SPECIAL PROJECT PROGRESS REPORT

Progress Reports should be 2 to 10 pages in length, depending on importance of the project. All the following mandatory information needs to be provided.

Reporting year	2018 (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	50.000
Data storage capacity	(Gbytes)	12.000	0	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 and with an ocean model. The major focus of the project will be examining effects of the aerosol within the period from 3 weeks and longer.

Summary of problems encountered (if any)

(20 lines max)

It took our group longer time than predicted to embed the DREAM dust model component into the global NMMB atmospheric model structure. The major problem was to modify the original pre-processing NCEP/NMMB system to the ECMWF computer environment; we finally managed to make the whole NMMB-DREAM functional. For the moment, total use of storage and HP computer facilities is less than planned, but in the next period this use will be substantial larger when extensive final model runs will be performed.

Summary of results of the current year (from July of previous year to June of current year)

The resources allocated for the current year to test have been partly exploited. The major results are addressed to the following achievements:

- finalizing the preprocessing component of the modeling system, with included gridded data for dust modeling such as land cover, clay/silt/sand soil fractions, and dust source areas.
- online coupling the dust DREAM and the global atmospheric NMMB components of the modeling system. Observed fields of SST are currently used.
- Conceptual picture of the integrated dust-atmosphere is shown in Figure 1.
- finalizing and offline testing parameterization of ice nucleation due to dust (DeMott et al, 2015; Steinke et al, 2015; Nickovic et al, 2016) for some specific dust-cloud events in the Mediterranean and validating the model against lidar/cloud radar data (Figure 2)
- performing one-month model run (April 2018), assuming for the time being dust as a passive tracer (not linking it with the cloud physics part of NMMB). The model had a cold dust start, performing 'warming up' of the concentration field within first 2-3 days of the model run. The wet depositing is also not included for the time being, but it will be done in the next project period. The major DREAM dust patterns has been generally well reproduced when compared against the global CAMS dust analysis (Figure 3,4 and 5) and against regional DREAM SDS-WAS prediction; Here, maps for 14 April has been shown when the major dust storm has passed the Crete island bringing extreme surface dust concentrations.

FIGURES

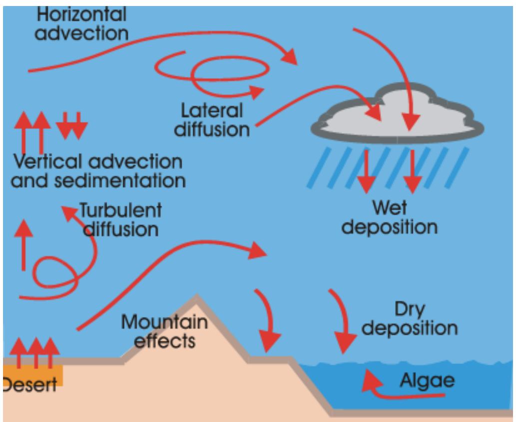


Figure 1. Schematic picture of the components of the atmospheric dust process

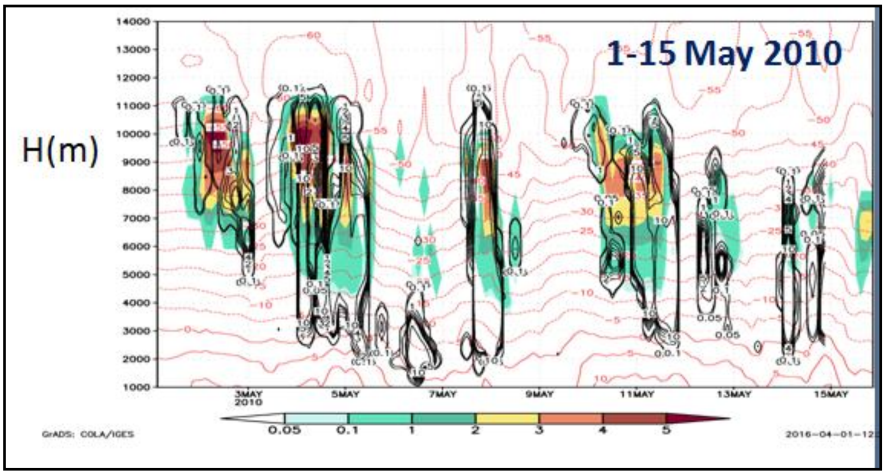
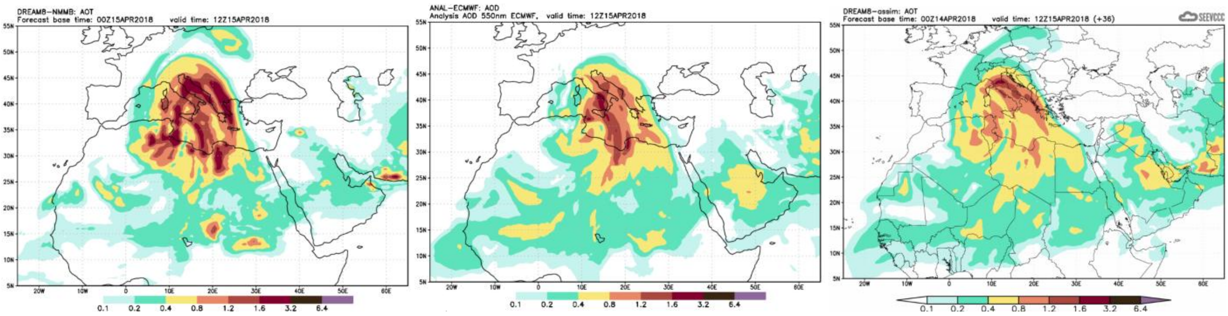
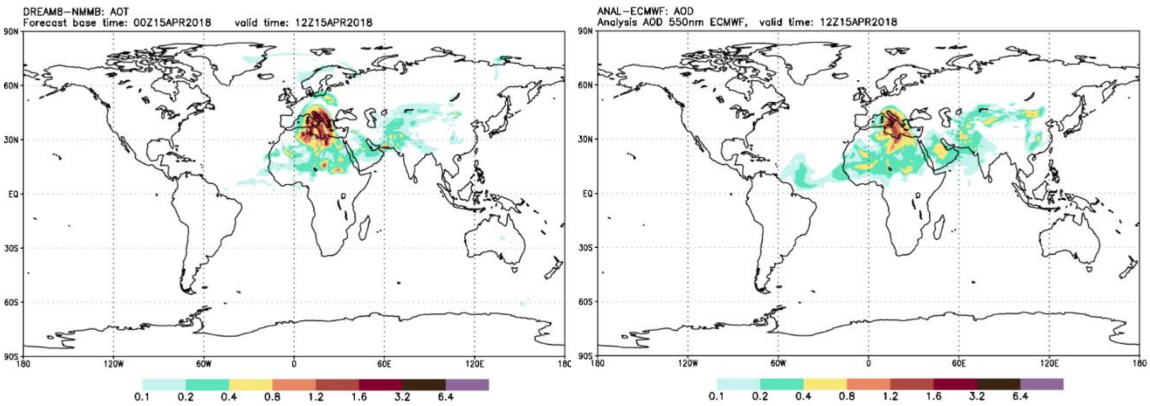


Figure 2. Model parameterization of ice nucleation generated by dust: model validation against the Potenza lidar/cloud radar observation for the period 1-15 May 2010 (Nickovic et al, 2016)



(a) (b) (c)

Figure 3. Dust Aerosol Optical Depth AOD: (a) regional section of the DREAM-NMMB global prediction. (b) global CAMS dust analysis. (c) RHMSS operational regional dust model forecast



(a) (b)

Figure 4. Global view for the 4 April AOD: (a) DREAM-NMMB global run. (b) global CAMS dust analysis.

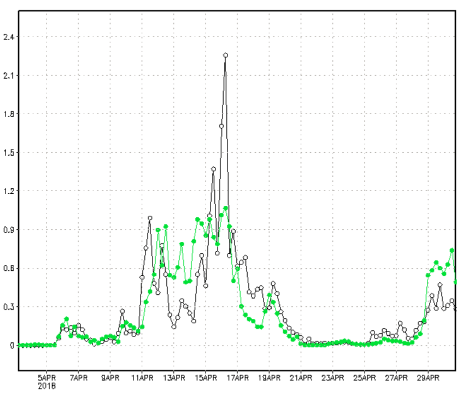


Figure 5. Global time evaluation of AOD at Crete for the period of 1-30 April 2018: model (black), CAMS analysis (green)

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 plans for the continuation of the project

(10 lines max)

The following tasks are planned for the coming 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
- 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