

SPECIAL PROJECT PROGRESS REPORT

All the following mandatory information needs to be provided. The length should *reflect the complexity and duration* of the project.

Reporting year 1 Jan 2021 -30 June 2022

Project Title: An enhanced use of passive microwave radiances in the scandinavian HARMONIE-AROME km-scale limited-area data assimilation

Computer Project Account: spselind

Principal Investigator(s): Magnus Lindskog

Affiliation: Swedish Meteorological and Hydrological Institute

Name of ECMWF scientist(s) collaborating to the project (if applicable) -

Start date of the project: 1 January 2021

Expected end date: 31 December 2023

Computer resources allocated/used for the current year and the previous one (if applicable)

Please answer for all project resources

		Previous year		Current year	
		Allocated	Used	Allocated	Used
High Performance Computing Facility	(units)	15000000 .	15000000 .	15000000 .	0 .
Data storage capacity	(Gbytes)	-	-		

Summary of project objectives

The objective of this project is to harmonise and enhance the use of microwave radiances in the Nordic countries. Initial work will be with existing microwave sensors and towards the end of the project also preparation for the microwave sensor on the upcoming Arctic Weather Satellite will be addressed.

Summary of problems encountered (10 lines max)

No serious problems encountered.

Summary of plans for the continuation of the project (10 lines max)

During the coming year more tests with revised bias correction procedure will be carried out and also pre-operational parallel runs with mwhs-2,atms, mhs and amsu-a instruments assimilated, also low peaking channels. There are as well near future plans towards tuning of observation error variances and to investigate cross-channel correlations. We will also work on enhance the use of low peaking channels and prepare for introduction of Arctic weather satellite data.

List of publications/reports from the project with complete references

http://www.umr-cnrm.fr/accord/IMG/pdf/accord_asw_2021_eresmaa_v3b.pdf

https://cdn.eventsforce.net/files/ef-xnn67yq56ylyu/website/21/2_r_randriamampianina.pdf

https://cdn.eventsforce.net/files/ef-xnn67yq56ylyu/website/21/2_r_randriamampianina.pdf

https://www.umr-cnrm.fr/accord/IMG/pdf/assimilation_of_surface-sensitive_mw_observations_over_land_and_sea-ice_in_harmonie-arome_accord_meeting_asw_-_april2022_2.pdf

<http://www.iapjournals.ac.cn/fileDQKXJZ/journal/article/dqkxjz/newcreate/AAS-2020-0326.pdf>

Summary of results

If submitted **during the first project year**, please summarise the results achieved during the period from the project start to June of the current year. A few paragraphs might be sufficient. If submitted **during the second project year**, this summary should be more detailed and cover the period from the project start. The length, at most 8 pages, should reflect the complexity of the project. Alternatively, it could be replaced by a short summary plus an existing scientific report on the project attached to this document. If submitted **during the third project year**, please summarise the results achieved during the period from July of the previous year to June of the current year. A few paragraphs might be sufficient.

The work during the first half year has been devoted to harmonising and enhancing the microwave observation usage in the Swedish/Finish/Norwegian/Estonian MetCoOp system and, the Norwegian AROME-Arctic and the Danish/Icelandic NWP system. Therefore there has been work on introduction of ATMS data in MetCoOp and AROME-Arctic systems and on introduction of MWHS-2 data in Danish/Icelandic and AROME ArcticNWP system. Supported by research in this project MetCoOp is now assimilating operationally MW radiances from ATMS and MWHS-2, in addition to MHS and AMSU-A. In Danish/Norwegian and AROME-ARCTIC pre-operational introduction of MWHS-2 and ATMS data has started or will happen in near future. This is largely possible thanks to the successful monitoring and assimilation of test data in the special project. The work by us pointing at the importance of an enhanced use of microwave data for Nordic limited-area NWP accepted to be published a scientific paper (<http://www.iapjournals.ac.cn/fileDQKXJZ/journal/article/dqkxjz/newcreate/AAS-2020-0326.pdf>). In addition there has been work on investigating best practices for variational bias correction procedure for satellite data in limited-area data assimilation (<http://www.iapjournals.ac.cn/fileDQKXJZ/journal/article/dqkxjz/newcreate/AAS-2020-0326.pdf>). Also the impact in snow and ice on results has been explored (https://cdn.eventsforce.net/files/ef-xnn67yq56yly/website/21/2_r_randriamampianina.pdf).

During the second half of 2021 and first half of 2022 the work with introducing more information from microwave sensors in the Nordic NWP configurations also focused on utilisation of low-peaking channels from existing instruments. The aim is extended use over land, ice and snow. We started with AMSU-A and MHS instruments and planned to extend to ATMS and MWHS. The dynamical emissivity approach taken is described here:

https://www.umr-cnrm.fr/accord/IMG/pdf/assimilation_of_surface-sensitive_mw_observations_over_land_and_sea-ice_in_harmonie-arome_accord_meeting_asw_-_april2022_2.pdf

and is now applied operationally for AROME-Arctic. Both MetCoOp and Danish/Icelandic NWP systems are planned to be enhanced in a similar way.

In addition to these enhancements in use of data from existing instruments we have managed to prepare our system for use of data from the Arctic Weather Satellite (AWS), planned to be launched in a few years time. This work included reading of a by ESA provided test data file, derivation of RTTOV coefficients and preparations in code for recognising the new satellite and instrument. There is as well up-started work on setting up Observing system Simulation Experiments (OSSEs) for estimating the impact of a constellation of AWS satellites. The AWS work has been asked for by ESA and EUMETSAT and will continue the coming years,

During the last half a year we have as well focused on transferring our modelling system from cca to aa. On aa there has been no billing on computing resources used, which explains our not-existent computing resources used by the project. We however foresee continues experiments as planned and use for these additional computing resources when the billing counting continues.