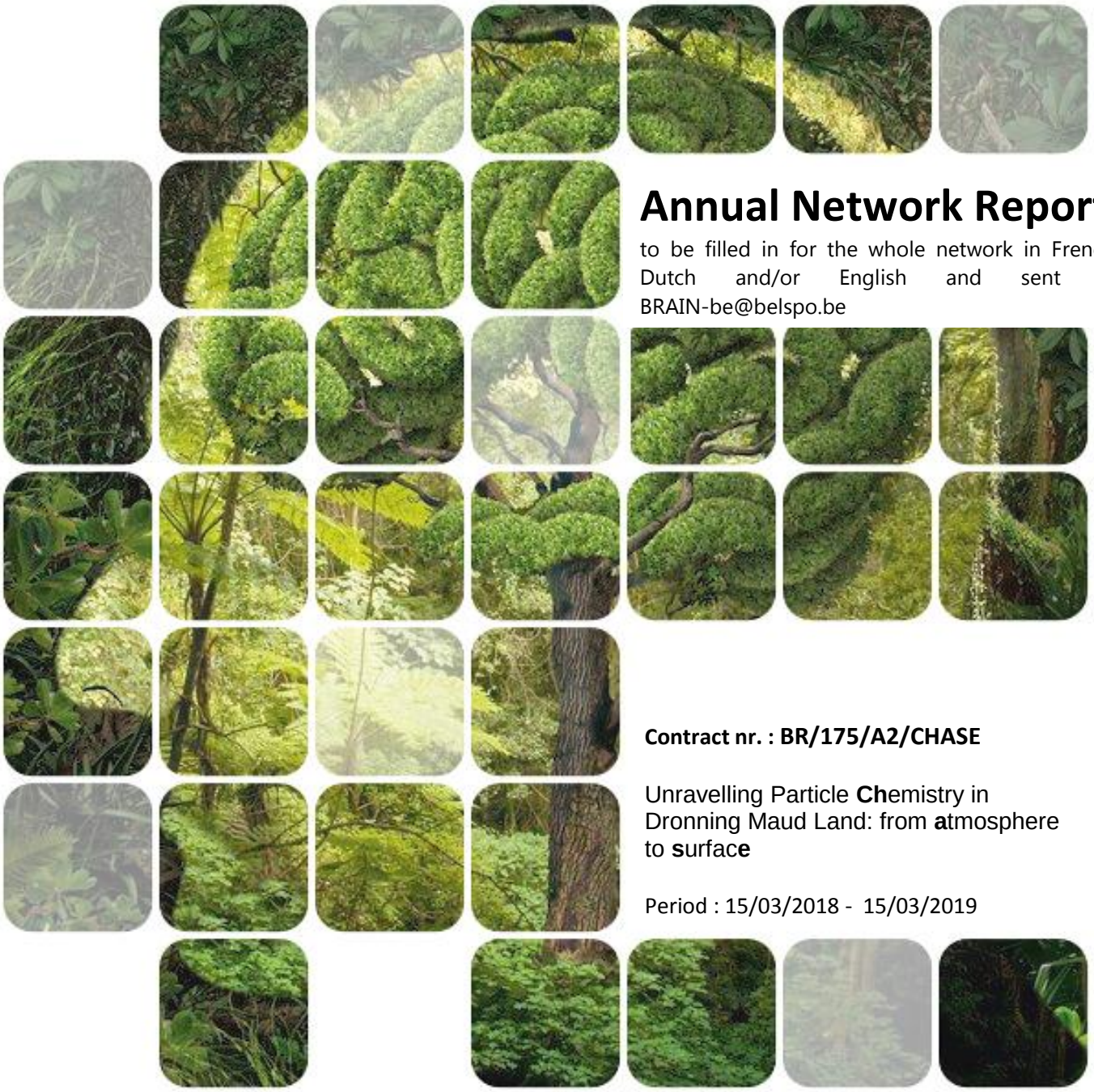
BRAIN-be

BELGIAN RESEARCH ACTION THROUGH INTERDISCIPLINARY NETWORKS



Annual Network Report

to be filled in for the whole network in French, Dutch and/or English and sent to BRAIN-be@belspo.be

Contract nr. : BR/175/A2/CHASE

Unravelling Particle **Ch**emistry in Dronning Maud Land: from **a**tmosphere to **s**urfac**e**

Period : 15/03/2018 - 15/03/2019

NETWORK

COORDINATOR

Dr. Alexander Mangold and Dr. Andy Delcloo, Royal Meteorological Institute of Belgium

PARTNERS

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2. Prof. Herman Van Langenhove and Prof. Kristof Demeestere, Ghent University
3. Prof. Nadine Mattielli, Université Libre de Bruxelles (ULB)
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9. Prof. Philippe, Claeys, Vrije Universiteit Brussel (VUB)

PROJECT WEBSITE:

Project website is under construction

Yearly, one report (max. 15-20 pages) should be filled in for the whole network in French, Dutch or English and sent to BRAIN-be@belspo.be.

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1. EXECUTIVE SUMMARY OF THE REPORT

The CHASE project provides detailed physical-chemical analyses of both atmospheric and surface snow particles as well as of volatile organic compounds recovered near the Belgian research station Princess Elisabeth (PE), Dronning Maud Land, East Antarctica, and thoroughly investigates their atmospheric transport pathways. Such detailed studies have never occurred in the region where Princess Elisabeth station is located. The project consists of 4 components: (i) a particle and air sampling with physical-chemical analysis component, (ii) a data interpretation component, (iii) a synthesis component, and (iv) a valorisation component.

The work is subdivided in several tasks and deliverables, executed by the different partners of this project. Their progress regarding the different deliverables is listed in table 1. The start date of the project was the 1st January 2017. In the table below, the submission date is counted from the 15th April 2017 (48 months until end of project in contract 15/04/2021.

No.	Description	Partner	Subm. date	Status
D1.1	Active and passive sampling methods for the atmospheric organic composition analysis of both particulate and gaseous fraction	UGent	M12, M24, M36, M46	PROG
D1.2	Advanced analytical procedures enabling detailed molecular characterization of collected air samples by using highly innovative mass spectrometry based equipment	UGent	M12, M24, M36, M46	PROG
D1.3	Unique dataset on detection frequencies and concentration levels of organic micropollutants in both Austral Summer and Winter at Dronning Maud Land	UGent	M12, M24, M36, M48	PROG
D1.4	Analysis methods developed for stable isotopes C and N of the organic aerosol fraction and related dataset on isotopic composition of the organic fraction of particulate matter	VUB	M12, M24, M36, M48	NOT
D2.1	Active sampling and analysis methods developed for inorganic composition of atmospheric particles and related dataset of inorganic composition	ULB	M12, M24, M36, M48	PROG
D2.2	Passive sampling and analysis methods developed for inorganic composition of atmospheric particles and related dataset of inorganic composition	ULB	M12, M24, M36, M48	PROG
D2.3	Surface snow samples collected and analysis methods developed for inorganic composition of particles therein and related dataset of inorganic composition	ULB	M12, M24, M36, M48	PROG
D3.1	Air mass trajectories calculated, dispersion analysis of atmospheric pathways, clustering of source regions	RMI	M12, M24, M36, M42	PROG
D4.1	Source regions, transport pathways, seasonal variations and relative importance of trace elements, micronutrients and atmospheric pollutants, of natural and anthropogenic compounds	RMI	M18, M30, M48	NOT
D4.2	Cloud Condensation Nuclei and Ice Nuclei characterisation	RMI	M18, M30, M48	PROG
D5.1	Management of the network	RMI	Cont.	PROG
D5.2	Quality controlled chemistry database	RMI	Cont.	NOT
D5.3	Results published to scientific community, policy and public	RMI, UGent, ULB, VUB	Cont.	PROG
D5.4	Scientific workshop	RMI, UGent, ULB, VUB	M42.	NOT

Table 1: List of intermediate and final deliverables and their dissemination. The first three columns give the number, the description and the partner responsible for the deliverable, the fourth column gives the submission date, counted from 15 April 2017, and the fifth column gives the status (finished (FIN), in progress (PROG), or not started (NOT)).

After the end of the BELARE season 2017/18 in February 2018, first samples arrived either end of February or by April 2018 at the partner's institutes. At ULB, Dr. Stefania Gili started as PostDoc researcher on 2 February 2018 and at UGent, MSc Preben Van Overmeiren started on 15 March 2018 working for his PhD in the framework of CHASE.

The analytical methods for trace organic components, sampled by both active and passive methodologies, are being developed. The influence of several parameters (temperature, pressure, solvents, extraction time) on the pressurised liquid extraction (PLE) performance was evaluated. Chromatography and mass spectrometry settings were optimized to enable compound separation and optimal method performance (e.g. low detection limits). The first samples are scheduled to be processed in Q2 of 2019.

The filters and snow samples which arrived to ULB in April 2018 are stored in freezers, before being processed for trace and rare earth element (and isotopic) analyses. Some filters will also be analysed by SEM/EDS for individual particle chemical analyses (in addition to the morphology and size characterization). The first SEM-EDS analyses of the filters from the active collectors are positive and confirm the efficient dust collection with a periodicity of 1 filter per 8 days.

The following preparations were undertaken for the 2018/19 field campaign at PE station:

- Meetings and email-exchanges with the Station Operator in order to discuss the practical topics for the sampling campaign; preparation of the necessary air cargo boxes and shipment forms;
- Material for the sampling has been prepared and ordered (i.a. adaptations to the High-Volume Sampling of UGent; Ordering and preparation of the material needed for the installation of the two new sampling sites. Cleaning and; preparation of the bottles needed for sampling surface snow.

Stefania Gili and Preben Van Overmeiren participated on the CHASE project in the BELARE 2018/2019 field campaign to Princess Elisabeth station and have been there from 17 November to 18 December 2018. They re-installed the pumps for active sampling near the station. In addition to the five sites for passive sampling of atmospheric particles and volatile organic compounds installed last season, they succeeded in installing the same kind of samplers at two further locations – one at the plateau and one near the coastline (see Figure 1 below). At all of these seven sites, surface snow samples were collected. The collected samples arrived by mid-March in Belgium and are stored now either at Ghent University or at Laboratoire G-Time (ULB) for further analyses.
Stefania Gili and Preben Van Overmeiren helped in addition to supervise instruments of the Brain-Be AEROCLOUD project.
Further details are described below within the progress per task section.

Coordinates of the sites for passive and surface snow sampling:

- East of PE station: 71.96014 °S 23.47353 °E 1320 m
- Plateau: 72.25336 °S 23.23195 °E 2300 m
- Deep Plateau: 72.37655 °S 23.41896 °E 2370 m
- Romnoes: 71.34678 °S 23.61131 °E 700 m
- Frank Kenny South: 70.82900 °S 23.73500 °E 320 m
- Frank Kenny North: 70.43281 °S 23.84089 °E 110 m
- Breid Bay (coast): 70.30485 °S 23.61642 °E 75 m

Figure 1 shows the locations on a map of Dronning Maud Land.

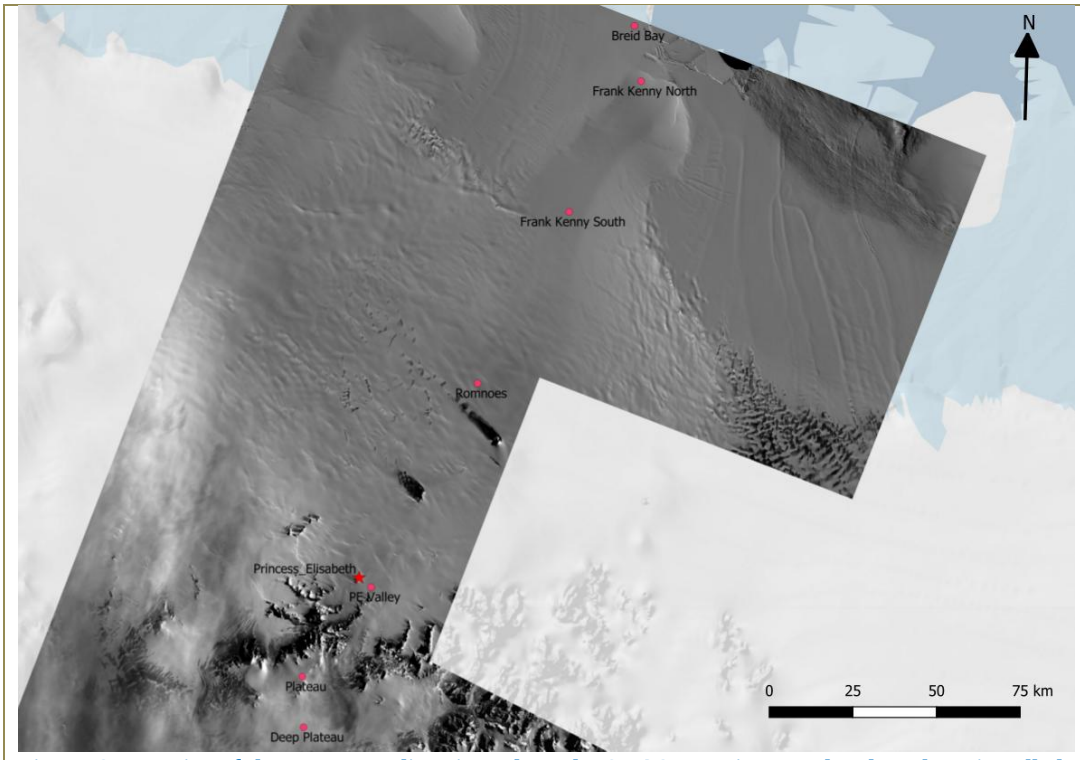

Figure 2: Location of the seven sampling sites where the CHASE passive samplers have been installed and where surface snow samples have been collected. 'Deep plateau', southward of PE, on the plateau; ii) 'Plateau', southward of PE, vicinity of the plateau; iii) 'PE valley', around 4 km eastward of PE; iv) 'Romnoes'; v) 'Frank Kenny South', between Romnoes mountains and the coast, vi) 'Frank Kenny North', near the coast; and vii) 'Breid Bay', near the coastline

2. ACHIEVED WORK

Detailed description of the achieved work and tasks of the past reporting year

Task 1: Characterisation of the organic atmospheric composition (particulate matter and VOCs) (UGent, VUB)

Task 1.1: Sampling and sample preparation of atmospheric particles for organic analysis (UGent)

A Digitel DHA-80 High Volume Sampler (HVS, 500 l/min) for active sampling of atmospheric particles has been installed in a container around 300 m north of PE station. The active sampling is limited to the austral summer period (filter exchange, energy demand). Pre-baked quartz-fibre filters have been used for the collection of particulate matter together with polyurethane foam filter cartridges to capture more volatile components.

Simultaneously with the high volume active sampling, polyurethane foam disk passive samplers have been installed, to be able to identify trace organic semi-volatile and non-volatile micro-pollutants. In addition, polymer sheet type passive samplers have been installed to sample organic micro-pollutants. Both kinds of these passive samplers have been set up at five sites during BELARE 2017/18 and the samples could be recoverrd and exchanged with new ones in November, December 2018 by Preben Van Overmeiren and Stefania Gili. In addition, the same kind of samplers have been installed at two further locations – one at the plateau and one near the coastline (see Figure 1). All these filters will stay a whole year until recovery and exchange of them in November, December 2019.

Task 1.2: Sampling and sample preparation for the analysis of Volatile Organic Compounds (UGent)
Volatile Organic Compounds (VOCs) are sampled by passive sampling. Axial passive samplers have been installed on poles (around 2-3 m above ground) at the same seven locations as the passive samplers for semi-volatile organic analysis mentioned before. These samplers will collect VOCs over a whole year until recovery and exchange of them in November, December 2019.

Task 1.3.1: Laboratory analysis for the molecular characterisation of the organic atmospheric composition (UGent)
To characterize and quantify organic components sampled using the active (HVS) and passive methodology an analytical approach using accelerated solvent extraction (ASE) was developed and validated. ASE has the advantage of reducing the required amount of solvent while obtaining high extraction efficiencies.

Task 1.3.2: Laboratory analysis for the stable isotopes C and N of the organic aerosol fraction (VUB)
Not started yet

Task 1.4: Interpretation of the results for organic atmospheric composition (UGent, VUB)
Not started yet.

Task 2: Characterisation of the inorganic composition of atmospheric particles (ULB)

Task 2.1: Active sampling and analysis of inorganic composition of atmospheric particles (ULB)
Active sampling on 47 mm – now with Teflon instead of polycarbonate filters – has been done from December 2018 (CHASE team) through February 2019 (PE station staff). The reason why we decided to change the type of material is because of their better blanks, and they can be reusable. Besides the filter, the same system as the previous campaign was used: a strong pump (nominal flow rate of 330 L/min) has been installed in the same container as for the active sampling for organic analysis. A flow meter was installed in the sampling line in order to derive accurate values for actual and total sample flow. In addition to several blank samples, a total of 9 filter samples could be collected. These filter samples have already arrived in Belgium for laboratory analysis. Further, we improved the inlet of the active pump with a sigma-2 sample head in order to guarantee that air (and thus particles) from all wind directions can equally enter the sample tube.

Task 2.2: Passive sampling and analysis of inorganic composition of atmospheric particles (ULB)
During the season 2018-19 two new passive atmospheric dust collectors have been installed by the CHASE team in November and December 2018, on poles (around 2-3 m above ground) at the same sites as the passive samplers for organic and VOCs analyses: i) one Sigma-2 collector at the deep plateau; ii) one Sigma-2 collector at Breid Bay, the nearest site to the coast. The samplers containing respectively one filter and a Savilex beaker at all sites have been installed for an atmospheric dust collection over one whole year until recovery and exchange of them in November-December 2019.

Task 2.3: Sampling of surface snow and analysis of inorganic composition of particles therein (ULB)
Surface snow samples have been taken in November and December 2018 by Stefania Gili at seven locations: i) around 4 km eastward of PE station; ii) one site southward of PE, in the vicinity of the plateau; iii) 16 km from that site, a new site at the deep plateau; iv) near Romnoes, northward of PE; v) in between Romnoes and the coast; vi) at one site at the western part of an ice rise at the coast and, vi) 'Breid Bay', near the coastline, Breid Bay. A total of 23 bottles of 10 L, i.e. a total of 230 L of surface snow, have been collected. The bottles have been shipped back and already arrived in Belgium on March 20th 2019 for laboratory analysis of the particles in the sampled snow.

Task 2.4: Interpretation of the results for inorganic particle composition (ULB)
Not started yet.

Task 3: Air mass tracing by dispersion analysis of atmospheric transport (RMI)

Task 3.1: Calculation of air mass trajectories (RMI)
The modelling platforms for the FLEXTRA trajectory model and FLEXPART dispersion model have been further implemented at RMI (e.g., Delcloo and De Meutter 2018, see section 7) and are ready to be applied to PE observations.

Task 4: Implications of the found results for atmospheric transport of trace elements, micronutrients and pollutants towards Antarctica and its closely associated Southern Ocean (RMI)

Task 4.1: Trace elements, micronutrients and atmospheric pollutants in Antarctica – their source regions, transport pathways, seasonal variations and relative importance of natural and anthropogenic compounds (RMI)
Not started yet.

Task 4.2: Implications of found particle chemistry on cloud condensation and ice nuclei (RMI)
Based on results of the Belspo BrainBe project Aerocloud, a paper on the cloud condensation nuclei (CCN) properties measured at PE has been published (Herenz et al., 2019, see section 7). These results will form the basis to interpret measured aerosol properties at PE with respect to CCN and ice nuclei.

The first samples collected for analysis on ice nucleating properties (INP) have been analysed in autumn 2018 at TROPOS, Leibniz Institute for tropospheric research. Apparently the air at PE was very clean. At least for the analysis methods used for INP sample analyses (*Wex et al., Annual variability of ice nucleating particle concentrations at different Arctic locations,, ACPD, 2018; https://doi.org/10.5194/acp-2018-1274*), the results for the blank samples were higher for one of the collected sample and the results of the second sample were only slightly higher than the blank sample, prohibiting further interpretation (see figure 2). Therefore, the sample time during Belare 2018-2019 was prolonged to at least 10 days.

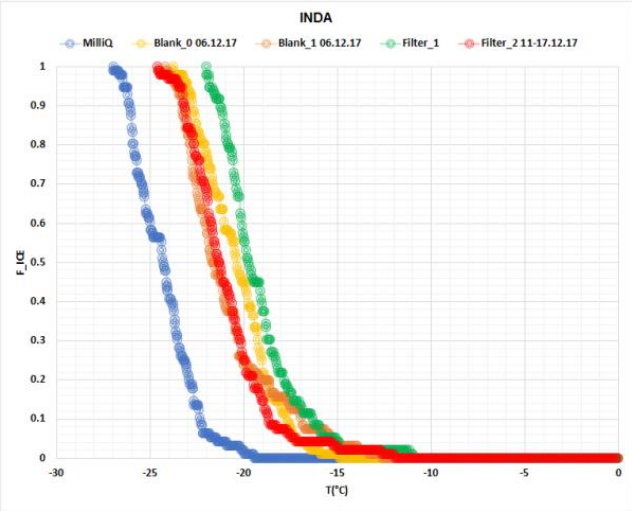

Figure 2: Fraction of frozen droplets at decreasing temperature. Graph for 'INDA' INP analysis method.

Task 5 Coordination, database management and valorisation (RMI, UGent, ULB, VUB)

Task 5.1: Network management (RMI)

Project coordination is led by the Royal Meteorological Institute. A meeting of the CHASE consortium is planned for 29 May 2019 at RMI. Meetings of partners took place before the BELARE 2018/19 campaign and after it, in order to prepare the campaign and to give feedback on the campaign.

Task 5.2: Management of the chemistry database (RMI)

The database has not started yet. The website is in preparation.

Task 5.3: Publication of results to the scientific community, policy stakeholders and the general public (RMI, UGent, ULB, VUB)

Blogs were maintained during the field campaign by Stefania Gili and Nadine Mattielli www.bncar.be), Preben Van Overmeiren (https://www.ugent.be/bw/gct/en/research/envoc/blog) and by Alexander Mangold (belatmos.blogspot.be).
Preben Van Overmeiren made two skype video calls from the station to two secondary schools in Belgium where students of all ages where allowed to ask questions after he made a short introduction of the project's subject. This activity was voluntary for the students which assured only students with interest were participating.
Further communications will be prepared when first results of the collected samples are available.
For publications, please see also section 7.

Task 5.4: Scientific workshop (RMI, UGent, ULB, VUB)

Not started yet.

3. INTERMEDIARY RESULTS

Task 1.1: Sampling and sample preparation of atmospheric particles for organic analysis (UGent)

At the five passive sampling sites installed in the 2017-2018 season all filter material was recovered and new filters were installed. The two additional sites deployed in the 2018-2019 season were equipped with identical sampling equipment and installed in a similar fashion as the others. On all sites the steel mechanism holding the polymer type sampler was replaced with an in-house developed new mechanism enabling an easier exchange.
The used method for conditioning the filter materials was validated.

Task 1.2: Sampling and sample preparation for the analysis of Volatile Organic Compounds (UGent)

At the five passive sampling sites installed in the 2017-2018 season all axial sorbent tubes were recovered and new tubes were installed. The two sites installed in the 2018-2019 season were equipped with identical sampling equipment. Therefore, 2 new stainless-steel shelters (in-house developed) had to be made and they were installed in a similar fashion as before.

Task 1.3.1: Laboratory analysis for the molecular characterisation of the organic atmospheric composition (UGent)

The method for the extraction of the samples was developed. Different extraction parameters were optimized and a gas chromatography mass spectrometry based method was optimised and validated in order to detect and quantify sub-trace organic components

Task 2.1: Active sampling and analysis of inorganic composition of atmospheric particles (ULB)

SEM-EDS analyses have been carried out on 6 samples from the active pump sampling, recovered from the campaign 2017-2018. The main goal is to have a general idea of dust quantification (dust concentrations and size distribution) and dust mineralogy. The first SEM-EDS analyses of the filters from the active collectors are positive and confirm the efficient dust collection with a periodicity of 1 filter per 8 days.

Task 2.2: Passive sampling and analysis of inorganic composition of atmospheric particles (ULB)

A lot of energy and time were spent to set up the methodology to dissolve the atmospheric particles from the filters, with attention to minimize the risk of particle loss and contamination risk. From the Sigma-2 passive collectors installed in 5 different sampling sites during the campaign 2017-2018 (i.e. (1) 'PE valley', around 4 km eastward of PE, (2) 'Plateau', southward of PE, (3) 'Romnoes'; (4) 'Frank Kenny South' and (5) 'Frank Kenny North', near the coast), trace element concentration analyses (Rare Earth (REE) and Metal Trace Elements) have been carried out. A total of 11 samples recovered from the passive collectors have been investigated including 6 polycarbonate filters (1 at each site, except at PEA there are two) and 5 Savilex beakers placed inside each Sigma-2 collector. The analyses were performed on an Element 2 HR-ICP-MS at the VUB (BIGE analytical platform). The goal was also to check if we were able to see any difference in between the plastic and the aluminium Sigma-2 collectors.

Task 2.3: Sampling of surface snow and analysis of inorganic composition of particles therein (ULB)
The 230 L of snow collected by Prof. Nadine Mattielli during November 2017 were melted by Stefania Gili at the G-Time Lab and processed for chemical and isotope analyses (Sr and Nd). As same as before, samples from the 5 sampling were analysed for trace element concentrations. For isotopes, only one sample (from the coast) was considered into account for analysis. This sample is the one located at the coast 'Frank Kenny North'. And it was chosen because it is influenced by the continent and the ocean, which means we should be able to see the input of both signatures. The preliminary results (e.g. Rare Earth ratios) obtained on snow and filters are promising in terms of dust origin identification when REE are compared for the Antarctic samples vs. dusts collected at the potential main source area from the Southern Hemisphere. The analyses of radiogenic isotopes should confirm the preliminary results. Some discrepancies may be observed between the filter's results and the ones from the snow samples. An explanation could be the successive repetitions of snow or ice accumulation and melting events inside the passive collectors throughout the year, which might imply moving of atmospheric particles out of the filters.

Task 3.1: Calculation of air mass trajectories (RMI)
The modelling platforms for the FLEXTRA trajectory model and FLEXPART dispersion model have been further implemented at RMI (e.g., Delcloo and De Meutter 2018, see section 7) and are ready to be applied to PE observations.

Task 5.1 : Network management (RMI)
See section 2.

Task 5.2: Management of the chemistry database (RMI)
See section 2.

Task 5.3: Publication of results to the scientific community, policy stakeholders and the general public (RMI, UGent, ULB, VUB)
See section 7 for an overview list of publications.

4. PRELIMINARY CONCLUSIONS AND RECOMMANDATIONS

Work package 1: Characterisation of the organic atmospheric composition (particulate matter and VOCs)
Experiments were done, using a similar sampling technique as in Antarctica, in order to test the developed method. The developed analytical scheme can be used to process the samples as soon as they arrive in our laboratory.

Work package 2 Characterisation of the inorganic composition of atmospheric particles:
The expedition BELARE 2018/19 was extremely successful. The transect for sampling of dust in suspension (through 7 Sigma-2 passive samplers) and deposition (snow samples) was established from the plateau to the coast with 7 equipped sites. For each site, for the analyses of dust inorganic composition, one filter and one savilex beaker were installed in the sigma passive samplers, and between 10 and 140L of snow (depending on the sampling site) were collected. Earlier that last year, the filters and snow samples arrived to ULB and were stored in freezers, before being

processed for trace and rare earth element (and isotopic) analyses. Some filters will also be analysed by SEM/EDS for individual particle chemical analyses (in addition to the morphology and size characterization). The first SEM-EDS analyses of the filters from the active collectors are positive and confirm the efficient dust collection with a periodicity of 1 filter per 8 days.

Work package 3 Air mass tracing by dispersion analysis of atmospheric transport:
The modelling platforms for the FLEXTRA trajectory model and FLEXPART dispersion model have been further implemented at RMI and are ready to be applied to PE observations.

Work package 4 Implications of the found results for atmospheric transport of trace elements, micronutrients and pollutants towards Antarctica and its closely associated Southern Ocean:
The first samples collected for analysis on ice nucleating properties (INP) have been analysed in autumn 2018 at TROPOS, Leibniz Institute for tropospheric research. Apparently the air at PE was very clean. The results for the blank samples were higher for one of the collected sample and the results of the second sample were only slightly higher than the blank sample, prohibiting further interpretation (see figure 2). Therefore, the sample time during Belare 2018-2019 was prolonged to at least 10 days.

Work package 5 Coordination, database management and valorisation:
See section achieved work.

General recommendations:
The installation of the instrumentation for both the active sampling and the transect for passive sampling (two additional sites) was successful. However, given the long sampling duration, it is essential that the sampling can continue as planned over four seasons. Also, particular attention will be paid to avoid contamination and to avoid disturbances of the samples, e.g., by snow intrusion during storm conditions.

5. FUTURE PROSPECTS AND PLANNING

Overview of the foreseen activities and planning for next reporting year, taking into account the actual state of the work and the intermediary results

Work package 1: Characterisation of the organic atmospheric composition (particulate matter and VOCs) (UGent, VUB):
Analysis of trace organic compounds on the PUF passive samplers (which were exposed during the 2018 austral winter) and the high-volume samples (from both the first and second field campaign) is scheduled for Q2 of 2019.
First samples for work package analyses 1.3.2 (Laboratory analysis for the stable isotopes C and N of the organic aerosol fraction) will be available and the respective (preparatory) laboratory work can start.

Work package 2: Characterisation of the inorganic composition of atmospheric particles (ULB) :
In the following weeks, the melting of the snow and filtration to recover the new particles from the 2018 samplers will begin. This will allow us to have a new batch of samples ready for the second step of total dissolution before the trace element analyses on the HR-ICP-MS at the VUB. Also, additional isotopic data (Sr, Nd and Pb) will be obtained after a chemical purification on chromatographic columns and analyses on the Nu Plasma II MC-ICP-MS at ULB.

Work package 3: Air mass tracing by dispersion analysis of atmospheric transport: (RMI):
The FLEXTRA and FLEXPART models will be used by the personnel to be hired by RMI on the CHASE project.

Work package 4: Implications of the found results for atmospheric transport of trace elements, micronutrients and pollutants towards Antarctica and its closely associated Southern Ocean (RMI):
New results from the analysis of the filters for ice nucleating particles properties will be available from the samples of Belare 2018-2019. First results from the back trajectory and dispersion modelling combined with the chemical analyses will be available.

Work package 5: Coordination, database management and valorisation (RMI, UGent, ULB, VUB):

- The next Belgian Research Expedition to the Princess Elisabeth station (November 2019 – February 2020) will probably host again two CHASE scientists. They will proceed to do the active sampling, exchange the samples at the passive sampling site and collect the snow samples.
- A CHASE website will be created and first work will be done to generate a Chase database.
- Papers on first results will be submitted (Geochemical Perspective Letters);
- Nadine Mattielli and Stefania Gili will present a talk and poster at the international INQUA conference (Dublin, August 2019);
- Results for the isotopic analysis (obtained from snow samples) are planned to be presented at the EGU or AGU conferences in 2019-2020;
- Philippe Claeys and Alexander Mangold will attend the meetings of the Belgian National Committee on Antarctic Research;
- Further outreach activities like talks, and blogs will be continued

6. FOLLOW-UP COMMITTEE

Dates of the meetings and overview of the concrete contributions of the follow-up committee

Nadine Mattielli has been in email contact with Profs. Karine Deboudt and Pascal Flament **(**Laboratory of Physics and Chemistry of the Atmosphere (LPCA), Université du Littoral – Côte d'Opale, Dunkerque, France). They will provide their expertise in aerosol characterisation by applying single-particle analysis (SEM-EDX) on the suspended atmospheric particles collected directly on filters (Sigma-2 and active pump samplers) and dust deposits (snow samples). Two SEM-EDX analytical sessions have been organized at Dunkerque for the single particle characterizations.

Nadine Mattielli has also been in email contact with Dr. Volker Dietze (German Meteorological Service, Research Centre Human Biometeorology, Air Quality Department, Freiburg, Germany) who provided the passive sampler equipment. Volker Dieze also visited ULB in autumn 2018. They discussed the installation and improvement of the samplers.

A collaborations with Paola Formenti, Senior Scientist of the National Center for Scientific Research (CNRS) at LISA (France), opens new perspectives on a better understanding of the dust genesis from the main dust precursors (soils or loess from Southern South America or South Africa). Her work focuses on the optical and hygroscopic properties of aerosols and mineral dust in particular. She is head of the department where experiments on the CESAM simulation chamber are developed.

Nadine Mattielli, Christophe Walgraeve and Alexander Mangold have been in contact with Prof Annick Wilmotte (University of Liège, Belgium). Her group and collaborators (e.g. of UGent, Brain-Be Microbian project) are studying the microbial diversity on deglaciated rocks, nunataks, or ridges in Antarctica. They are interested in how such taxa are distributed in Antarctica, e.g. via air transport. Our filter material might therefore be useful for microorganisms analyis. In addition, she is member of the Belgian delegation to the Committee for Environmental Protection to the Antarctic Treaty and is preparing a document to protect some of the biological soil crusts in the Sor Rondane Mountains and to keep a reference area non-violated for future studies.

The employment of Preben Van Overmeiren opened the perspective to collaborate with Prof. Laszlo Vincze UGENT), the former supervisor of Preben. Prof Vincze is doing research on (interstellar) dust characterisation using Synchrotron X-Ray analysis. Prof. Vincze remains interested in the project, whenever the samples are available in Belgium further steps will be taken to explore the possibilities of this collaboration.

Alexander Mangold met before and after the Antarctic field campaign with Prof. Nicole Van Lipzig (KU Leuven). Within the Brain-Be Aerocloud project they are both collaborating on investigating the relationship between clouds, precipitation and aerosols in Antarctica. The results of CHASE on the chemical nature of atmospheric particles will be helpful for understanding the formation of clouds. Within her group, the COSMO-CLM2 regional climate model has been adapted to simulate also the influence of different types of particles on the formation of clouds and precipitation.

Alexander Mangold has been in email contact with Dr. Heike Wex (Leibniz Institute for tropospheric research, TROPOS, Germany) who is doing research on cloud formation, cloud processes and the aerosol particles involved in it. He met her also during the SCAR/IASC Open Science Conference, Davos, Switzerland in June 2018. Her group is interested in the chemistry of the particles sampled within CHASE. A specific sampling setup has been sent to PE station during 2018/19 and several filters dedicated to analyses on the ice nucleating capabilities of the particles have been collected. The samples are currently stored in a freezer of Ghent University and will be transferred to Leipzig, Germany in May 2019 for their laboratory analysis.

The employment of Stefania Gili (see Staff-section) opens the perspective to collaborate with Prof. Diego Gaiero (National University of Cordoba, Argentina), the former supervisor of Stefania Gili. He is doing research on dust characterisation and genesis in Chili and Argentine, the areas foreseen as the main sources of dust deposits in Antarctica. His research is complementary to the CHASE objectives and the exchange of expertise and results will be beneficial for the outcome of the project.

7. VALORISATION ACTIVITIES

7.1 PUBLICATIONS

Publications in peer-reviewed scientific journals:

- Herenz, Wex, Mangold, Laffineur, Gorodetskaya, Fleming, Panagi, Stratmann, CCN measurements at the Princess Elisabeth Antarctica Research station during three austral summers, Atmos. Chem. Phys. 19, 275-294, doi.org/10.5194/acp-19-275-2019, 2019.
- A manuscript is in preparation for submission to the Atmosphere Journal: Is the Argentinean Loess a primary dust source in the Southern Hemisphere?, by S. Gili, D. Gaiero, N. Mattielli, G. Torre, S. Goldstein, F. Chemale and E. Koester.
- A manuscript is preparation: Pb-Sr-Nd-Zn-Cu-Fe multi-isotope analytical protocole adapted for dust studies, by A. Vandertsraeten, N. Mattielli, S. Bonneville.

7.2 PARTICIPATION/ORGANISATION OF SEMINARS (NATIONAL/INTERNATIONAL)

Oral presentation, poster… and/or organisation of workshops, symposia etc.

Oral presentations:

- Mangold, A., Q. Laffineur, A. Delcloo, C. Hermans, F. Hendrick, A. Gossart, N. Souverijns, P. Herenz, H. Wex, N. Van Lipzig and H. De Backer, Aerosol variability linked to clouds and precipitation in the Sor Rondane area, POLAR2018, SCAR/IASC Open Science Conference, Davos, Switzerland, 19-23 June 2018.
- Gili, S. Chasing dust in Dronning Maud Land, East Antarctica: A geochemical perspective. *Seminar, Ghent University,* 10 May 2018
- A. Vanderstraeten, Gili. S, Mangold, A., Bonneville, S., Walgraeve, C., Van Overmeiren, P., Goderis, S., and Mattielli, N. Chasing dust in Dronning Maud Land, East Antarctica: A Trace Element perspective. INQUA, *Dublin, Ireland, 23-31 July 2019*

Poster presentations:

- Mangold, A., Q. Laffineur, R. Van Malderen, C. Hermans, K. Nys, M. Verbruggen and H. De Backer, Total ozone, UV and radio sounding measurements in the Sør Rondane Mountains, POLAR2018, SCAR/IASC Open Science Conference, Davos, Switzerland, 19-23 June 2018.
- Andy W. Delcloo and Pieter De Meutter, Uncertainty quantification of Lagrangian dispersion modelling using ECMWF's ERA5 ensemble data within the framework of the ATM Challenge, NERIS workshop, 25 - 27 April 2018, Dublin, Ireland.

CHASE partners will participate and contribute to the 'Antarctic climate symposium', organised by the BrainBe AEROCLOUD project on 10 May 2019 in Brussels.

7.3 SUPPORT TO DECISION MAKING (IF APPLICABLE)

The connection between scientific research on Antarctica and policy is largely managed by the Scientific Committee on Antarctic Research (SCAR). Belgium is a Full Member of SCAR, represented by the Belgian National Committee on Antarctic Research (BNCAR, http://dev.ulb.ac.be/glaciol/BNCAR/). Prof. Philippe Claeys and Dr. Alexander Mangold are members of BNCAR and have been attending the meetings to ensure that all scientists involved are aware of the ongoing research. This is further strengthened via discussions with members of the follow up committee. CHASE scientists attended and gave presentations at the XXXV SCAR Biennial Meeting and the associated symposium POLAR2018 co-organized between SCAR and the International Arctic Science Committee IASC (June 2018, Davos, Switzerland).

7.4 OTHER

- Blog by Stefania Gili and Nadine Mattielli on research activities during Belare 2018/19: (www.bncar.be)
- Blog on RMI's activities at Princess Elisabeth station: belatmos.blogspot.be
- Blog by Preben Van Overmeiren on the research activities during Belare 2018/19 (https://www.ugent.be/bw/gct/en/research/envoc/blog)
- 2 videocalls from the PEA station to secondary schools by Preben Van Overmeiren
- A reporter from the Belgian newspaper 'Het Laatste Nieuws' interviewed Preben Van Overmeiren before departing for the second field campaign. The article was published on 16/11/2018
- Stefania Gili produces a short video on the dust sampling during Belare 2018-2019: http://www.ulb.ac.be/actulb/index.php?d=1&article=15107

8. ENCOUNTERED PROBLEMS AND SOLUTIONS

Encountered problems/obstacles, adopted and/or envisaged solutions, unsolved problems

The localisation of the 'Atmos' shelter for active sampling is not ideal with respect to avoid as much as possible contamination of the filter samples. Although the main station is downwind of the main wind direction, the distance to it is still only around 300 m. Also, the fuel platform where full fuel drums are stored is at less than 100 m distance. This meant bulldozer traffic from time to time with the need to interrupt the active sampling. Although the pumping was mostly interrupted in time, this cannot be guaranteed always. Chase partners will discuss with the station operator possible improvements and adaptations in order to assure to the most possible non-contaminated measurements. A proposal was introduced to the Brain-be Valorisation action 2018 with the aim to support a new mobile measurement container which could be installed further away from the station. It was however not withhold for financing.

9. MODIFICATIONS COMPARED TO THE PREVIOUS REPORT (IF APPLICABLE)

9.1 PERSONNEL

No changes with respect to project-financed personnel

Partner	Name	Nationality	Gender	Date of birth	Certificate	Year of graduation	Statute	Time implication in the project financed by BELSPO (in FTE)	Type of labour contract	Annual gross salary	Time implication in the project financed by other source(s) (in FTE)	Name(s) of the other funding source(s)	Remarks

9.2 COMPOSITION OF THE FOLLOW-UP COMMITTEE

n/a

10. REMARKS AND SUGGESTIONS

Concerning for example: the coordination, the use or valorisation of the results, personnel change …

UGent:
Herman Van Langenhove retired on the 1st of October 2018, he remains involved in the meetings of CHASE and continues to follow up Preben's research. Christophe Walgraeve is the successor of Herman and is now professor in EnVOC. He was already involved in the project (participation in the first field campaign) and will thoroughly follow up all CHASE meetings and scientific experiments.

KMI:
KMI will hire a new staff member in the course of the next months. This staff member should have expertise in atmospheric trajectory and dispersion modelling.