SPECIAL PROJECT PROGRESS REPORT

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

Reporting year	2019 (Jun-Jun)
Project Title:	Mineral Aerosol Impacts to Sub-seasonal to Seasonal Predictability (MASP)
Computer Project Account:	SPRSNICK
Principal Investigator(s):	Slobodan Nickovic
Affiliation:	RHMSS, Serbia
Name of ECMWF scientist(s) collaborating to the project (if applicable)	N/A
Start date of the project:	01/01/2017
Expected end date:	31/12/2019

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)	5.000.000	34.607	5.000.000	70.000
Data storage capacity	(Gbytes)	12.000	2	12.000	2

Summary of project objectives (10 lines max)

The main objective of this special project is to investigate the impact of aerosol direct and indirect effects on the predictability of a prognostic model at sub-seasonal and seasonal (S2S) scales using the global NMMB model integrated with the dust aerosol model DREAM. The major focus of the project will be examining effects of the aerosol within the period of at least 3 weeks.

Summary of problems encountered(10 lines max)

For the moment, total use of storage and HP computer facilities is less than planned, but in the next period this use will be larger when more model runs will be performed.

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

The major results are addressed to the following achievements:

- we have continued testing the calculation of number of ice nucleating dust particles (#INP) (DeMott et al, 2015; Steinke et al, 2015; Nickovic et al, 2016) - a precondition of cold and mixed phase cloud formation for some specific dust-cloud events.
- This parameterization has been included in the global atmospheric-dust modeling system.
- performing one-month model simulation of #INP (April 2018. The DREAM dust model component had a cold dust start, performing 'warming up' of the concentration field within first 2-3 days of the model run.

Comparison of the model #INP against SEVIRI/MSG observation of Ice Water Path (IWP) has been performed and shown in Figure 1. All the major observed cold cloud patterns have been reasonably well predicted by the NMMB-DREAM model. Figure 2. shows vertical distribution of the Log10 (ice nuclei due to dust) at the vertical section crossing at 50N (red line in Figure 1a).

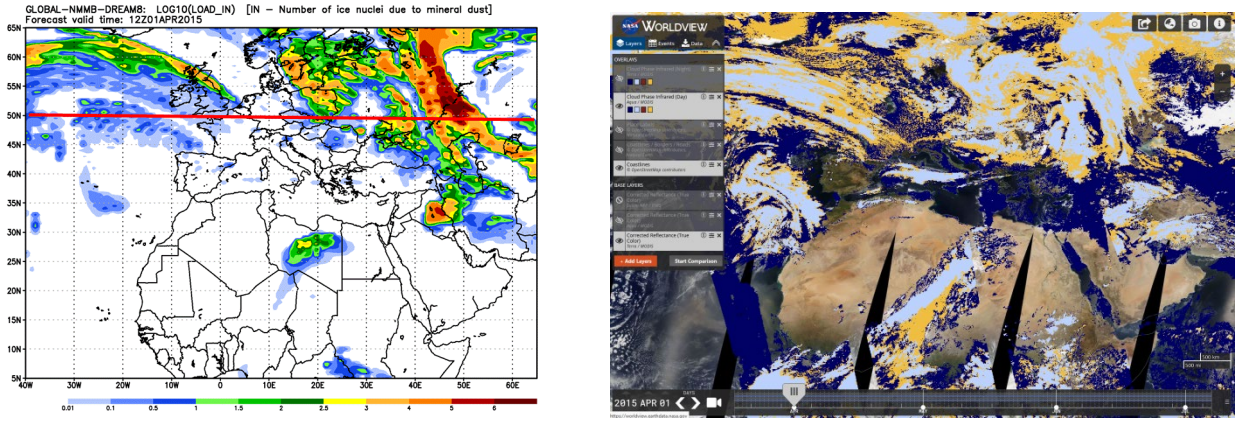

Figure 1. (a) Log10 (vertically integrated ice nuclei due to dust) predicted by the global NMMB-DREAM8 model, valid for 12UTC 1 April 2015. (b) Ice cloud phase as observed by NASA MODIS satellite valid for the same time

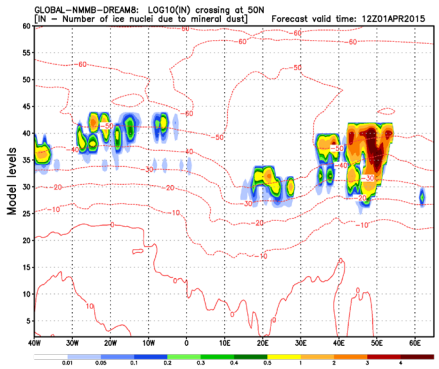

Figure 2. vertical distribution of the Log10 (ice nuclei due to dust) at the vertical section crossing at 50N

List of publications/reports from the project with complete references

DeMott, P. J., Prenni, A. J., McMeeking, G. R., Sullivan, R. C., Petters, M. D., Tobo, Y., Niemand, M., Möhler, O., Snider, J. R., Wang, Z., and Kreidenweis, S. M.: Integrating laboratory and field data to quantify the immersion freezing ice nucleation activity of mineral dust particles, Atmos. Chem. Phys., 15, 393-409, doi:10.5194/acp-15-393-2015, 2015.

Nickovic, S., Cvetkovic, B., Madonna, F., Rosoldi, M., Pejanovic, G., Petkovic, S., and Nikolic, J.: Cloud ice caused by atmospheric mineral dust – Part 1: Parameterization of ice nuclei concentration in the NMME-DREAM model, Atmos. Chem. Phys., 16, 11367-11378, https://doi.org/10.5194/acp-16-11367-2016, 2016.

Steinke, I., Hoose, C., Möhler, O., Connolly, P., and Leisner, T.: A new temperature- and humidity-dependent surface site density approach for deposition ice nucleation, Atmos. Chem. Phys., 15, 3703-3717, doi:10.5194/acp-15-3703-2015, 2015.

Summary of results

If submitted **during the first project year**, please summarisethe 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 major results achieved from the beginning of the project are:

- including wet deposition and improving dry parameterizations in DREAM model
- inputting predicted dust concentration and the corresponding predicted ice nuclei number into the Thompson dust-friendly microphysical cloud scheme in NMMB, providing thus interactive feedback between dust and atmosphere
- coupling NMMB-DRAEM with POM model to replace observed SST with simulated one
- performing sub-seasonal (~month) DREAM-NMMB forecasts with and without interactive dust
- exploring if there is an improved weather predictability signal due to added dust
- continued testing the calculation of number of ice nucleating dust particles (#INP) (DeMott et al, 2015; Steinke et al, 2015; Nickovic et al, 2016) - a precondition of cold and mixed phase cloud formation for some specific dust-cloud events.
- This parameterization has been included in the global atmospheric-dust modeling system.
- performing one-month model simulation of #INP (April 2018. The DREAM dust model component had a cold dust start, performing 'warming up' of the concentration field within first 2-3 days of the model run.

The following tasks are planned for the final project period:

- including wet deposition and improving dry parameterizations in DREAM model
- inputting predicted dust concentration and the corresponding predicted ice nuclei number into the Thompson dust-friendly microphysical cloud scheme in NMMB, providing thus interactive feedback between dust and atmosphere
- performing sub-seasonal (~month) DREAM-NMMB forecasts with and without interactive dust
- exploring if there is an improved weather predictability signal due to added dust