Estimation of Dust Emission from the Western Coastal Plains of Arabian Peninsula

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Introduction

Motivation

1. The Red Sea, bordered by the Sahara and Arabian deserts with little or no river discharge and fast fluvial from land, is highly oligotrophic, especially in the northern part, probably affected by the nutrients coming from the Indian Ocean. The impact of dust on this ecosystem has not been extensively studied.

2. Dust storms in the Western Arabian Peninsula substantially affect densely populated metropolitan areas of Makkah, Madinah, and Jeddah.

3. Satellite images and ground observations show that there is a zone of increased dust activity in the western part of Arabian Peninsula. This coarse dust generation zone may be important for nutrient balance of the Red Sea, as located close to the transition line between the hot and cold ocean currents.

Models and methods

We employ the high-resolution CLM (Community Land Model) (Zender et al., 2002) aerosol module, which includes several model components and has the highest spatial resolution among the available models. We use the estimation of dust emission from the Red Sea using the CLM model.

4. The model is based on the observed dust emission in the Red Sea area and uses the CLM model with a refined spatial resolution.

5. Modal – semi-empirical source function of D()) and the dust emission parameter, D() is the number of active cells in the model, and C1 is the proportion of the total land area of the Red Sea basin.

Results

1. We present the results based on 4 km SAIL simulation and SEVIRI source function that shows the dust emission from the Red Sea area.

2. The spatial pattern of total dust emission in high spatial resolution is considerably different from the CLM model and has a semi-empirical source function.

3. The dust emission parameter is defined based on the seasonal variation of wind direction and the dust emission parameter is closely related to the seasonal variation of wind direction.

4. The dust emission parameter is defined as an intensity function of wind direction.

5. The spatial pattern of total dust emission is compared with the CLM model and the SAIL simulation.

6. The seasonal pattern of dust emission is compared with the CLM model and the SAIL simulation.

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Sensitivity experiments

1. We extend the sensitivity study by Gla et al., 2014, for the following experiments: considering the threshold for the seasonal variation of wind direction.

2. The seasonal pattern of dust emission is compared with the CLM model and the SAIL simulation.

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Conclusions

1. The importance of using high-resolution input surface datasets was demonstrated. The resolution of vegetation datasets was shown to be the most critical factor in determining dust emission from the Red Sea. The resolution of vegetation datasets is shown to be the most critical factor in determining dust emission from the Red Sea.

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