CRAICC pre WP5-meeting

Copenhagen, Denmark

14/01/2014

Attendees

1. Erik Thomson, Goteborg University
2. Quynh Nguyen, Aarhus University
3. Erik Swietlicki, Lund University
4. Jan Pettersson, Goteborgs University
5. Zamin Kanji, ETH Zürich
6. Eva Emanuelsson, Aarhus University
7. Mikhail Paramonov, University of Helsinki
8. Berko Sierau, ETH Zürich
9. Frank Stratmann, TROPOS Leipzig
10. Mikko Sipila, University of Helsinki
11. Merete Bilde, Aarhus University

Recorded by

Quynh Nguyen

13:00 Update on current status of the 2nd generation PINC instrument – Erik Thomson

- Aarhus workshop has a re-designed drawing
- 7 parts were sent out to sub-contractors
- The rest of the parts are being made in Aarhus workshop
- Cost estimate now available

Changes in design: Evaporation section has been changed a lot so now it can evaporate larger particles, longer length of the main chamber (1 m), now it is about 20% more residence time, larger refrigeration coil, o-ring fittings etc., specs for refrigerator unit can go to -75 ^{o}C.

- The question was: Could we open the refrigeration system, which is a rare case. Answer: We may need external people for that.

13:30 Budget breakdown and cost estimate – Erik Thomson

Right now not included inlet system items, pump, OPC, computer, time (person). In addition, there are 3 major items to think about: 1. Inlet concentration; 2. Exit valve; 3. Detector. To be discussed for system upgrade later.

Machine parts: 4,000 (Aarhus shop); 7,000 (Aarhus external)
Rack: 2,500 (Aarhus shop)
Refrigeration: 29500 (per unit cost can go down about 6,000 if buying more units)
Computing/control hardware: 12,000 (National Instrument)
Electronics: 7,000
Currently unbudgeted: 5,000
TOTAL: **67,000 EUR**.

There is a "common" cost of drawing (7,000 – 8,000) spent at Uni Helsinki, which needs to be dispersed to the units later.

Merete Bilde noted that the price estimate for the Aarhus shop was subsidized for labour cost, which is a special condition for Aarhus Uni only, which needs further discussion with the head of the Department of Chemistry.

LabView can probably be used for the new unit. There is a version already available from Zurich, which can be used to develop further upon.

In general, the total expected price could be 100,000 EUR.

14:15 Big improvements

1. Inlet concentration; 2. Exit valve; 3. Detector

1. Inlet concentration. Needed to be measured in regions such as the Arctic where very few larger particles are available. Concentrator now used in 3 places (ETH, PNNL, UofT).

Berko Sierau: It is not straight forward to characterize the concentrator, and characterize it the same way at different institutes. ETH concentration not working 100% correctly (The company made measurements for particles > 600 nm using a sophisticated lens system to focus the larger particle particles, and prepared some efficiency calibration curve, which not fitting the results 100% right now). Toronto has not done a detailed characterization yet. The curve is slightly closer to the company calibration curve at PNNL. However 3 groups are having different results right now.

The concentrator is just an individual piece (not built-in) hence can be easily removed for using the instrument in the long run, in the Arctic or somewhere else.

This part will need careful consideration, to make sure that it can work, and worth buying it.

ETH will be in contact with the other 2 groups, and will have a Master student working further on the concentrator, and will inform more later.

2. Exit valve

To improve the ability to flow water inflow, outflow, evacuation and sample throughput. Evacuation is done to make sure the background is low, drying out any residual water/ice in there.

Frank Stratmann mentions that evacuation might not be automated even in Version 2. The instrument is generally in a very early stage.

ETH has done a lot of advanced work with this. Any new ETH option?

Berko Sierau: ETH has a design, can help to automize the procedure. It has been tested on an independent software but not tested integratedly. It has not been on the field due to busy schedule of the instrument. ETH might have a chance in autumn to try integrating it.

Exit valve however might not be an urgent issue right now. It however needs to be kept in mind for discussion with technical people.

3. Detector.

Frank Stratmann: Detector gives a decent size distribution with over 60 channels. It is calibrated so can also be used for offline size measurements. Depolarization detector (behind the evaporation section) (DMT design). Detector can be used to ice particle number, assuming the evaporation section works properly. Size distributions can also be used to distinguish droplets and ice.

Possible issues: Temp, flow current, interpretation of data.

In general, it can work.

PPD detector: **Zamin Kanji:** ETH are discussing the possibility and details.

"The original depolarization detector seems to be the best somehow" (**Frank Stratmann**). Possible option (Tops-ice).

Any specific OPC? **Zamin Kanji**: Climat and Met both seem to work fine, both made in the US. There is also a lighthouse instrument. ETH will come up with a suggestion later, since they have tested all three of them.

16:00 ETH updates on recent PINC activities – Zamin Kanji

Ice nucleation properties of diesel and wood burning (2009). Results in Chou et al., 2013, ACP (13), 761.

ACIo3 campaign (2009) SOA coating on Asian and Saharan dust particles. Paper still in progress.

PINC went to JFJ (Jungfraujoch) (further to Saharan dust event) and Tenerife (closer to Saharan dust event). Long data set at JFJ from 2008. Higher IN concentration at JFJ when there is a dust event. Bit low IN concentration at Tenerife, probably due to the use of concentrator. However there are no comparative measurement without the concentrator.

Bio IN (KIT, 2009), where the bacteria were involved.

Inter-comparison between PINC and LACIS. Tested with birch pollen. Results were quite comparable.

Loss in PINC has been identified as due to the impactor (a rectangular impactor was used).

Comparing PINC and Snomax: relatively good agreement

Lessons learnt: Can we measure immersion freezing in PINC and how to assess data in comparison with other cloud chambers. Larger evaporation section in PINC2 so can go for even higher RH.

Particle losses could be due to impactor, concentrator.

Must validate and calibrate chamber regularly (e.g. by homogeneous freezing of H_2SO_4).

Future campaigns: back to JFFJ, Tenerife (CALIMA), Hyytiälä (BAECC).

17:00 Summary of SPIN operation – Frank Stratmann TROPOS

Frank gave a nice summary of ice nucleation:

Chemical composition of IN, with high portion of mineral dust and biological part, then there are organics, soot salt.... See Pratt et al., 2009.

At Lepzig Aerosol Cloud Interaction Simulator (LACIS)

Using atomizer (dispersing solution and suspension), fluidized bed generator (dispersing dust) and coater (modifying surface properties)

Instruments available:

- WELAS (White Light Aerosol Spectrometer)
- TOPS-ICE (best, Thermally Stabilized Optical Particle Spectrometer)
- LISA (2D light scattering)

Arizona Test Dust. Broadley et al. (2012).

Homogeneous ice nucleation with and without thermo denuder Niedermeier et al., 2010, ACP.

Investigated bacteria (Snomax) and pollen (birch pollen). Snomax was suspended in water, then atomize it. Birch is also suspended in water, shaked, filtered, atomized. Observed Fice as a function of temperature. Snomax results in Hartmann et al., 2013, accepted in ACP. Birch pollen results in Augustin et al., 2013, under review for ACP.

K-Feldspar found as best mineral so far for ice nucleation.

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09:00 Group discussion

How long would it take from now to get the first instrument made?

4 weeks for the parts to be made at external companies

4 weeks + for the parts to be made at Aarhus workshop

2 months for refrigeration parts made in Goteborg

➔ About 6-8 months for the instrument to work

Goteborg and Helsinki want to make 2 units.

ETH wants an instrument for the spring campaign 2015.

Helsinki has a person (Jonathan) starting from February who can participate in assembling.

It is agreed that the PINC2 should be compared with SPIN and first generation PINC beforehand.

Agreement

Potential number of units to be made:

- ETH
- TROPOS
- Goteborg
- Lund
- Helsinki
- Aarhus

Aarhus: The machine shop in Århus should be prepared to build 2 immediately, and also prepare the cost estimate if more to be made (say 3 up to 6).

Goteborg: Only 1 cooling unit should be made first, if it works 5 more will be ordered.

Should buy multiple (6 units) on LabView packages as well.

Should also check with the sub-contractor companies in Århus how would it cost + timeline to produce the parts outside (that are currently planned to be made in Århus right now).

Plan for inter-comparison

- There is a chance to compare PINC and PINC2 between ETH and Goteborg in November - December
- At Lepzig comparison will only be possible from March 2015
- Dust event in Cyprus will be a good opportunity to compare field performance of old PINC (ETH) and a new one.

Assembling

First instrument will be assembled in Goteborg, as the cooling unit is made there. 1 person for each other place should come for e.g. 2 weeks.

There should be a common teaching session from ETH on how to operate the instrument where every group should come at the same time.

For the subsequent units, human resource will be an issue. Need a person in charge of mechanical engineering and then another for software. Need to investigate on how much it would cost to employ such persons on short-term (a few months) basis.

Plan for subsequent units

After inter-comparison, by spring-summer 2015 we can start building the rest of the units.

Long term

In the long run, the instrument will require a full time person's attention.