

Table S1: Names and numbers of the stations providing dust concentration data (monthly and annually).

| No | Station Name | Latitude | Longitude | Measurement Period | |
|-----------|---------------------------|-----------------|------------------|---------------------------|-------------|
| 1 | CapePoint | 34.35°S | 18.48°E | 27-Feb-92 | 21-Nov-96 |
| 2 | Cape Grim Tasmania | 40.68°S | 144.68°E | 11-Jan-83 | 08-Nov-96 |
| 3 | Marsh King George Island | 62.18°S | 58.30°W | 27-Mar-90 | 25-Sept-96 |
| 4 | Mawson Antarctica | 67.60°S | 62.50°E | 18-Feb-87 | 01-Jan-96 |
| 5 | Palmer Station Antarctica | 64.77°S | 64.05°W | 03-Apr-90 | 18-Oct-96 |
| 6 | Yate New Caledonia | 22.15°S | 167.00°E | 23-Aug-83 | 23-Oct-1985 |
| 7 | Funafuti Tuvalu | 8.50°S | 179.20°W | 08-Apr-83 | 31-Jul-87 |
| 8 | Nauru | 0.53°S | 166.95°E | 16-Mar-83 | 02-Oct-87 |
| 9 | Norfolk Island | 29.08°S | 167.98°E | 27-May-83 | 21-Feb-97 |
| 10 | Rarotonga Cook Islands | 21.25°S | 159.75°W | 23-Mar-83 | 23-Jun-94 |
| 11 | American Samoa | 14.25°S | 170.58°W | 19-Mar-83 | 03-Jan-96 |
| 12 | Midway Island | 28.22°N | 177.35°W | 18-Jan-81 | 02-Jan-97 |
| 13 | Oahu Hawaii | 21.33°N | 157.70°W | 21-Jan-81 | 13-Jul-95 |
| 14 | Cheju | 33.52°N | 126.48°E | 10-Sep-91 | 27-Oct-95 |
| 15 | Hedo | 26.92°N | 128.25°E | 01-Sep-91 | 18-Mar-94 |
| 16 | Fanning Island | 3.92°N | 159.33°W | 02-Apr-81 | 14-Aug-86 |
| 17 | Enewetak Atoll | 11.33°N | 162.33°E | 27-Feb-81 | 10-Jun-87 |
| 18 | Barbados | 13.17°N | 59.43°W | 05-May-84 | 01-Jul-98 |
| 19 | Izana Tenerife | 28.30°N | 16.50°W | 25-Jul-87 | 01-Jul-98 |
| 20 | Bermuda | 32.27°N | 64.87°W | 29-Mar-89 | 01-Jan-98 |
| 21 | Mace Head | 53.32°N | 9.85°W | 11-Aug-88 | 15-Aug-94 |
| 22 | Miami | 25.75°N | 80.25°W | 02-Jan-89 | 07-Aug-98 |
| 23 | Rukomechi | 16.00°S | 29.50°E | Not-Known | Not-Known |
| 24 | Jabirun | 12.70°S | 132.90°E | Not-Known | Not-Known |

Table S2: Names and numbers of the stations providing dust deposition data.

| No | Location | Latitude | Longitude | Deposition (g/m ² /year) | Region |
|----|----------------------|----------|-----------|-------------------------------------|-----------|
| 1 | FrenchAlps | 45.50°N | 6.50°E | 2.1 | Europe |
| 2 | Spain | 41.80°N | 2.30°E | 5.3 | Europe |
| 3 | Midway | 28.20°N | 177.35°W | 0.6 | WPacific |
| 4 | Miami | 25.75°N | 80.25°W | 1.62 | NAtlantic |
| 5 | Oahu | 21.30°N | 157.60°W | 0.42 | WPacific |
| 6 | Enewetak | 11.30°N | 162.30°E | 0.44 | EPacific |
| 7 | Fanning | 3.90°N | 159.30°W | 0.09 | WPacific |
| 8 | NewZealand | 34.50°S | 172.75°E | 0.14 | EPacific |
| 9 | Taklimakan | 40.00°N | 85.00°E | 450 | Asia |
| 10 | TelAviv | 32.00°N | 34.50°E | 30 | Europe |
| 11 | CampCentury | 77.00°N | 61.00°W | 0.04 | Greenland |
| 12 | Dye3 | 65.00°N | 44.00°W | 0.02 | Greenland |
| 13 | Renland | 71.00°N | 27.00°W | 0.06 | Greenland |
| 14 | GRIP | 73.00°N | 38.00°W | 0.008 | Greenland |
| 15 | Byrd | 75.00°S | 120.00°W | 0.003 | Antartica |
| 16 | Huascarán | 9.00°S | 78.00°W | 0.2 | SAmerica |
| 17 | Corsica | 42.00°N | 9.00°E | 15.43 | Europe |
| 18 | RossSea1 | 69.52°S | 170.60°E | 0.002 | SOcean |
| 19 | RossSea2 | 75.00°S | 170.67°W | 0.003 | SOcean |
| 20 | RossSea3 | 76.45°S | 175.52°W | 0.003 | SOcean |
| 21 | DumontAntartica1 | 64.60°S | 140.33°E | 0.0006 | SOcean |
| 22 | DumontAntartica2 | 64.88°S | 141.07°E | 0.0009 | SOcean |
| 23 | DumontAntartica3 | 64.97°S | 141.45°E | 0.0009 | SOcean |
| 24 | DumontAntartica4 | 64.93°S | 141.25°E | 0.0009 | SOcean |
| 25 | PrydzBay1 | 65.57°S | 74.98°E | 0.002 | SOcean |
| 26 | PrydzBay2 | 64.90°S | 75.00°E | 0.003 | SOcean |
| 27 | PrydzBay3 | 66.12°S | 75.32°E | 0.002 | SOcean |
| 28 | PrinceElizabethLand1 | 66.30°S | 75.72°E | 0.002 | SOcean |
| 29 | PrinceElizabethLand2 | 70.57°S | 76.90°E | 0.002 | SOcean |
| 30 | PrinceElizabethLand3 | 73.43°S | 76.52°E | 0.002 | SOcean |
| 31 | PrinceElizabethLand4 | 74.90°S | 74.52°E | 0.001 | SOcean |
| 32 | PrinceElizabethLand5 | 75.85°S | 71.50°E | 0.0009 | SOcean |
| 33 | Eilat | 29.52°N | 34.92°E | 5.83 | Europe |
| 34 | Sapporo | 43.10°N | 141.30°E | 5.2 | EPacific |
| 35 | DeadSea | 31.50°N | 35.30°E | 44.57 | MEast |
| 36 | LakeKinneret | 32.70°N | 35.50°E | 285.71 | Europe |
| 37 | Crete | 35.20°N | 24.80°E | 21.26 | Europe |
| 38 | SEFrance1 | 43.50°N | 4.80°E | 11.31 | Europe |
| 39 | SEFrance2 | 43.60°N | 7.30°E | 1.8 | Europe |
| 40 | Sspain | 36.30°N | 5.4°W | 22.8 | Europe |
| 41 | Nordsea | 54.42°N | 7.20°W | 2.09 | NAtlantic |
| 42 | Eiderstedt | 54.30°N | 8.60°W | 1.57 | NAtlantic |
| 43 | SEFrance3 | 43.60°N | 7.30°E | 32 | Europe |
| 44 | WeddellSea | 64.93°S | 2.59°W | 0.52 | SOcean |
| 45 | Site13Shallow | 35.52°S | 161.0°E | 1.24 | EPacific |
| 46 | WR1 | 20.05°S | 9.16°E | 4.03 | SAtlantic |
| 47 | Site12Shallow | 17.76°S | 154.83°E | 0.4 | EPacific |
| 48 | Site11Shallow | 12.99°S | 155.99°E | 0.73 | EPacific |

| | | | | | |
|----|-------------------|---------|----------|-------|------------|
| 49 | GBZ4 | 2.18°S | 9.90°W | 1.2 | EqAtlantic |
| 50 | CEPS03upper | 0.00°N | 175.00°E | 0.825 | EPacific |
| 51 | Site10 | 1.22°N | 160.57°E | 0.84 | EPacific |
| 52 | GBN3upper | 1.79°N | 11.13°W | 4.3 | EqAtlantic |
| 53 | ECC-T | 5.01°N | 138.83°E | 0.57 | EPacific |
| 54 | PB2 | 5.37°N | 85.58°W | 4.8 | WPacific |
| 55 | M5 | 10.00°N | 65.00°E | 1.5 | IndianOc |
| 56 | CV1upper | 11.48°N | 21.02°W | 22.62 | EqAtlantic |
| 57 | NEC-T | 12.02°N | 134.29°E | 0.11 | EPacific |
| 58 | Cast | 14.48°N | 64.77°E | 4.3 | IndianOc |
| 59 | East | 15.47°N | 68.75°E | 7.4 | IndianOc |
| 60 | M4 | 15.98°N | 61.50°E | 4.5 | IndianOc |
| 61 | Wast | 16.25°N | 60.47°E | 6.1 | IndianOc |
| 62 | M2M3 | 17.40°N | 58.80°E | 12.4 | IndianOc |
| 63 | EumeliMesotropic | 18.50°N | 21.08°W | 18.74 | NAtlantic |
| 64 | BOSF1 | 19.00°N | 20.17°W | 21.55 | NAtlantic |
| 65 | CB1-1 | 20.92°N | 19.74°W | 20.17 | NAtlantic |
| 66 | EumeliOligotropic | 21.05°N | 31.17°W | 3.73 | NAtlantic |
| 67 | CB2-1 | 21.15°N | 20.69°W | 20.09 | NAtlantic |
| 68 | 22N25W | 21.93°N | 25.23°W | 6.7 | NAtlantic |
| 69 | 25N23W | 24.55°N | 22.83°W | 5.21 | NAtlantic |
| 70 | 28N22W | 28.00°N | 21.98°W | 2.4 | NAtlantic |
| 71 | C11upper | 29.11°N | 15.45°W | 4.15 | NAtlantic |
| 72 | Site6 | 30.00°N | 175.0°E | 3 | EPacific |
| 73 | ST | 31.55°N | 24.67°W | 2.36 | NAtlantic |
| 74 | Sargasso | 32.08°N | 64.25°W | 1.9 | NAtlantic |
| 75 | L1-93 | 33.15°N | 21.98°W | 1.76 | NAtlantic |
| 76 | 34N21W | 33.82°N | 21.02°W | 4.75 | NAtlantic |
| 77 | Site5upper | 34.42°N | 177.74°E | 3.25 | EPacific |
| 78 | Site7upper | 37.40°N | 174.95°E | 8.77 | EPacific |
| 79 | WP-3 | 40.00°N | 145.43°E | 7.32 | EPacific |
| 80 | Site8 | 46.12°N | 175.03°E | 4.09 | EPacific |
| 81 | NP-B | 46.82°N | 162.12°E | 0.86 | EPacific |
| 82 | 48N21W-1 | 47.72°N | 20.87°W | 3.1 | NAtlantic |
| 83 | 48N21W-2 | 47.83°N | 19.50°W | 2.8 | NAtlantic |
| 84 | P | 50.00°N | 144.98°W | 0.3 | WPacific |

Table S3: AERONET stations used in this study.

| Station Number | Station Name | Longitude | Latitude |
|-----------------------|---------------------|------------------|-----------------|
| 1 | Anmyon | 126.33 | 36.54 |
| 2 | Arica | -70.31 | -18.47 |
| 3 | Bahrain | 50.61 | 26.21 |
| 4 | Banizoumbou | 2.66 | 13.54 |
| 5 | Barbados | -59.62 | 13.15 |
| 6 | Capo_Verde | -22.93 | 16.73 |
| 7 | Dakar | -16.96 | 14.39 |
| 8 | El_Arenosillo | -6.73 | 37.11 |
| 9 | Illorin | 4.34 | 8.32 |
| 10 | IMC_Oristano | 8.50 | 39.91 |
| 11 | IMS-METU-ERD | 34.25 | 36.56 |
| 12 | Kaashidhoo | 73.47 | 4.96 |
| 13 | Lampedusa | 12.63 | 35.52 |
| 14 | La_Parguera | -67.04 | 17.97 |
| 15 | Nes_Ziona | 34.79 | 31.92 |
| 16 | Ouagadougou | -1.40 | 12.20 |
| 17 | SEDE_BOKER | 34.78 | 30.85 |
| 18 | Solar_Village | 46.39 | 24.91 |
| 19 | Suriname | -55.20 | 5.80 |

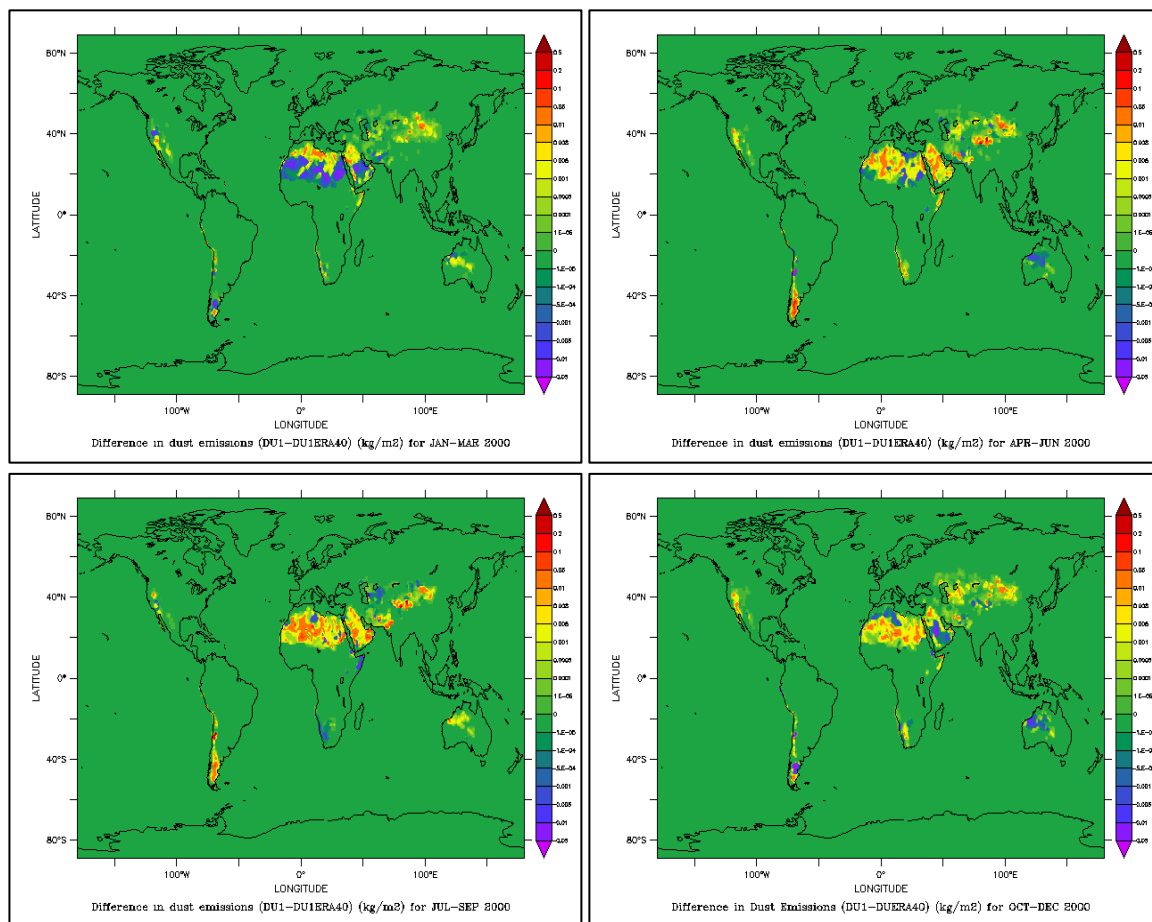


Fig S1. Difference in the seasonal dust emissions (kg/m^2) for the year 2000 for DU1 and DU1_ERA40: a) January to March, b) April to June, c) July to September and d) October to December

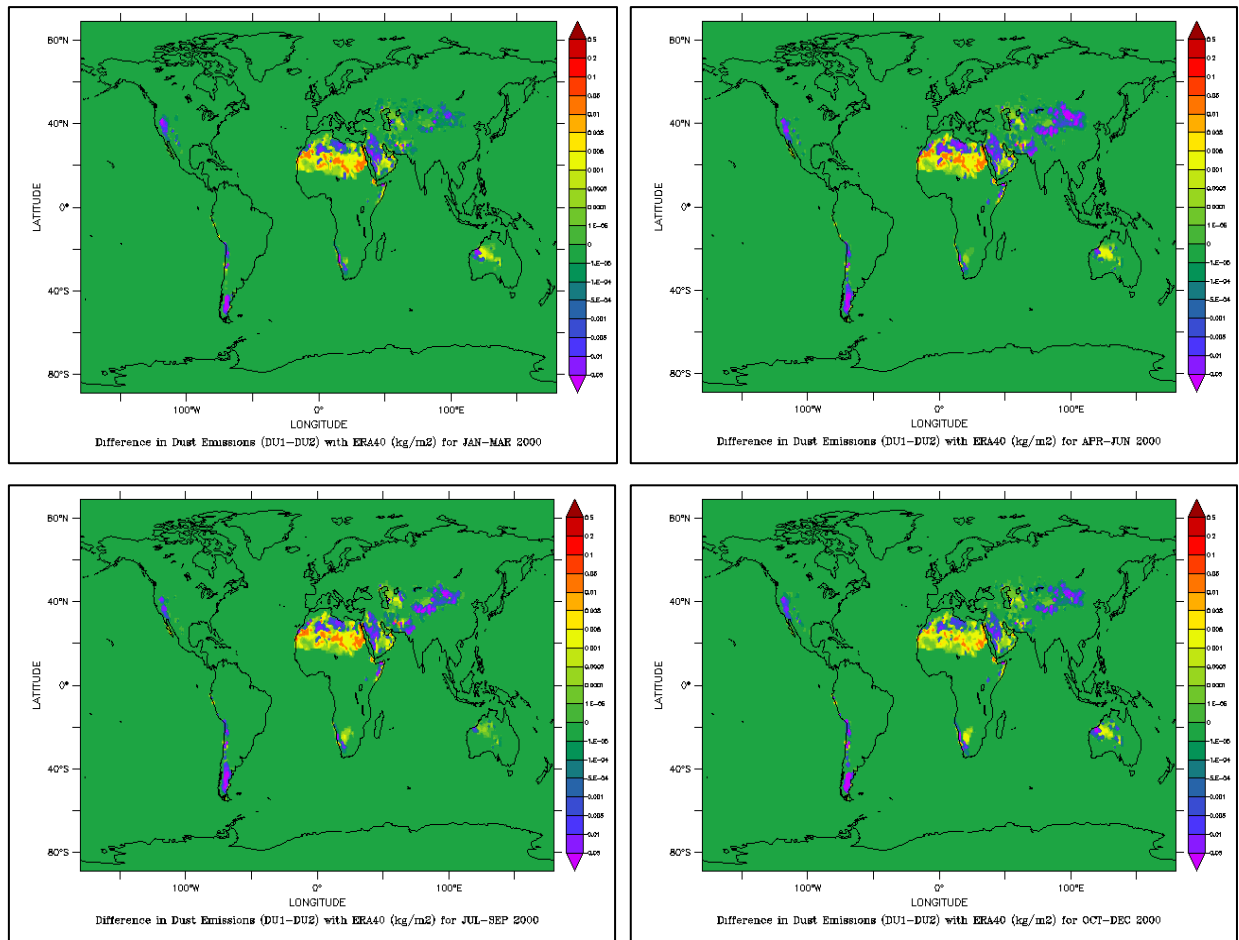


Fig. S2. Difference in the seasonal dust emissions (kg/m^2) between the nudged simulations for the year 2000 (DU1_ERA40-DU2_ERA40): a) January to March, b) April to June, c) July to September and d) October to December.

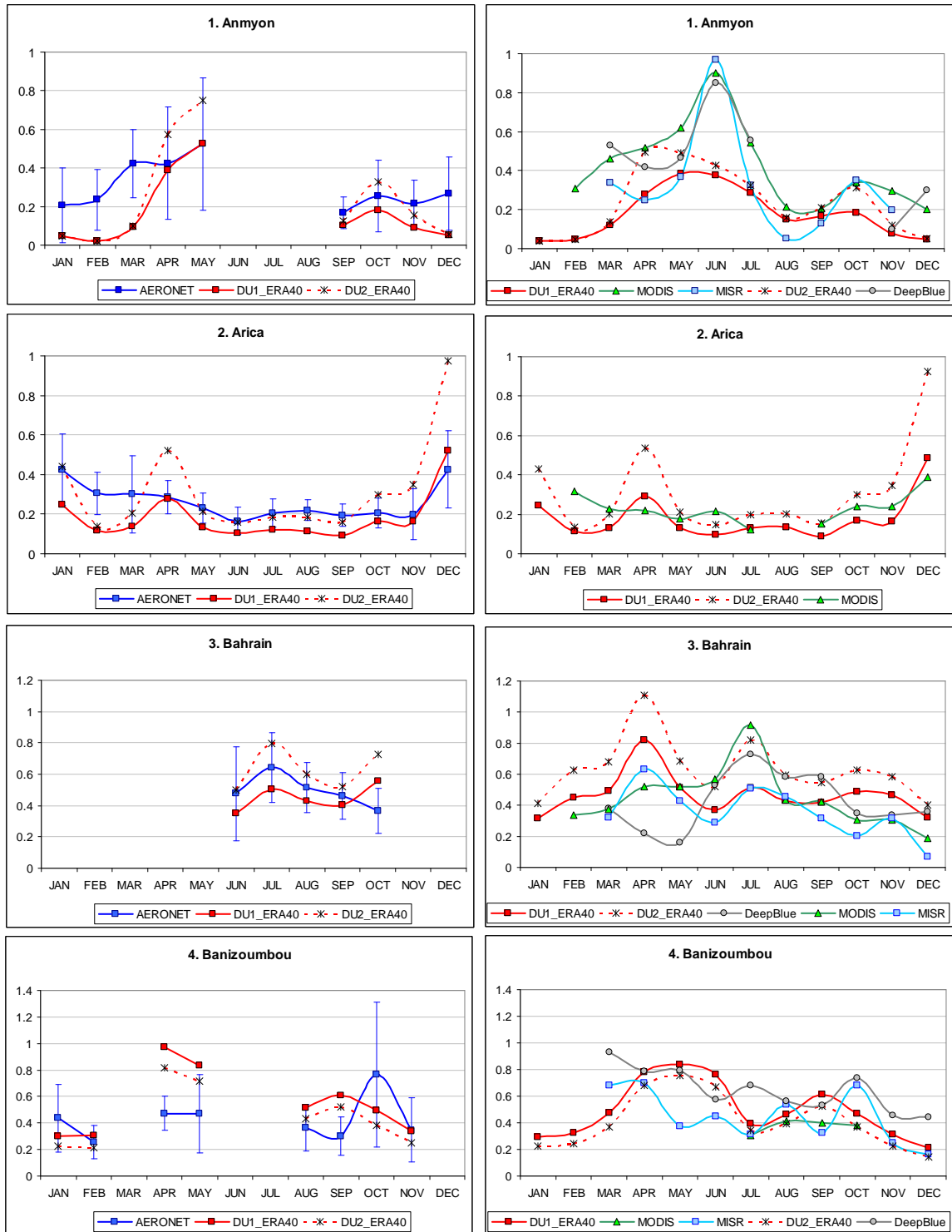


Fig. S3: Monthly AOD at the 23 AERONET stations (locations shown in Fig.3d). The left panels show the comparison between AERONET and modeled AOD for the specific dates available from AERONET. The right panels show the comparison between MODIS-Terra (for some stations additional MISR and Deep Blue AOD is included) and modeled AOD using the entire month from each simulation.

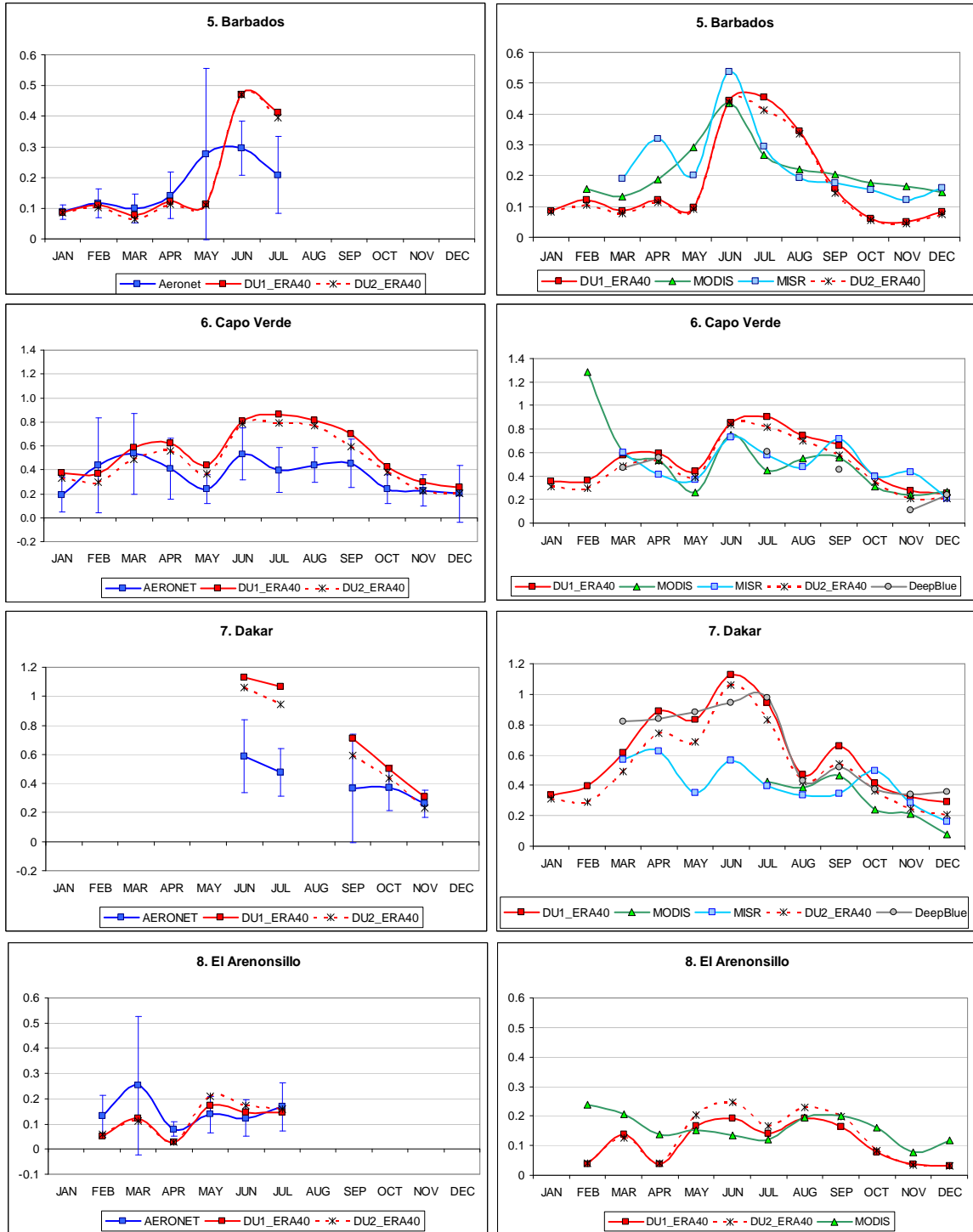


Fig. S3: continued.

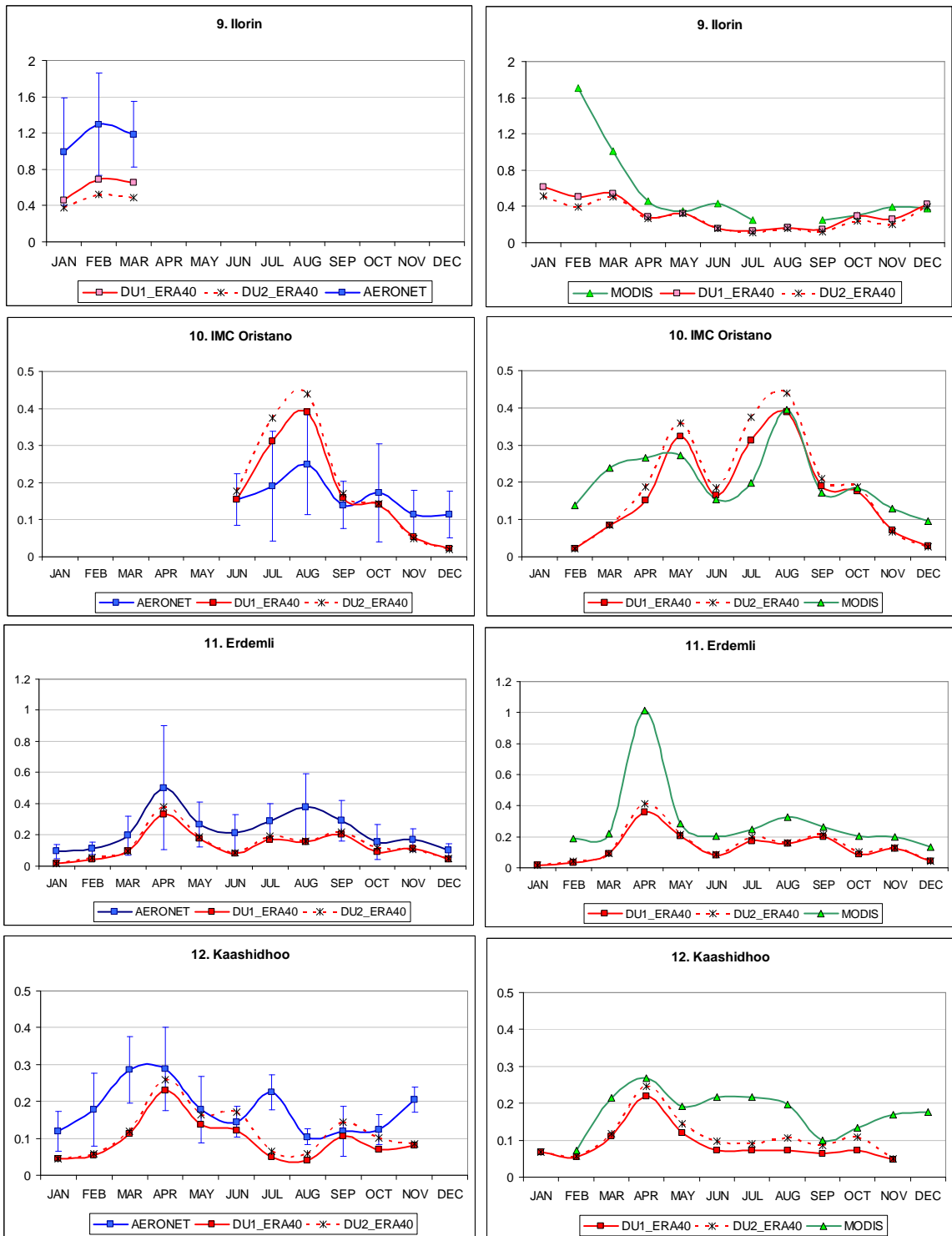


Fig. S3: continued.

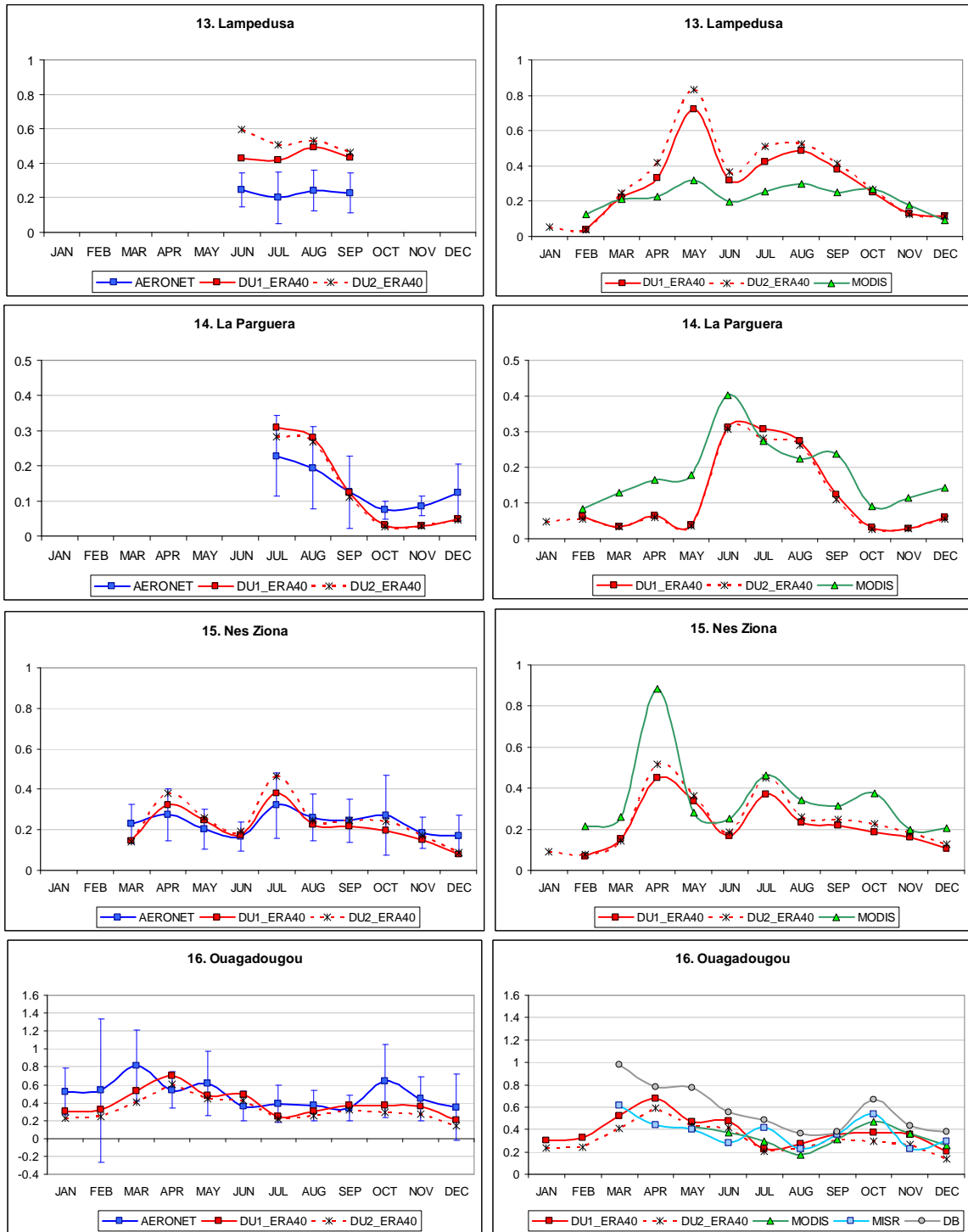


Fig. S3: continued

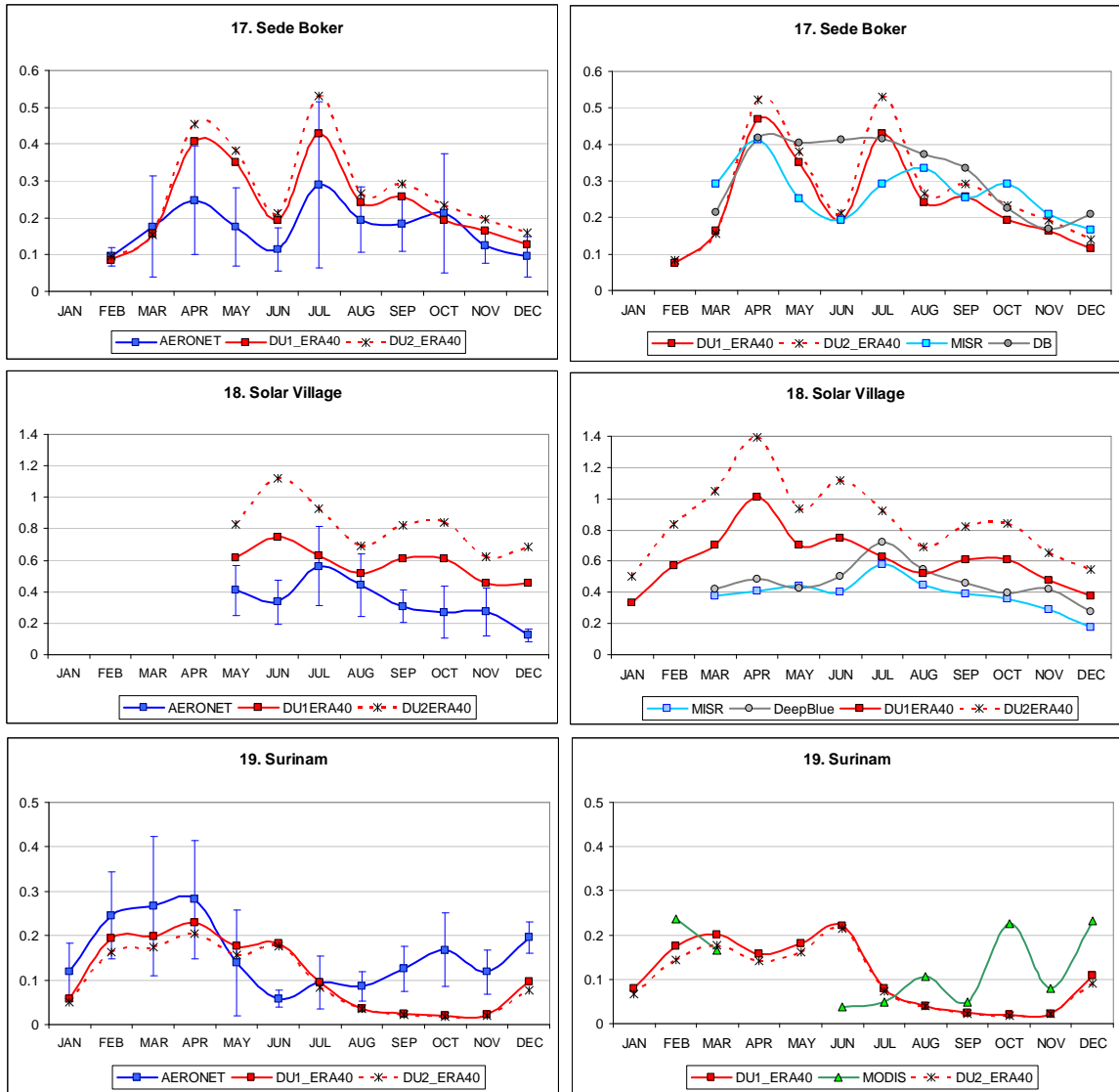


Fig. S3: continued.