



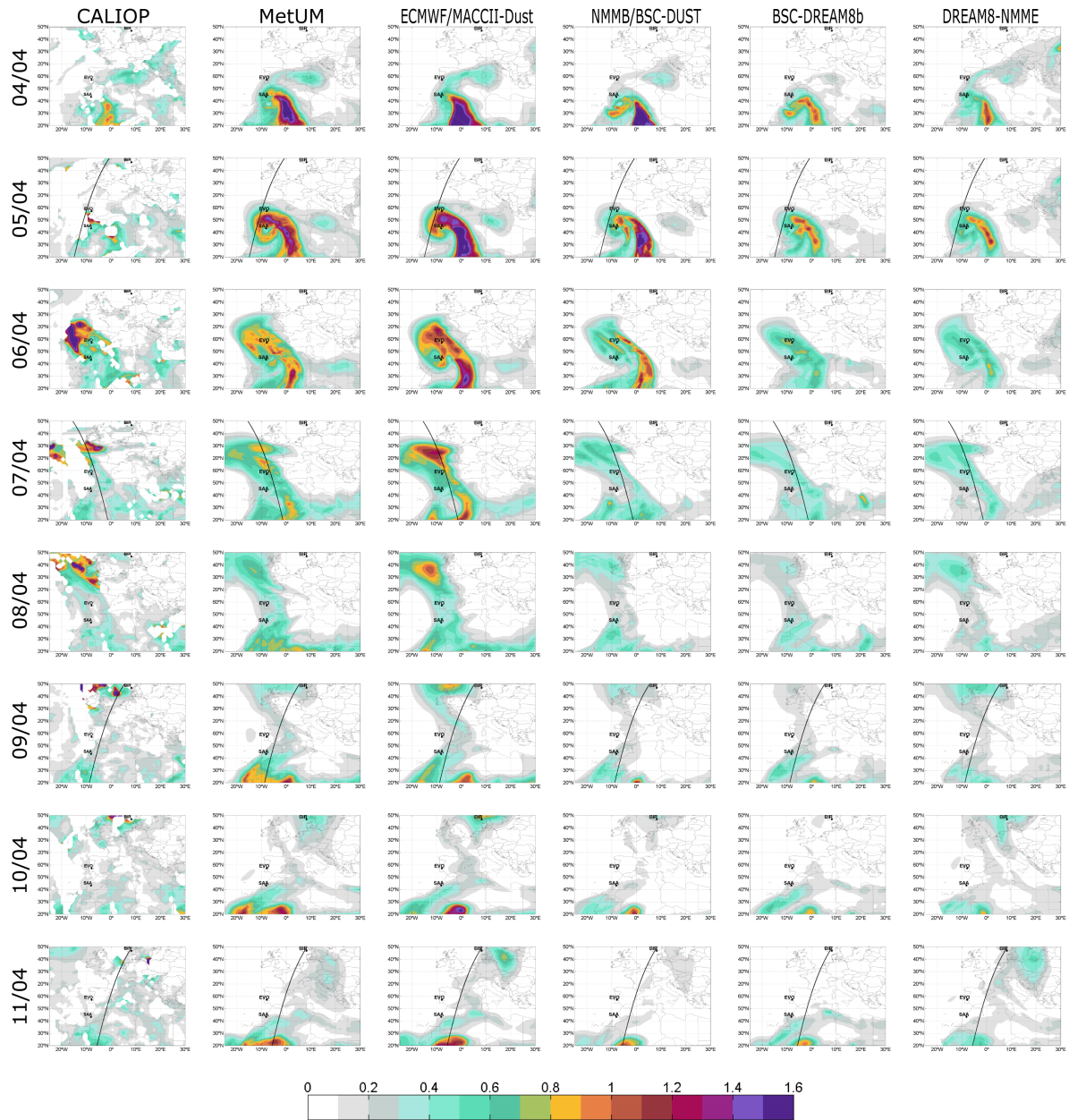
*Supplement of*

## **Forecasting the North African dust outbreak towards Europe in April 2011: a model intercomparison**

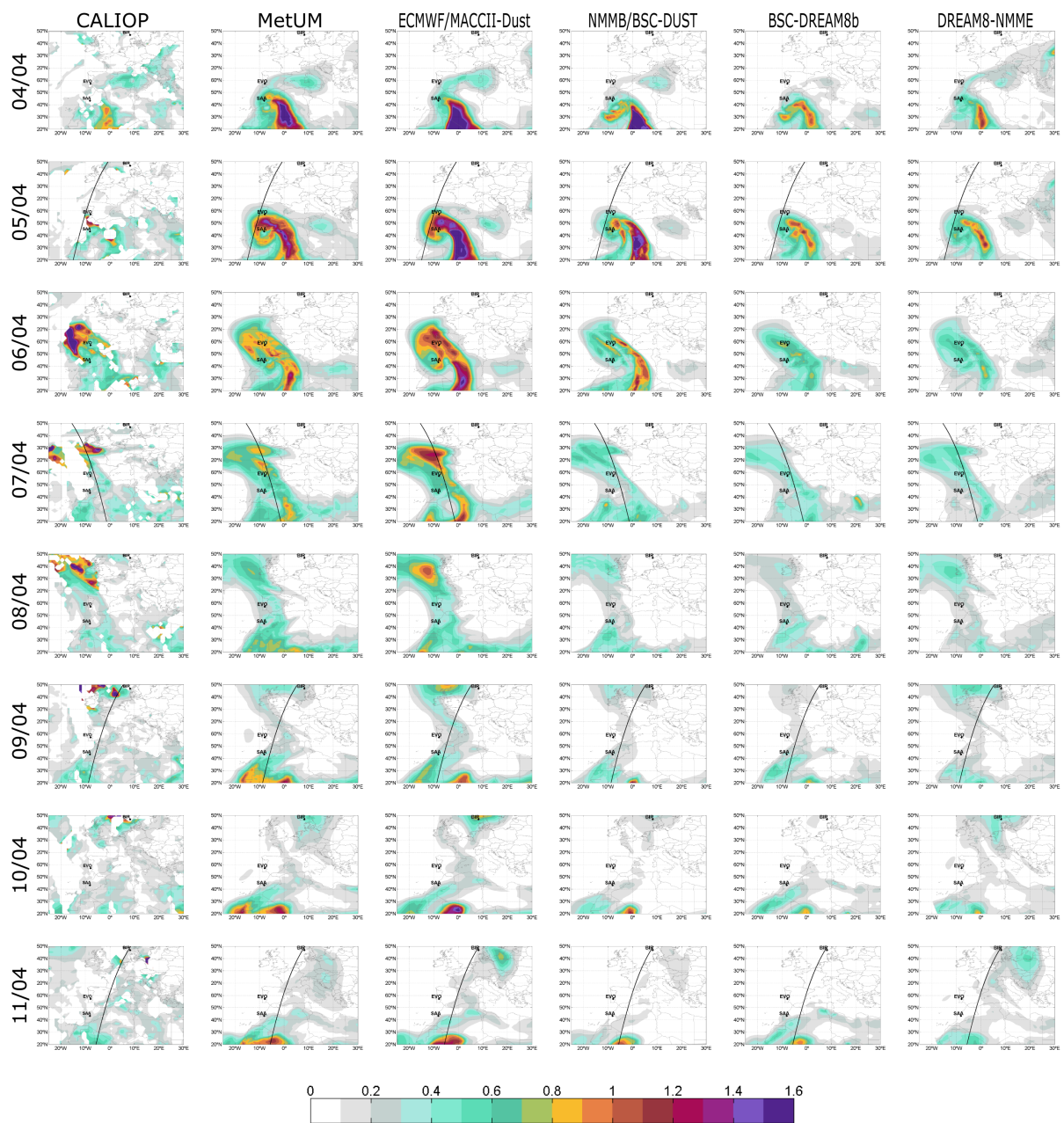
**N. Huneeus et al.**

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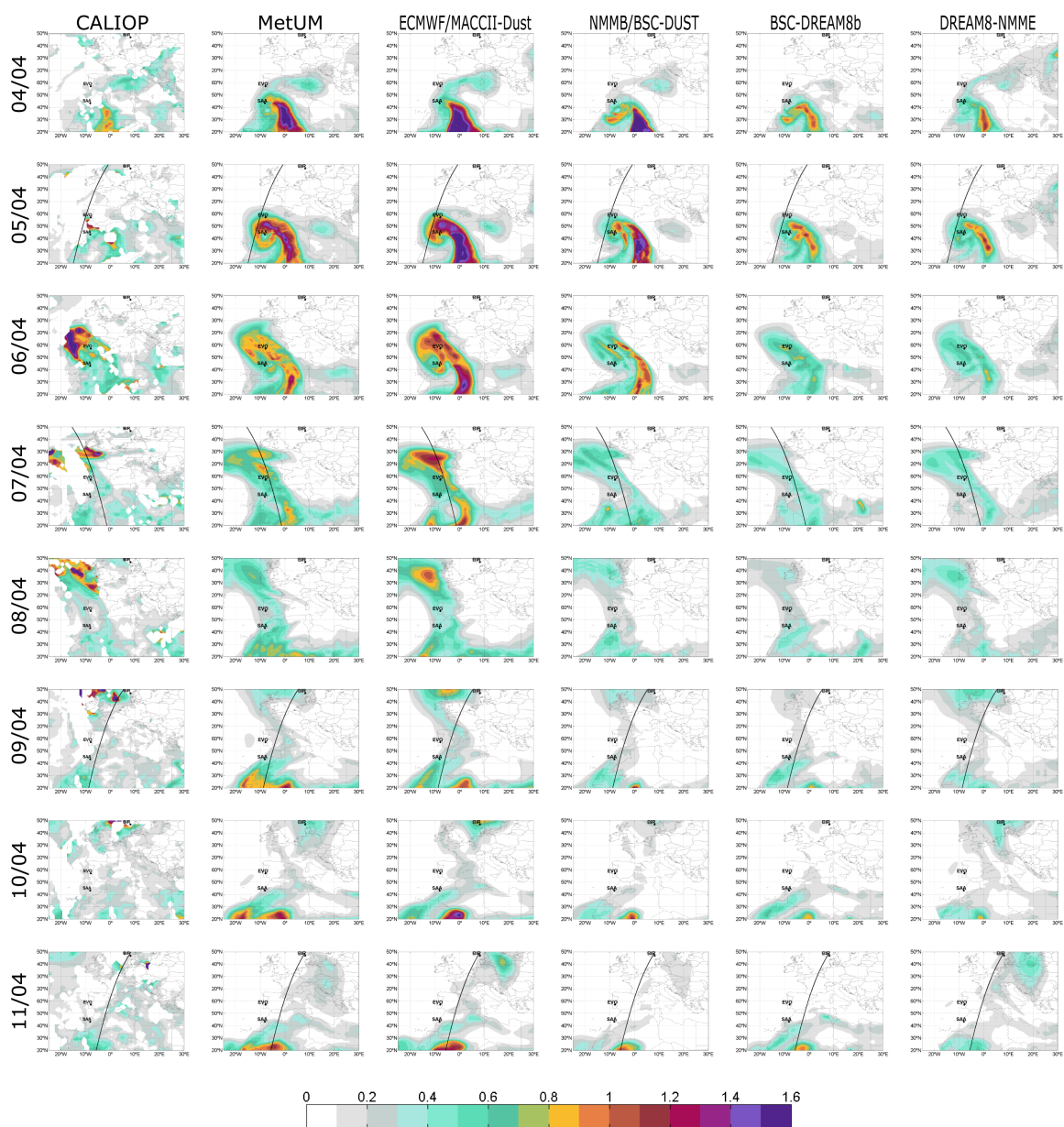
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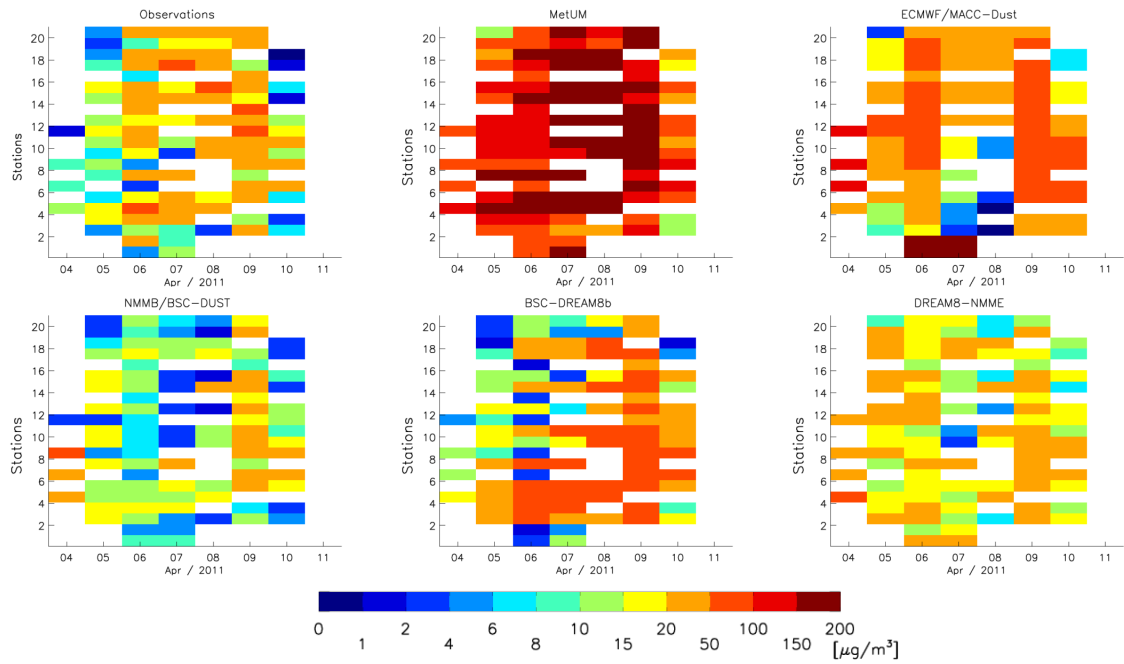
**Figure S01:** Maps of daily total AOD at 550 nm from MODIS and corresponding 24-hour forecast of models MetUM (second column), ECMWF/MACC (third column), NMMB/BSC-DUST (fourth column), BSC-DREAM8b (fifth column) and DREAM8-NMME (sixth column) for each day between the 4<sup>th</sup> and 11<sup>th</sup> of April 2011. Black lines indicate the overpass trajectories of CALIPSO.



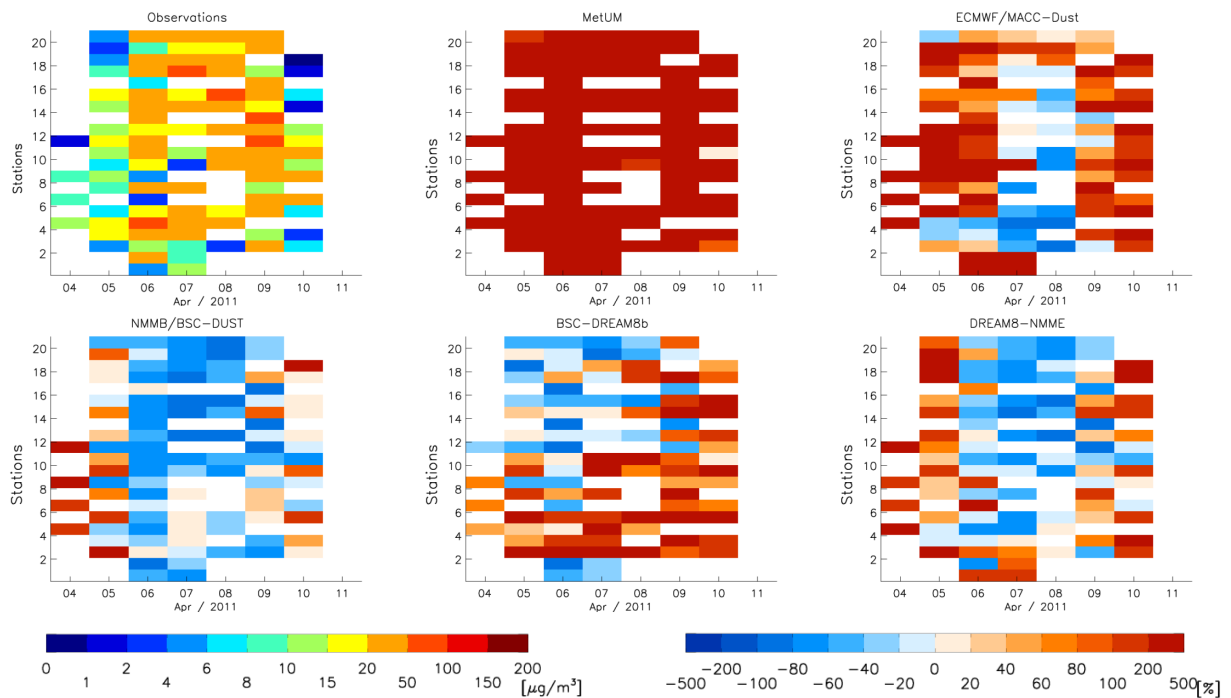
**Figure S02:** Same as Figure S01 but for 48-hour Forecast.



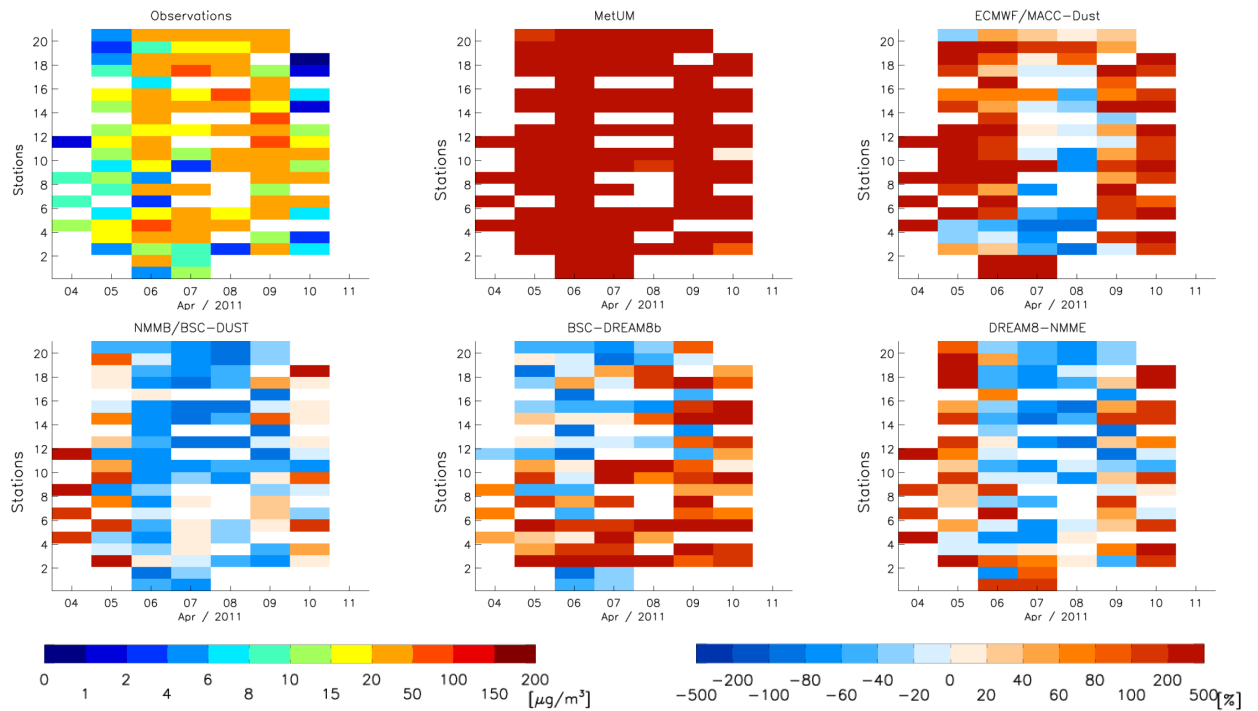
**Figure S03:** Same as Figure S01 but for 72-hour Forecast.



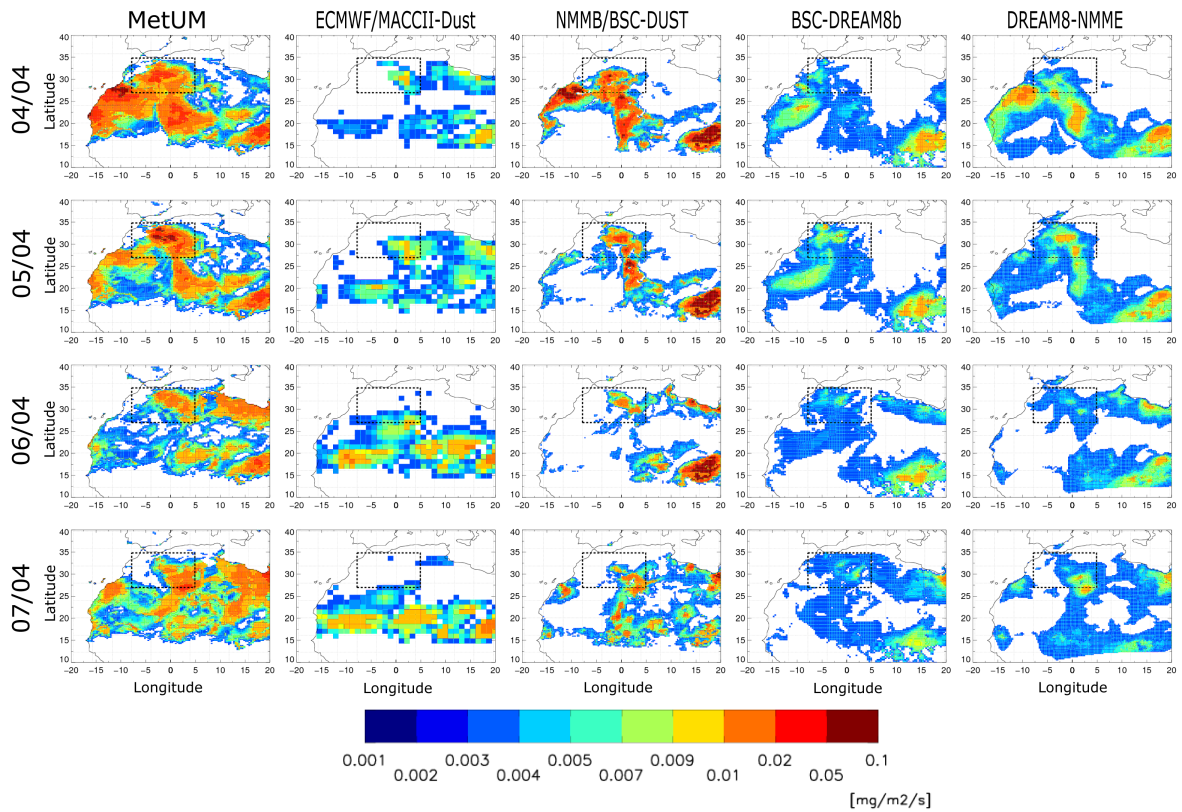
**Figure S04:** Daily measured surface concentration [ $\mu\text{g m}^{-3}$ ] and corresponding 24 hour forecast surface concentration [%] at stations illustrated in Figure 1. Each row corresponds to one of the stations. Stations are ordered from south to north and white colour corresponds to days without measurements.



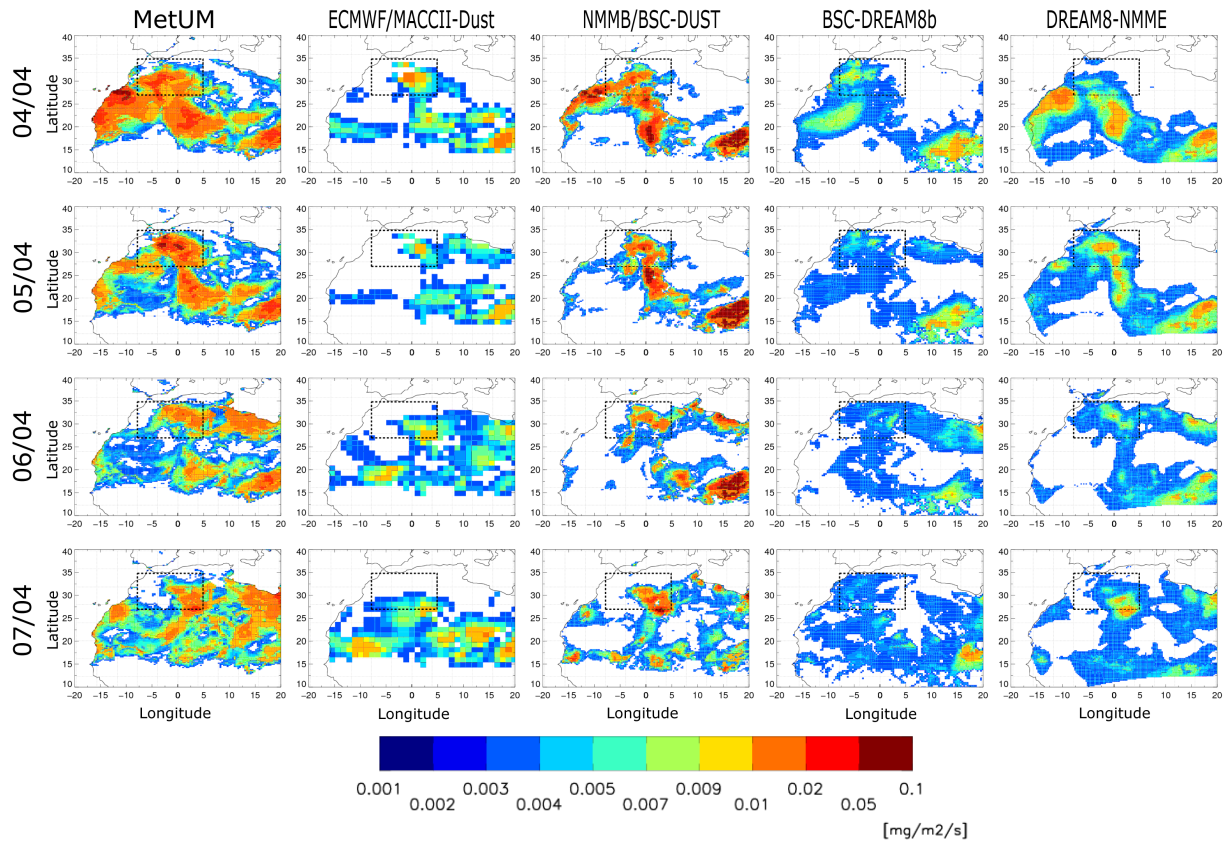
**Figure S05:** Daily measured surface concentration [ $\mu\text{g m}^{-3}$ ] and normalized bias of corresponding 48 hour forecast surface concentration [%] at stations illustrated in Figure 1. Each row corresponds to one of the stations and the row for each station corresponds to the number presented in Fig. 1. Stations are ordered from south to north and white colour corresponds to days without measurements.



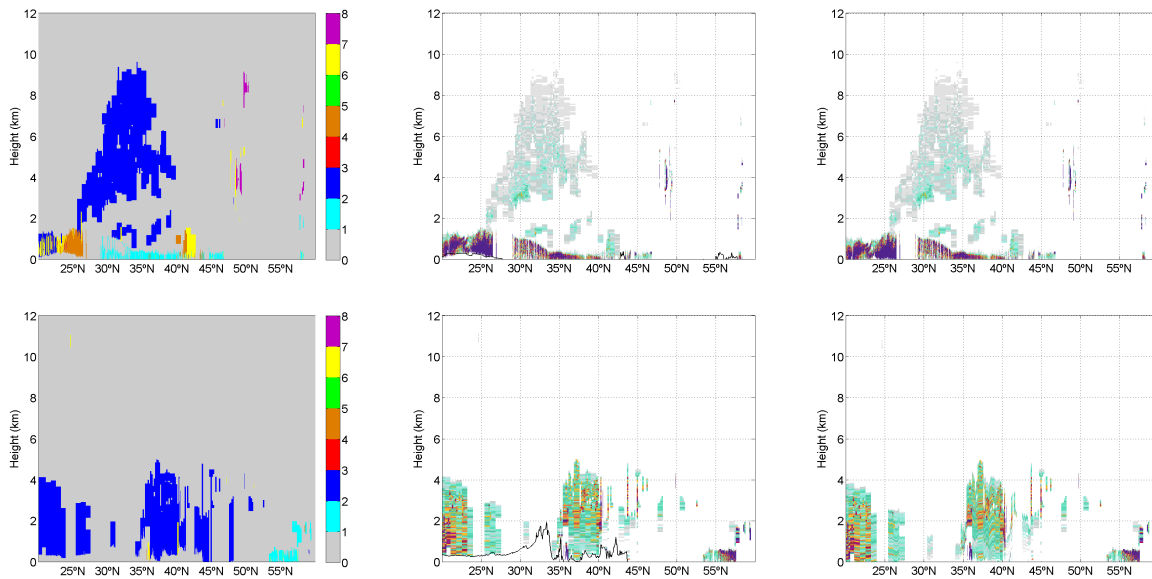
**Figure S06:** Same as Figure S05 but for 72-hour forecast



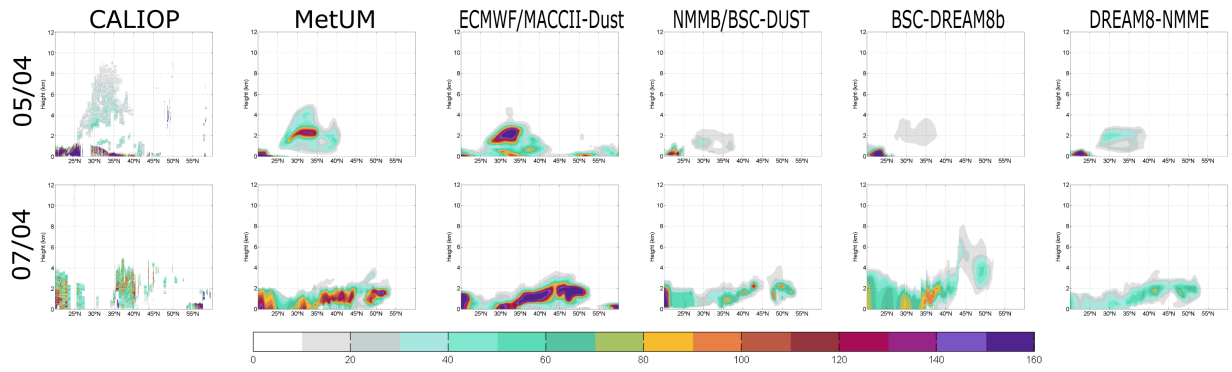
**Figure S07:** Average of forecasted daily emission with 48-hour lead-time for the models MetUM (first column), ECMWF/MACC (second column), NMMB/BSC-DUST (fourth column), BSC-DREAM8b (fifth column) and DREAM8-NMME (sixth column). Dashed box illustrates region used in the time series emissions illustrated in Figure 6.



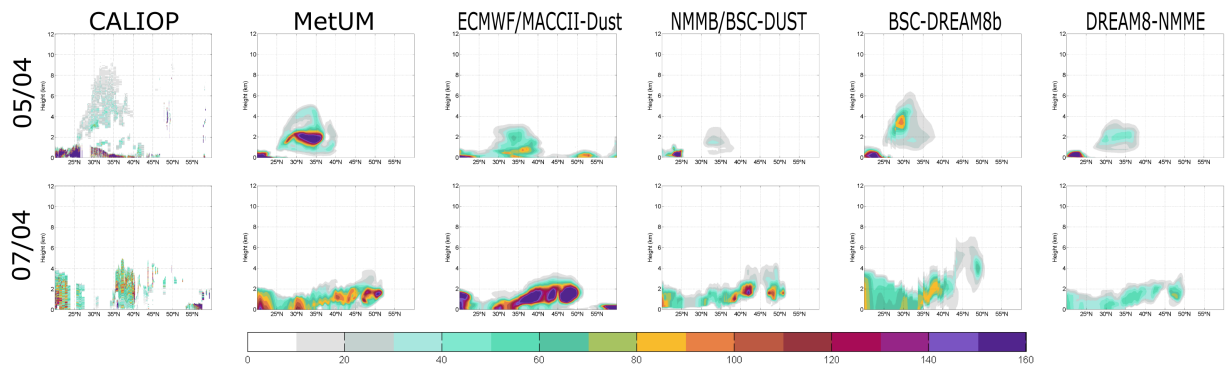
**Figure S08:** Same as Figure S07 but for 72-hour forecast.



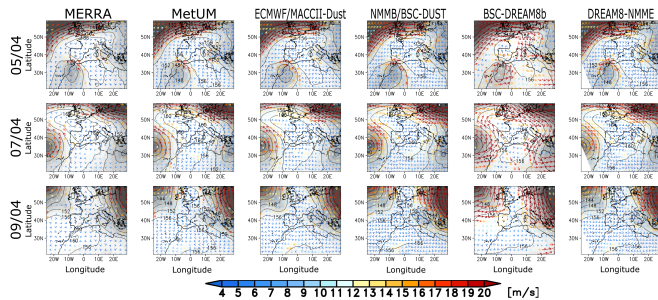
**Figure S09:** Profiles of CALIOP Vertical Feature Mask product (left panels) and total extinction coefficient at 532 nm (right panels) for 5th April at 2:41UTC (first row) and 7th April at 13:09UTC (second row). Central panels correspond to total extinction coefficient at 532 nm above sea level and right panel correspond to total extinction coefficient at 532 nm above surface level.



**Figure S10:** Profiles of measured extinction coefficient at 532 nm from the CALIOP instrument onboard of the CALIPSO satellite (first column) and 48-hour forecasted extinction coefficient profiles at 532 nm from models MetUM<sup>TM</sup> (second column), ECMWF/MACC (third column), NMMB/BSC-DUST (fourth column), BSC-DREAM8b (fifth column) and DREAM8-NMME (sixth column). Conditions are presented for the 5<sup>th</sup> (upper row) and 7<sup>th</sup> (lower row) of April. Overpass of the satellite in each case is illustrated in Figure S01.

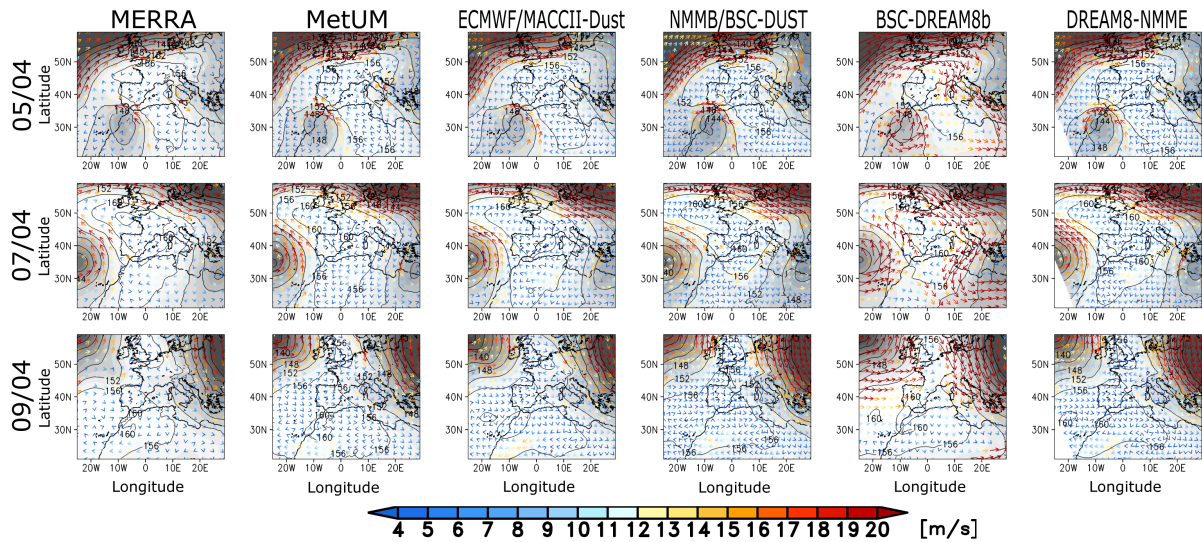


**Figure S11:** Same as Figure S09 but for 72-hour forecast.

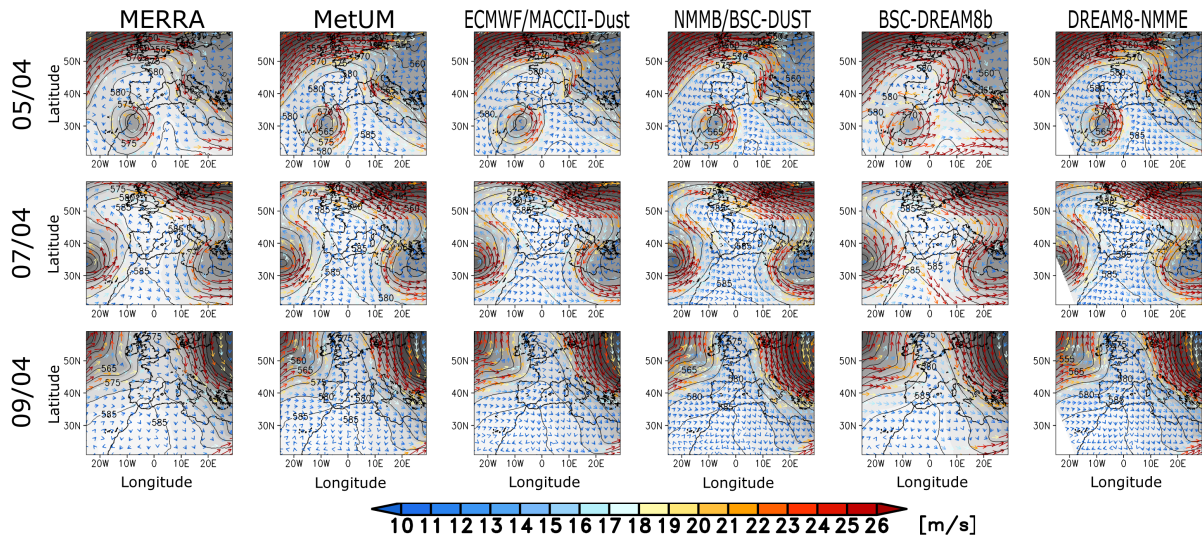


**Figure S12:** The geopotential height (contours) and wind speed stream lines at 850 hPa on 5<sup>th</sup> (first row), 7<sup>th</sup> (second row) and 9<sup>th</sup> (third row) of April 2011 at 12 UTC from MERRA reanalysis and the 48 hour forecast from MetUM, ECMWF/MACC, NMMB/BSC-DUST, BSC-DREAM8b and DREAM8-NMME (from left to right).

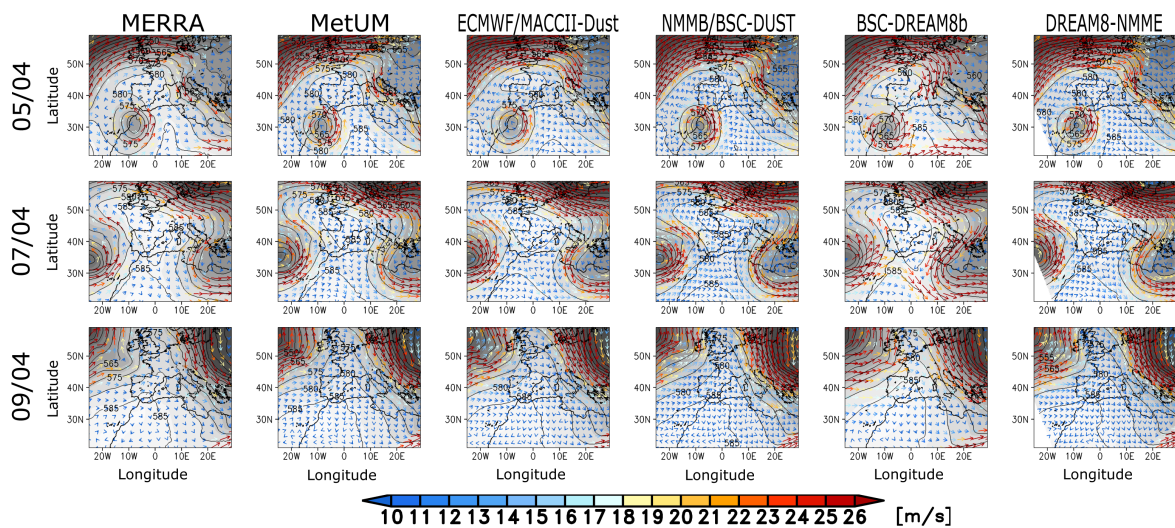




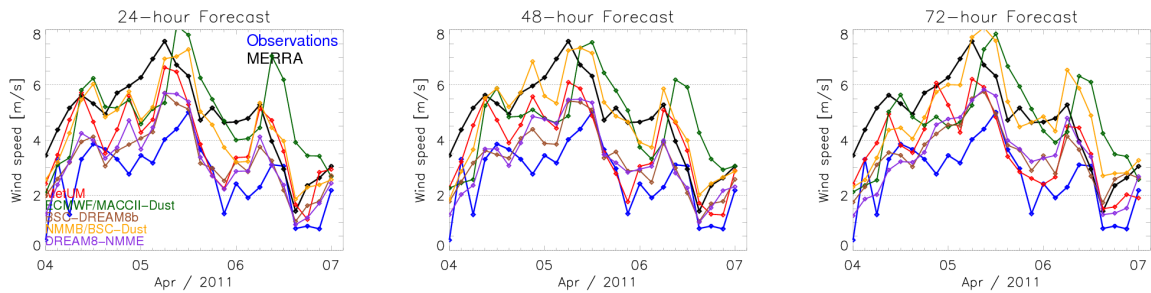
**Figure S13:** Same as Figure S12 but for 72 hour forecast.



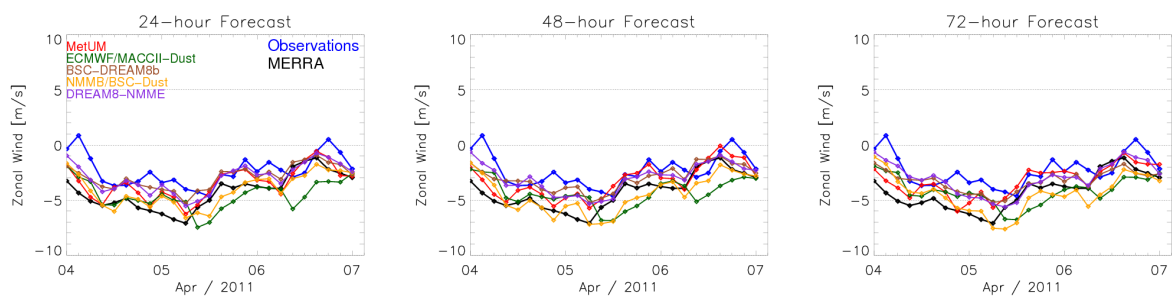
**Figure S14:** The geopotential height (contours) and wind speed stream lines at 500 hPa on 5<sup>th</sup> (first row), 7<sup>th</sup> (second row) and 9<sup>th</sup> (third row) of April 2011 at 12 UTC from MERRA reanalysis and the 48 hour forecast from MetUM, ECMWF/MACC, NMMB/BSC-DUST, BSC-DREAM8b and DREAM8-NMME (from left to right).



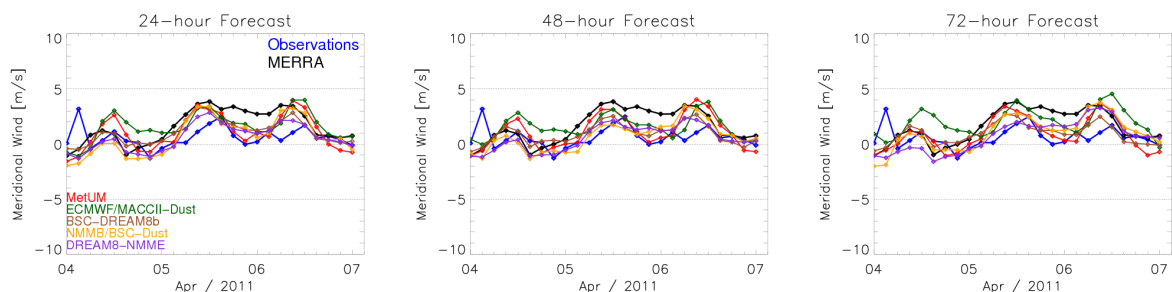
**Figure S15:** Same as Figure S14 but for 72 hour forecast.



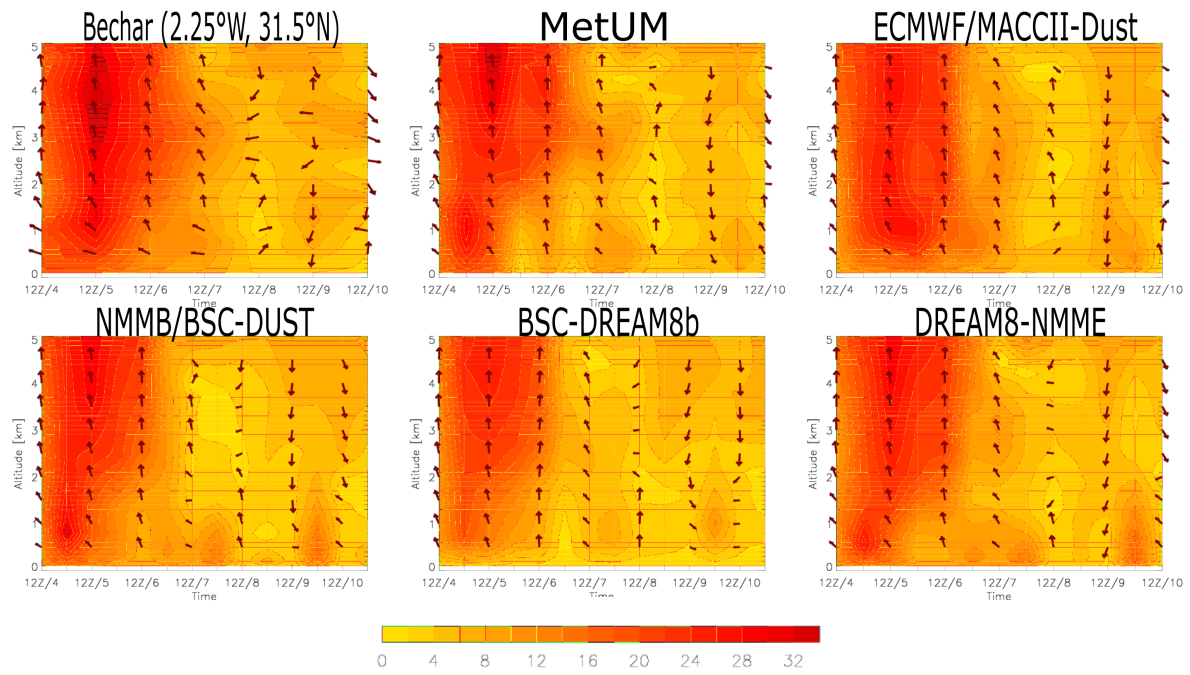
**Figure S16:** Observed (blue) three-hourly wind speed at 10m in dust source regions and corresponding re-analysis (MERRA, black), global models and regional models for the period 4<sup>th</sup> Apr 2011 to 7<sup>th</sup> Apr 2011 with (a) 24 hours lead time, (b) 48 hours, and (c) 72 hours. Observations are averaged over the region illustrated in Figure 1.



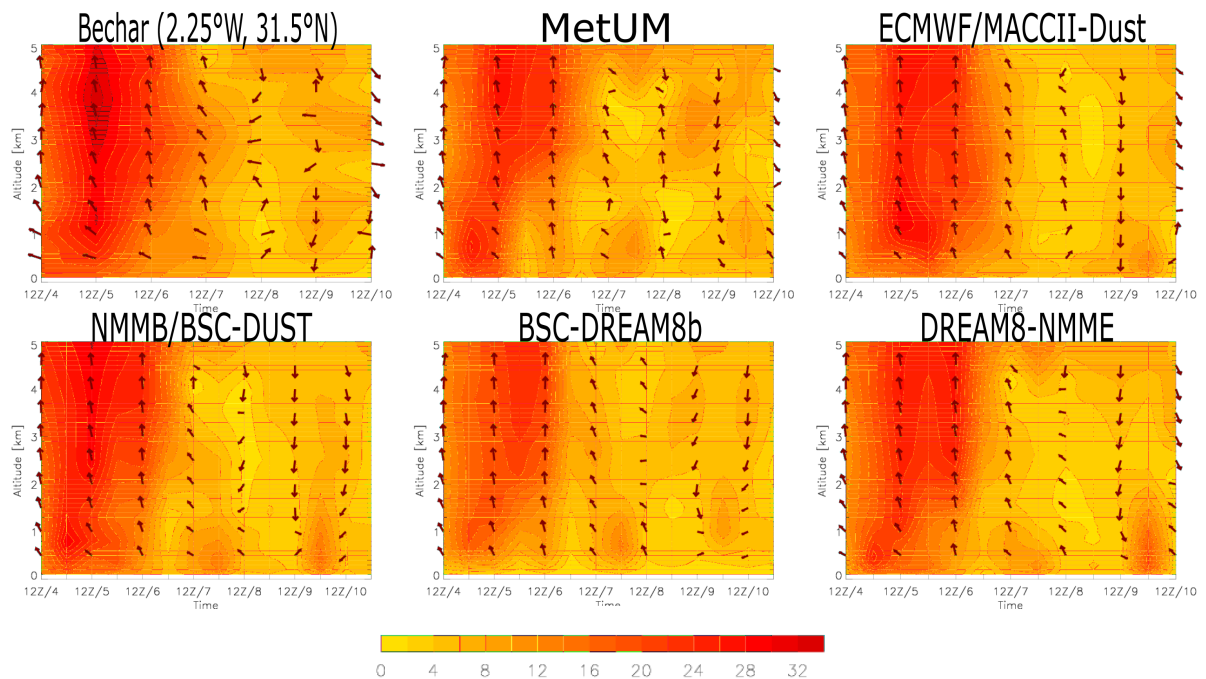
**Figure S17:** Observed three-hourly zonal wind component at 10m-wind in dust source regions and corresponding re-analysis (MERRA), global models and regional models for the period 4 Apr 2011 to 7 Apr 2011 with (a) 24 hours lead time, (b) 48 hours, and (c) 72 hours. Observations are averaged over the region illustrated in Figure 1.



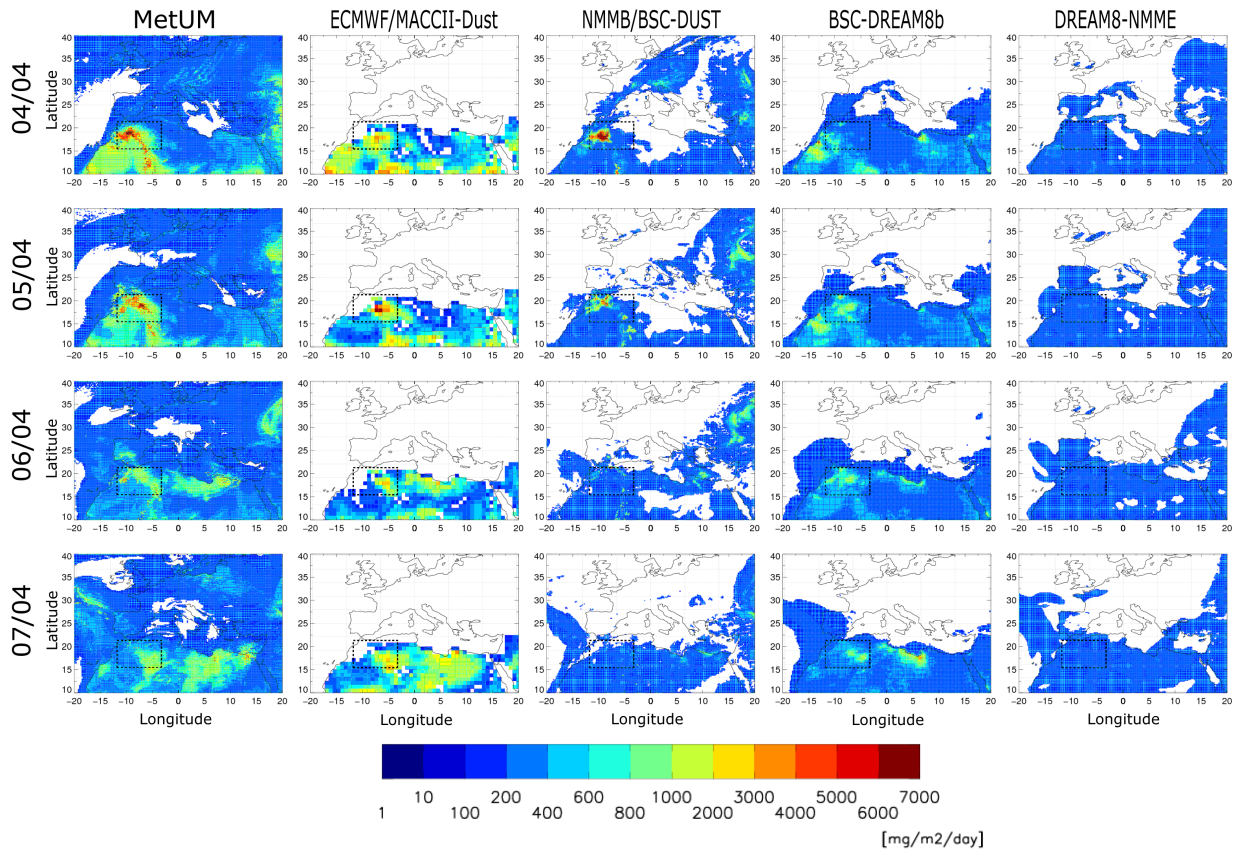
**Figure S18:** Same as Figure S17 but for meridional wind component.



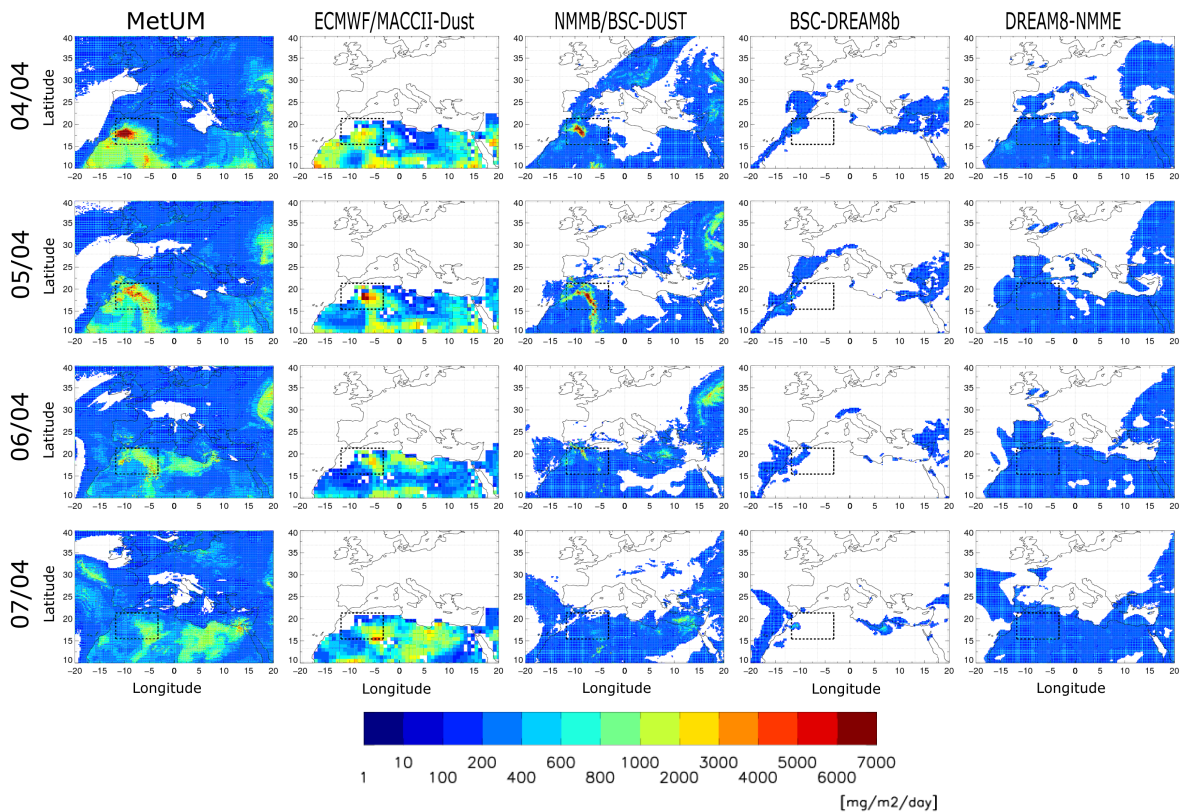
**Figure S19:** Profiles of measured wind [m/s] (first column) between the 4<sup>th</sup> and 10<sup>th</sup> of April from radiosounding at Bachar (5.43°E, 22.80°N) and the corresponding 48-hour forecast of models MetUM, ECMWF/MACC, NMMB/BSC-DUST, BSC-DREAM8b and DREAM8-NMME.



**Figure S20:** Same as Figure S19 but for 72-hour forecast.



**Figure S21:** Total accumulated forecasted daily deposition with 48-hour lead time for the models MetUM, ECMWF/MACC, NMMB/BSC-DUST, BSC-DREAM8b and DREAM8-NMME (from left to right).



**Figure S22:** Same as Figure S20 but for 72-hour forecast.