



*Supplement of*

## **Impact of dust size parameterizations on aerosol burden and radiative forcing in RegCM4**

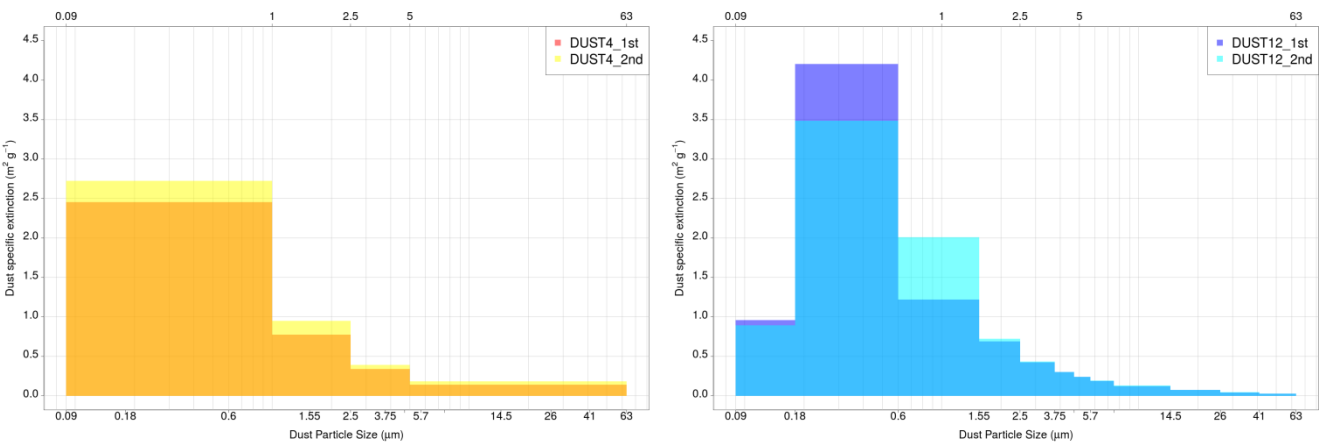
**Athanasios Tsikerdekis et al.**

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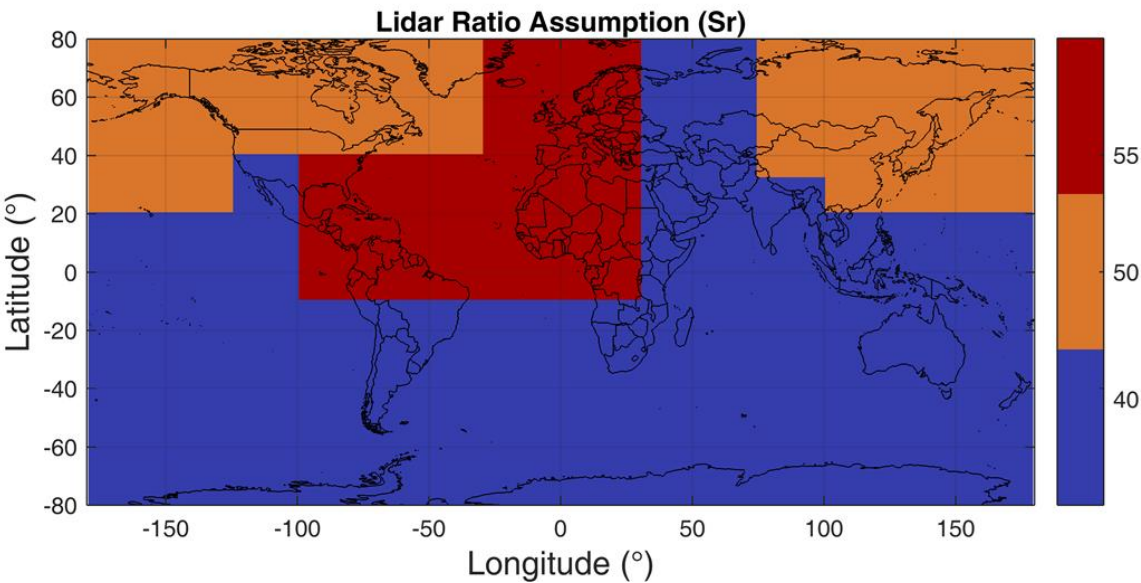
2 Material and Methods

2.1 RegCM4



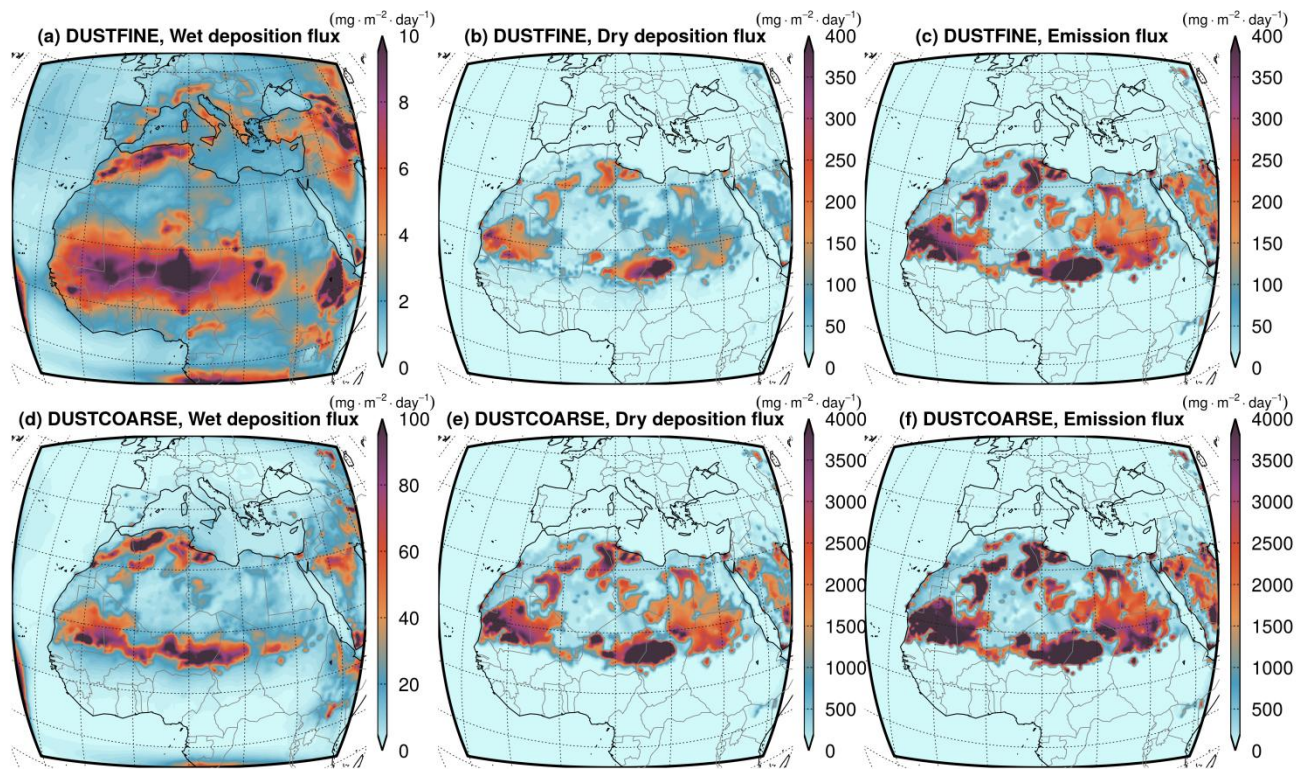
FigureS 1: Dust bin specific coefficient for 4 and 12 dust size bins. The first 1st method uses as effective particle radius the mean diameter of each size bin in order to calculate the extinction coefficient, while the 2nd method calculates the extinction coefficient for multiple radii within the range of each size bin and average them in the end.

2.2 LIVAS

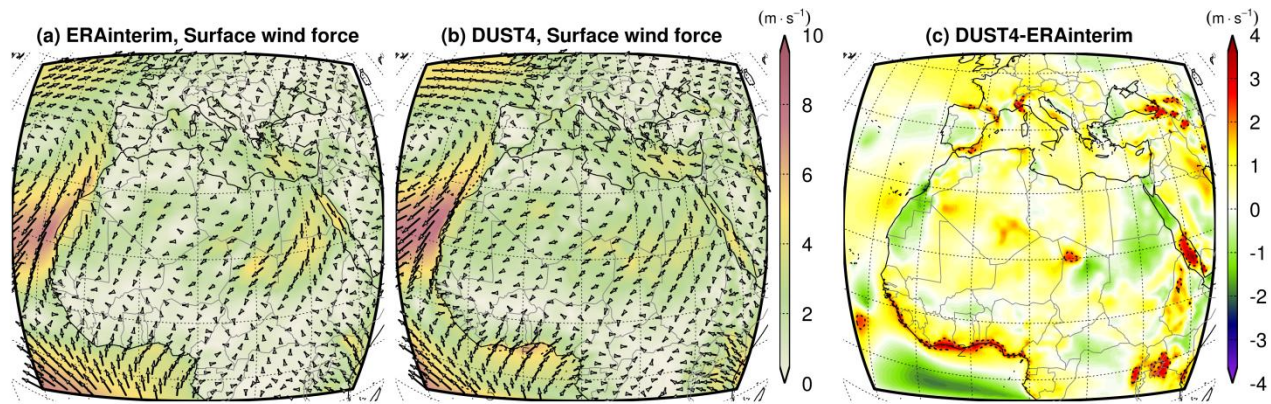


FigureS 2: The region specific Lidar Ratio assumption used in LIVAS.

3 Results and Discussion3.1 Evaluation

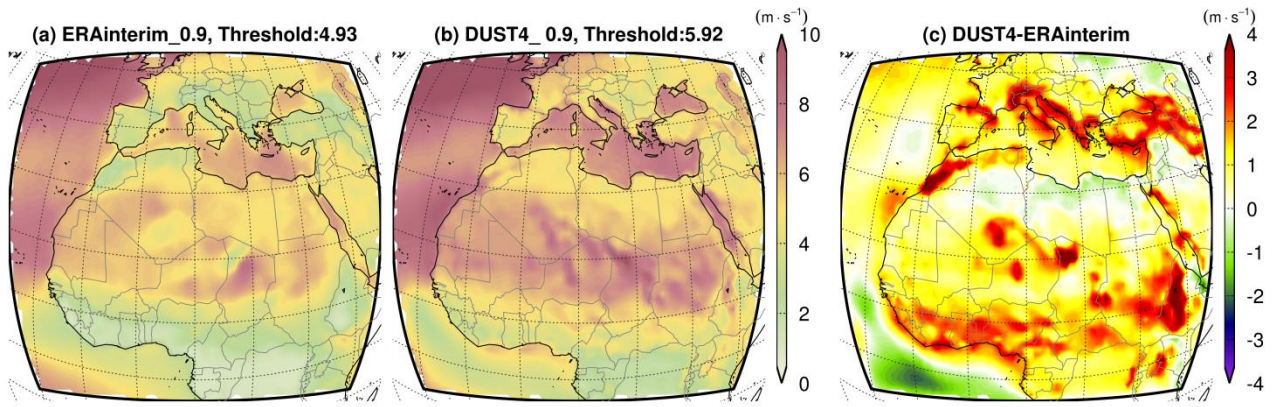


FigureS 3: Wet deposition, dry deposition and surface emission fluxes of fine (a, b, c) and coarse (d, e, f) dust particles in DUST4 experiment for the period December 2006 to November 2014.

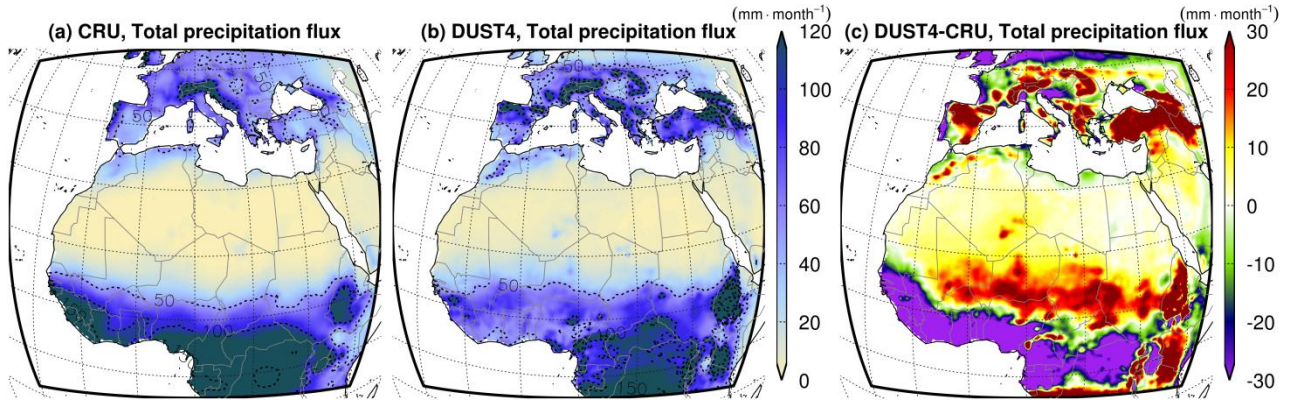


FigureS 4: Wind velocity at the surface of DUST4 experiment against the reanalysis ERA-interim for the period December 2006 to November 2014.

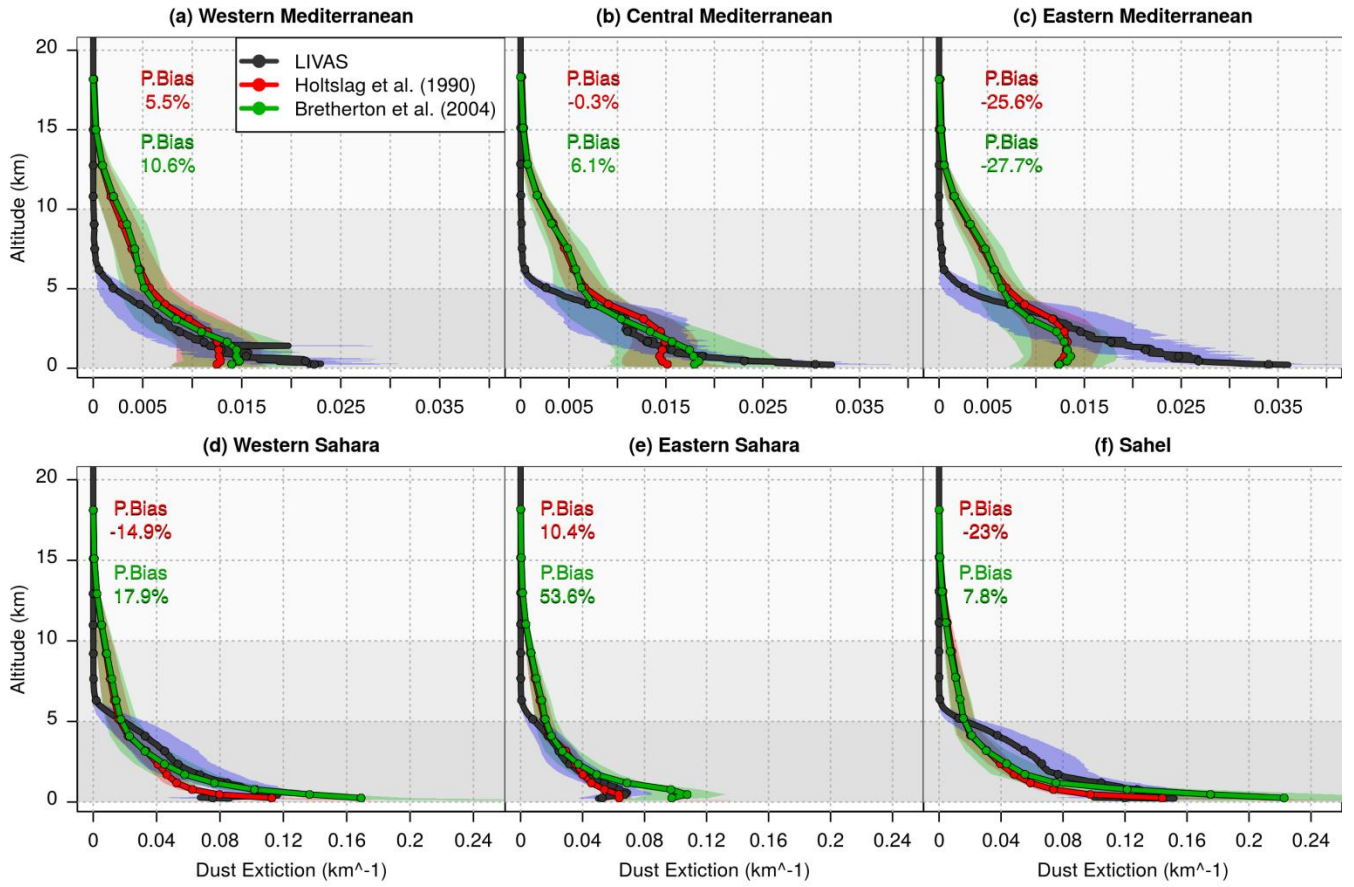




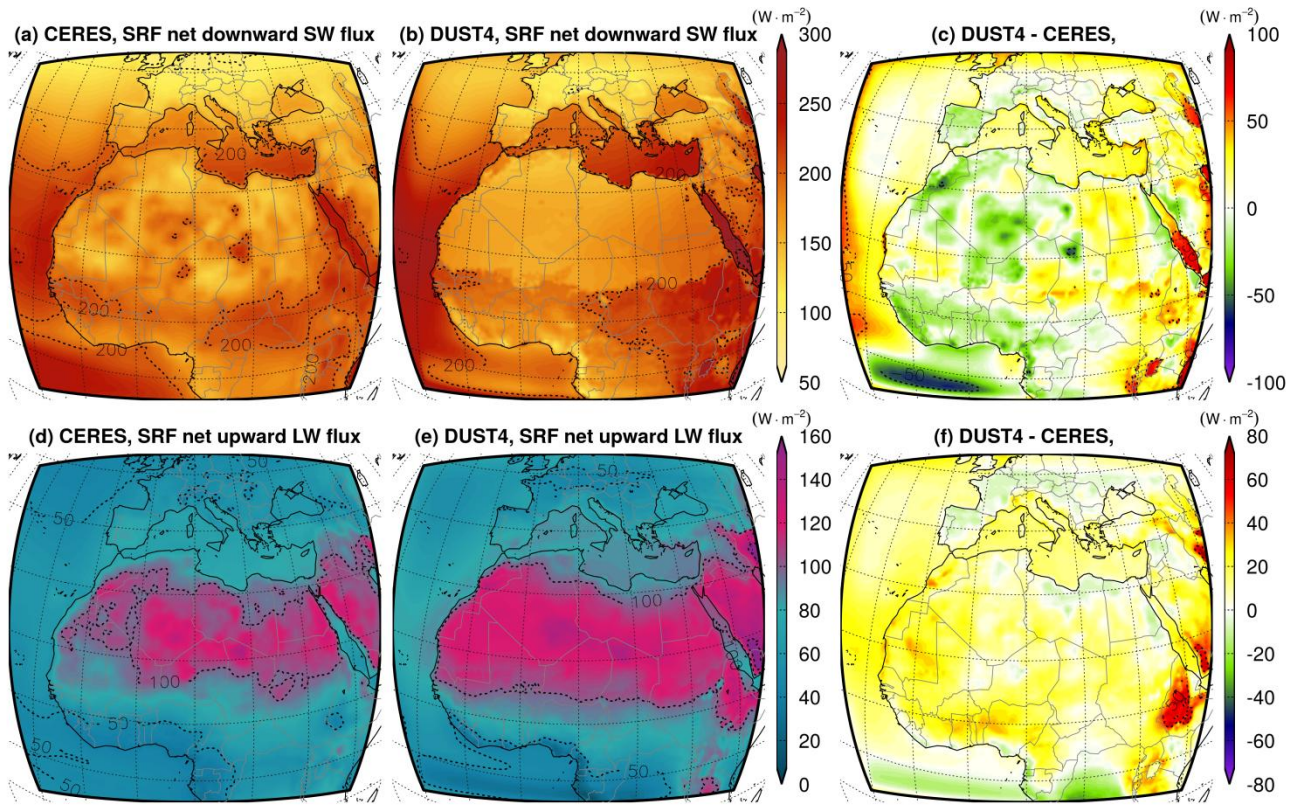
FigureS 5: Wind velocity at the surface of the 0.9 percentile over the desert for the period December 2006 to November 2014.



FigureS 6: Total precipitation flux of DUST4 experiment against the reanalysis ERA-interim for the period December 2006 to November 2014.



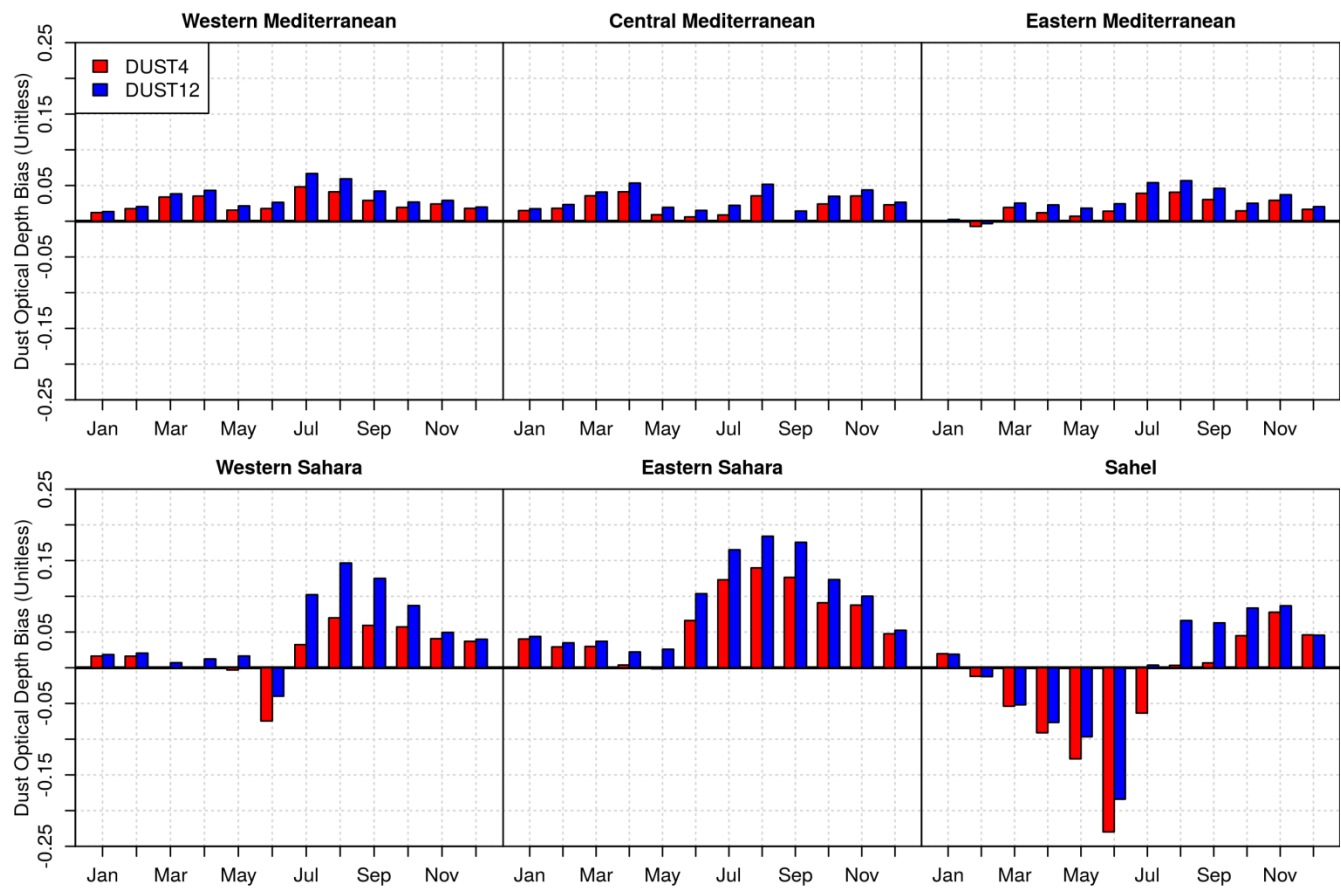
**FigureS 7: Dust extinction profiles of LIVAS and DUST4 using Holtslag et al. (1990) and Bretherton et al. (2004) PBL schemes for 2008. P.Bias indicates the column percentage bias of DEX.**



**FigureS 8:** Net shortwave downward (a, b, c) and net longwave upward flux (d, e, f) in the surface of CERES and DUST4 experiment for the period December 2006 to November 2014.

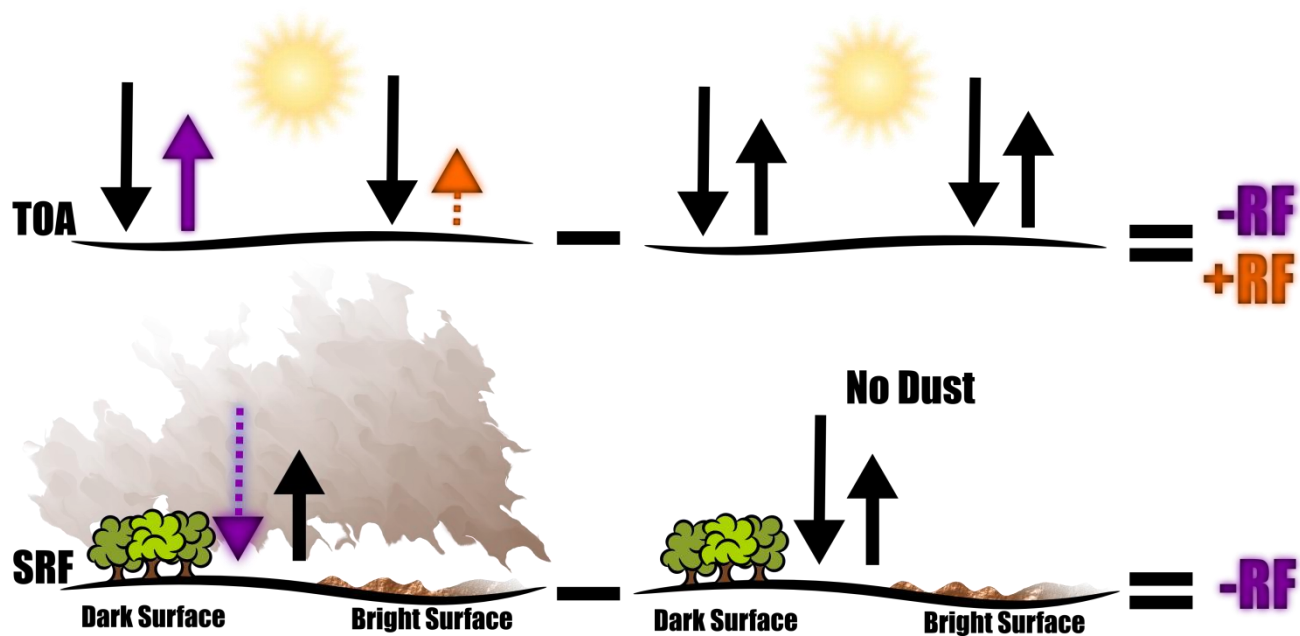


3.2 Comparison of 4-bin and 12-bin experiments



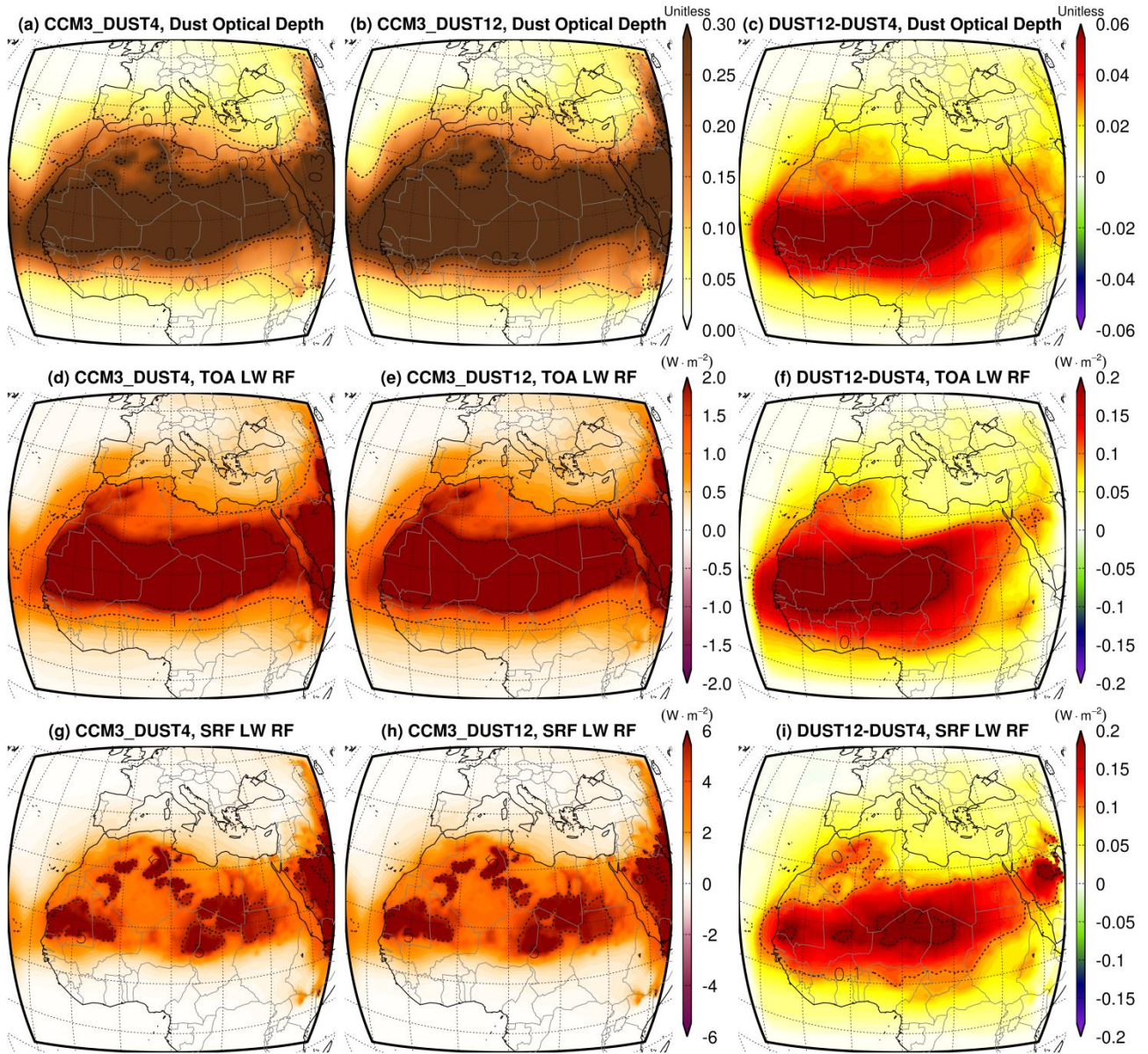
Figures 9: Monthly biases of DUST4 and DUST12 experiment in comparison to the LIVAS dust product for the period December 2006 to November 2014.

3.3 Radiative Forcing



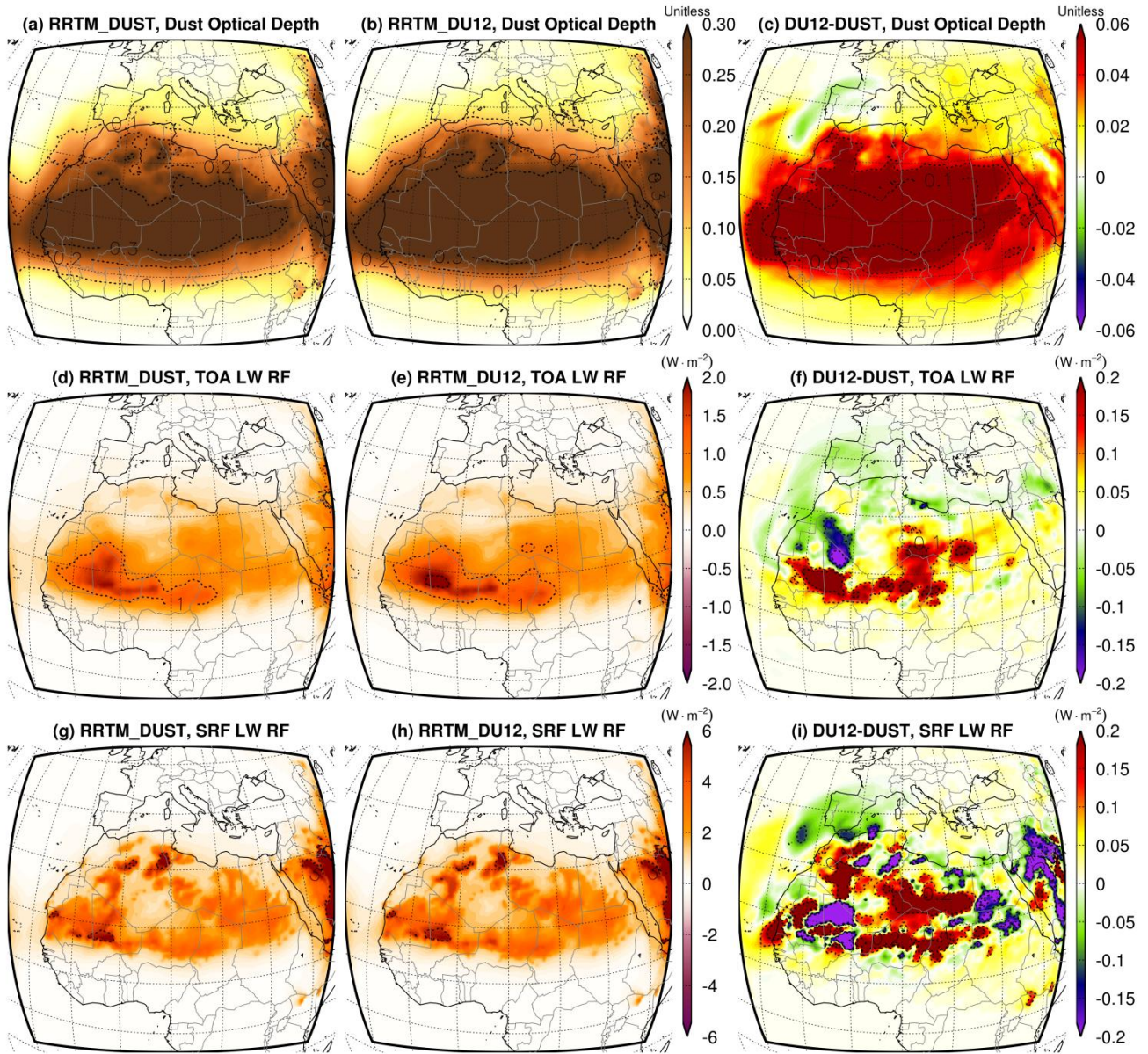
FigureS 10: Illustration of shortwave radiative forcing of dust at the surface and at the top of the atmosphere. Left and right panel depicts a dust loaded and a dust free atmosphere respectively. Arrows indicate the downward and upward radiation. The purple and the orange color correspond to a negative and positive radiative effect of dust particles respectively.





**FigureS 11: Dust optical depth, top of the atmosphere (TOA) and surface (SRF) radiative forcing on the longwave spectrum using the Community Climate Model 3 (CCM3) radiation transfer scheme for June 2008.**





**FigureS 12: Dust optical depth, top of the atmosphere (TOA) and surface (SRF) radiative forcing on the longwave spectrum using as radiation transfer scheme the Rapid Radiation Transfer Model (RRTM) for June 2008.**