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Role of Aerosol and its distribution over south Asian region

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Introduction

Atmospheric aerosols, being an important climate agent, critically influence regional as well as global climate (IPCC, 2013).

Aerosols of anthropogenic origin are mainly composed of sulphates, carbonaceous particles (black carbon and organic carbon), nitrates, ammonium and mineral dust of industrial origin (Srivastava 2017; Ghan and Schwartz, 2007).

Black carbon, sulfate, and organics play a major role in the solar dimming at the surface.

Introduction

Regional climate models (RCMs) offer useful tools to assess the regional impacts of anthropogenic aerosols because of their relatively high-resolution, their detailed physical parameterizations and their suitable computational cost compared to global climate models (GCMs) and chemistry climate models (CCMs) (Solmon et al., 2007)

In the present work it is investigated **the aerosols over the south Asia during summer and winter seasons.**

Data and Methodology

The **regional climate model RegCM** version 4.3 was used for the aerosol simulations over the south Asia in this study.

RegCM was originally developed at the National Center for Atmospheric Research (NCAR) is maintained in the Earth System Physics (ESP) section of the Abdus Salam International Centre for Theoretical Physics (ICTP), Italy.

The RegCM3/aerosol model is a **coupled model** between RegCM 4.3 and a simplified anthropogenic aerosol model, which **can be used to investigate the aerosol feedback to climate** (Solmon et al., 2006).

In this model version the direct shortwave effects of anthropogenic aerosols are included. The aerosol model includes sulphur dioxide (SO_2), sulphate (SO_4), hydrophobic and hydrophilic carbonaceous particles such as black carbon (BC) and organic carbon (OC).

Data and Methodology

In the present work it is simulated different types of aerosol over the south Asia region and its compare both winter and summer seasons.

Details of the model run are given in the Table.

Table The specifications of the RegCM model run

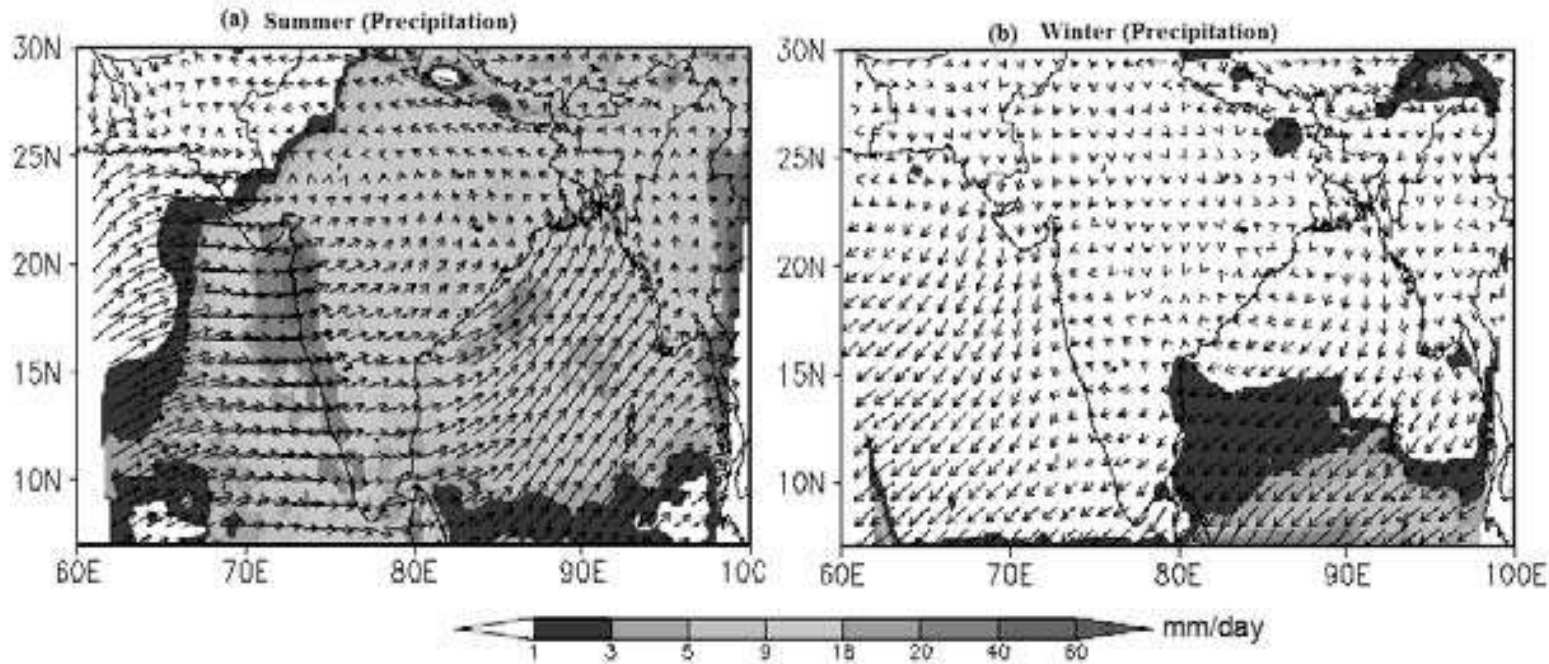
Grid Resolution	60 km
Computational Domain	4320 km x 3300 km
Vertical Level	18
Convection Scheme	Grell
Cumulus Closure Scheme	Fritsch and Chappell
ICBC	ERAINT 6hr data
Aerosol Type	AER11D1
Chemical Control	AERO
Emission Scenario	RCP2.6

Results and Discussions

Aerosol Induced Changes in Precipitation

Anthropogenic and biomass burning aerosols likely induce a reduction in summer monsoon (**JJAS**) rainfall over most parts of the south Asia region, like western Ghat of India and northeastern part of Bangladesh as well as southern part of Nepal and wind also blowing southwesterly over this region as shown in Fig. (a).

Winter (**DJF**) precipitation is not much change over northeastern part of India by the aerosol. Wind is also blowing from northeastern side over this region in winter as shown in Fig. (b).

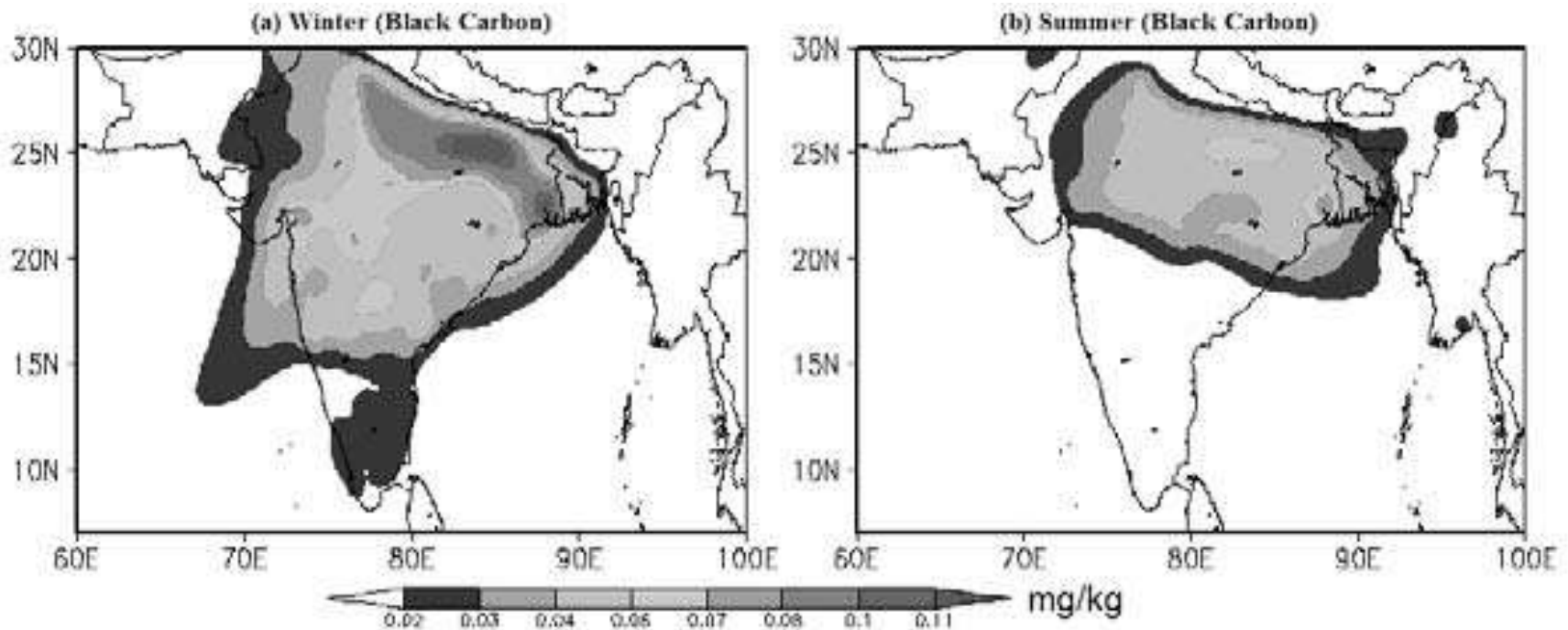


Spatial distribution of precipitation with wind (a) Summer and (b) winter

Comparison of Black Carbon Between Winter and Summer Seasons

From the Fig. (a), it is seen that black carbon is high over northeastern part of India and others region of India is low including western part of Bangladesh during winter.

It is observed that black carbon is **low over India and Bangladesh (Fig. b) during summer monsoon.**

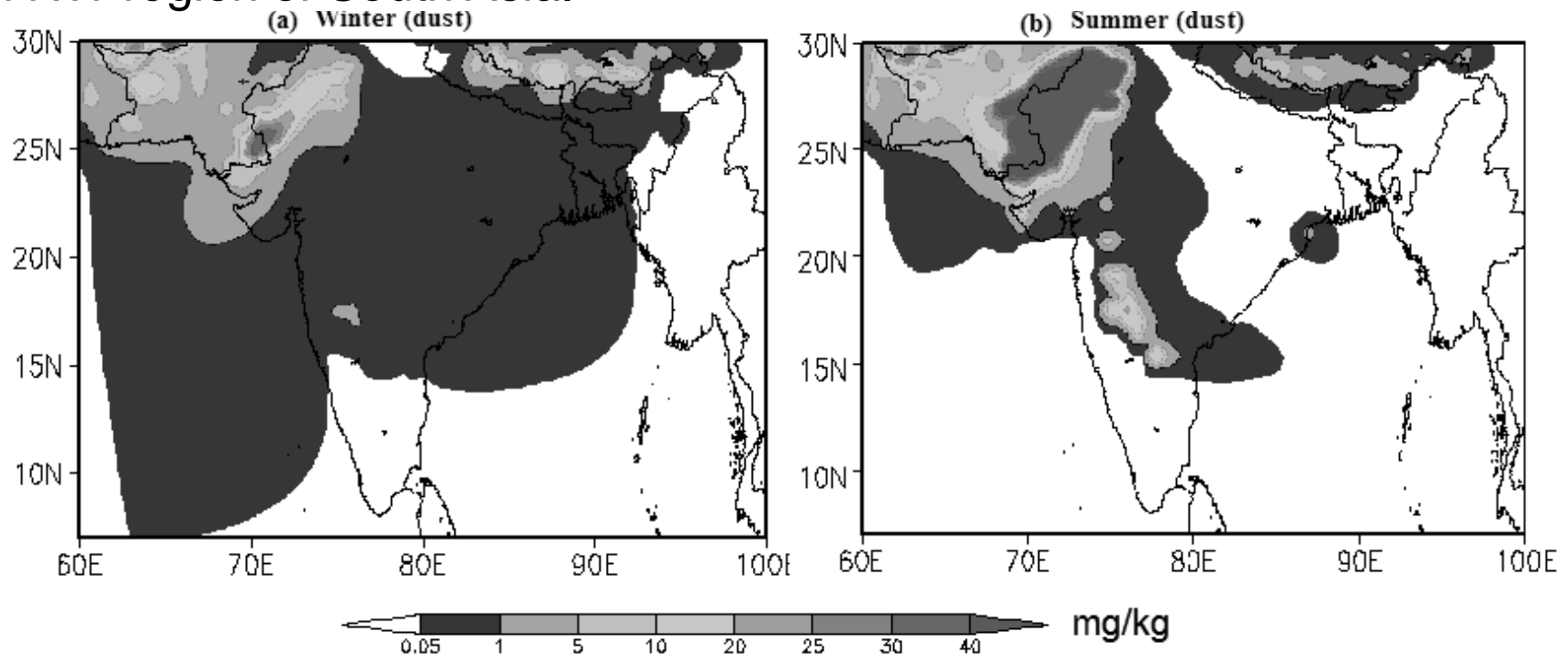


Comparison of dust between winter and summer seasons

Dust particle shows **high over Pakistan and northwestern (NW) part of India** and **low shows over Bangladesh and India** in winter season in Fig. a.

In summer, Dust particle shows **high over northwestern part of India** as shown in Fig. (b).

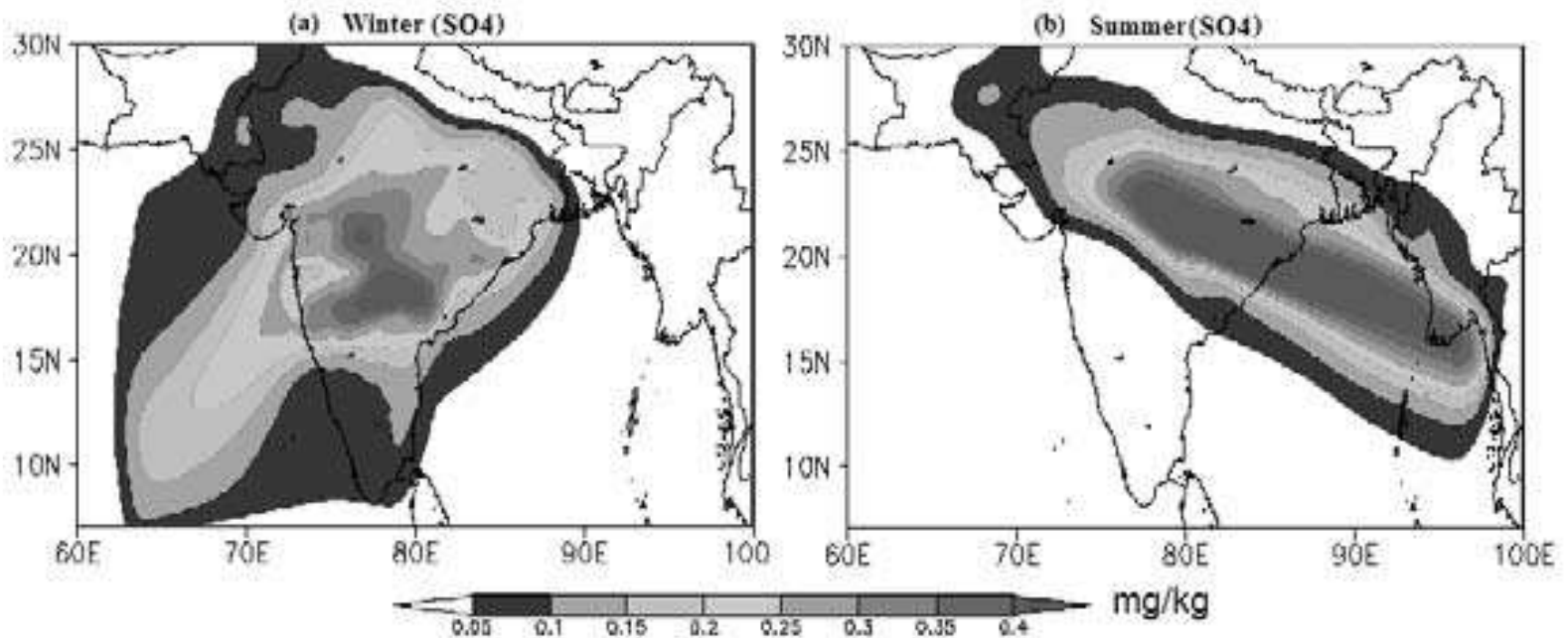
According to model result, dust is dominating in both the seasons and higher in NW region of South Asia.



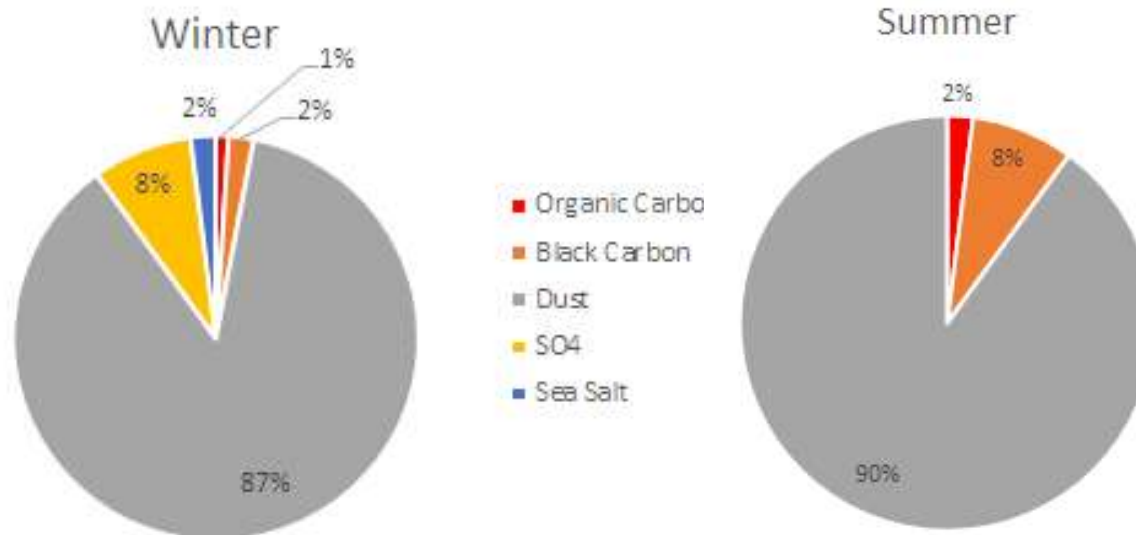
Comparison of sulphate (SO_4) between winter and summer seasons

It is observed that sulphate shows higher over India in winter season but other regions is almost zero over the South Asia.

Similarly, sulphate shows higher over central part of India and Bay of Bengal in summer season but other regions is zero over the South Asia region as shown in Fig.



Concentration of various type of aerosol



It is found that in winter season, **black carbon**, **organic carbon**, **dust**, SO₄ and sea salt by **2%**, **1%**, **87%**, **8%** and **2%** respectively.

In summer season, **black carbon**, **organic carbon** and **dust** by **8%**, **2%** and **90%** respectively.

Dust is the main source of aerosol during both summer and winter. But in winter season, other aerosol particles are more than summer except sea salt.

Conclusions

The model well simulated precipitation and wind during both summer and winter seasons.

South Asian summer season has more aerosols than winter.

According to model result, dust is dominating in both the seasons and higher in NW area of South Asia.

Sulphate (SO_4) is present in almost all areas over India during winter season whereas sulphate is more intense in summer season over India and Bay of Bengal.

Acknowledgements

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Thank you very much
For your kind attention