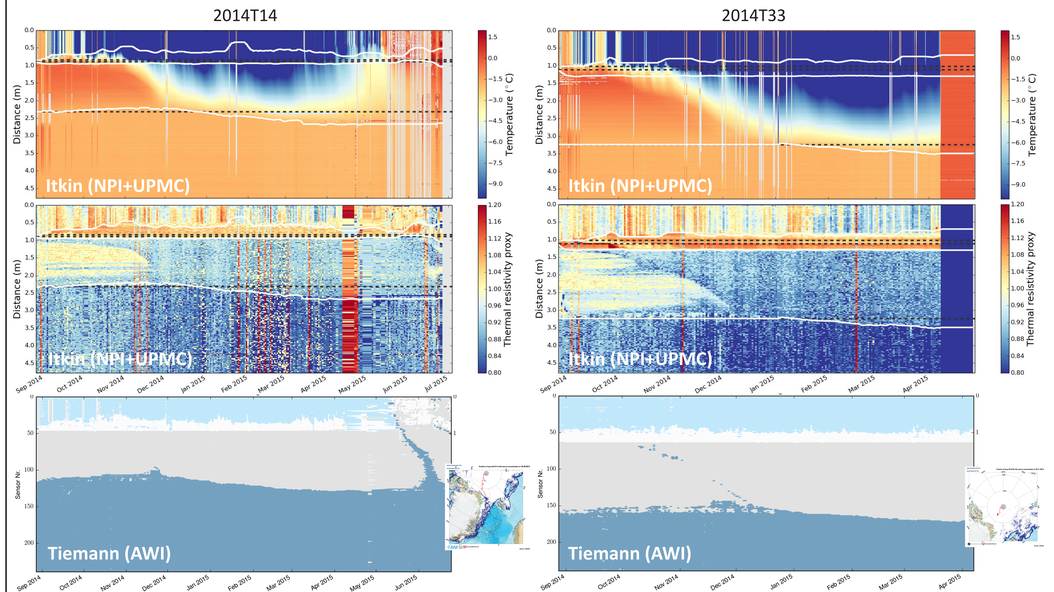
**Snow and ice conditions**
*Snow depth:* 0.07 m
*Ice thickness:* 1.49 m
*Ice freeboard:* 0.03 m
*Ice types:* MYI (Multi Year Ice)

**Buoy-specific parameters**
*Chain length:* 5 m
*Sensor spacing:* 0.02 m
*Sensor air snow (Sensor ID):* 42
*Sensor sea surface (Sensor ID):* 47
*Sensor snow ice (Sensor ID):* 45
*Sensor ice water (Sensor ID):* 116

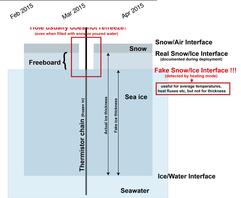
Sample buoy deployment sheet


Different deployment techniques

### V. Preliminary Results: ‘Itkin (NPI+UPMC)’ & ‘Tiemann (AWI)‘ algorithms




- Variable data quality: noise, erroneous data, broken thermistors.
- Time series shown here are among the longest, average length of valid datasets is much smaller.
- Both algorithms use very different approaches, but results of both are very promising.
- Strong temperature gradient at air/snow interface facilitates detection.
- Strong temperature rise gradient at „fake“ snow/ice interface (right figure).
- Isothermal conditions in summer prevent identification of ice/water. interface from temperature gradient.
- Ice/water interface pronounced in heating data, also when isothermal.
- Larger data gaps are problematic.




„Fake“ snow/ice interface issue

Tasks:
- Define unified procedure to process & clean data
- Develop & compare algorithms to extract ice thickness & snow depth
- Determine uncertainty range introduced by data processing techniques
- Improve exchange with modeling & remote sensing communities

**WE WANT YOU!**
Collaborations welcome!