# Nudge or Climatological ?

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**How does the geographical distribution and the interannual and seasonal variability of sea salt and mineral dust aerosol change between the different modes of operation of the climate model e.g. ECHAM4 ?**

**The climate model ECHAM4 can be operated in different modes, such as in a nudged mode and in a climatological mode.**

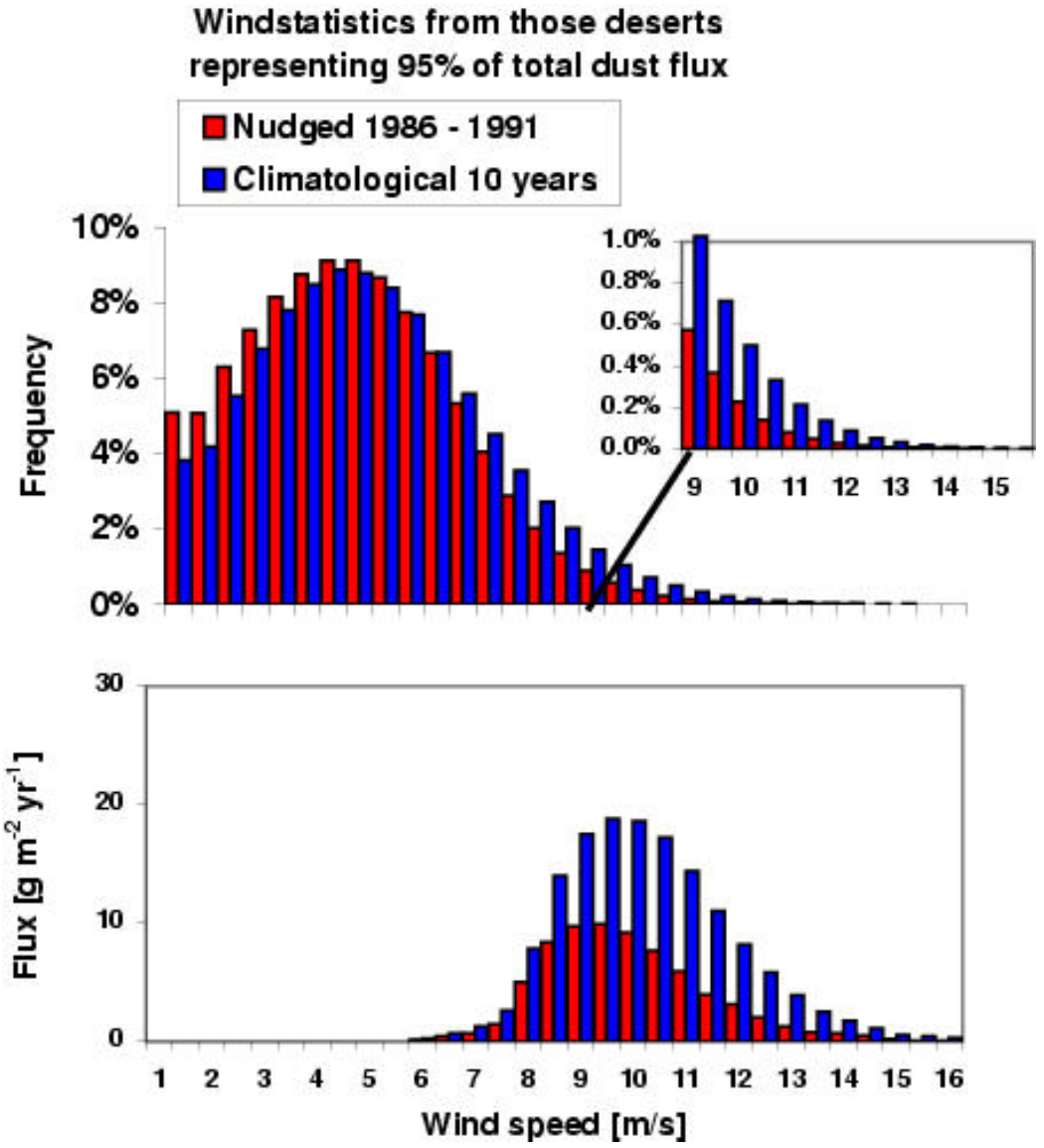
**Two experiments with the same model set up**

- **a climatological run (10 years) with prescribed climatological (monthly mean AMIP SST): CLIM**
- **a nudged model run with prescribed daily SSTs, where the model is forced by ECMWF data of the particular years (1986-1991): NUDGE**

# Mineral dust global budget

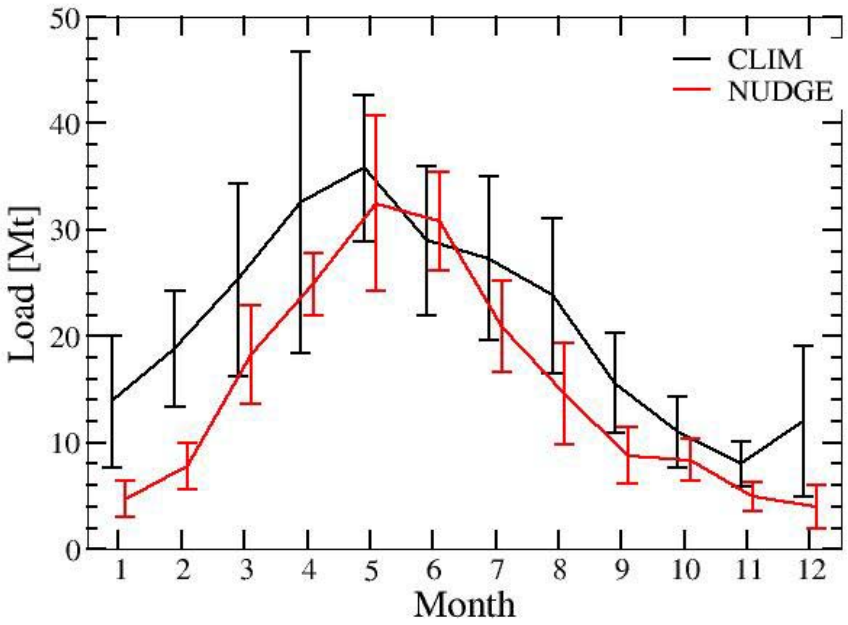
| | **CLIM** | | **NUDGE** | |
|---|---|---|---|---|
| Load (Mt) | 21.55 | | 15.08 | |
| Source (Mt) | **913.1** | | **504.2** | |
| Sinks (Mt) | 911.5 | 100% | 503.5 | 100% |
| T-Deposition (MT) | 231.4 | 25% | 115 | 23% |
| Sedimentation (MT | 286.5 | 31% | 163.6 | 32% |
| Wet dep. CS (MT) | 128.7 | 14% | 73.6 | 15% |
| Wet dep. LS (MT) | 264.3 | 29% | 150 | 30% |
| Lifetime (d) | **8,6** | | **10.93** | |

# Differences in 10m wind speed distribution

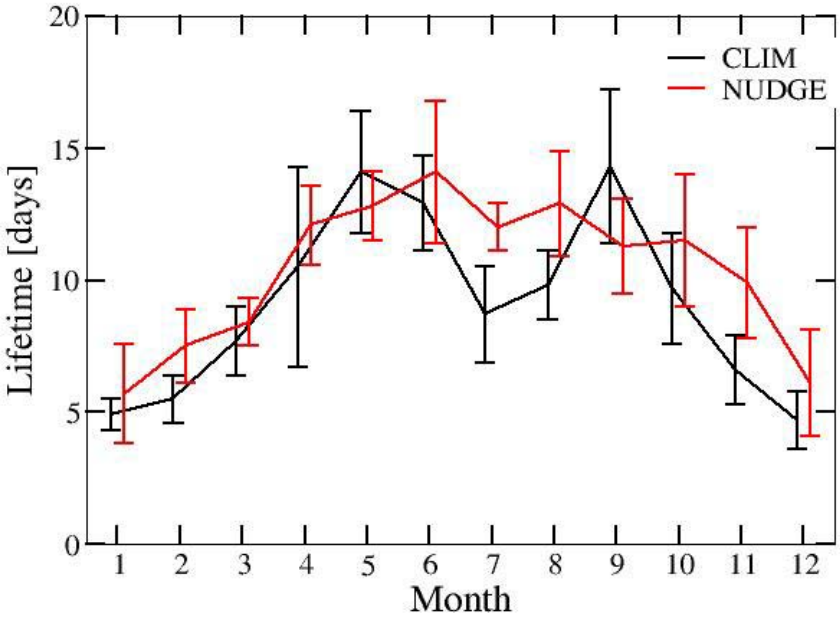



Schulz et Timmreck in prep.

# Annual Cycle of mineral dust load and lifetime




Load is higher in CLIM
(except in June)



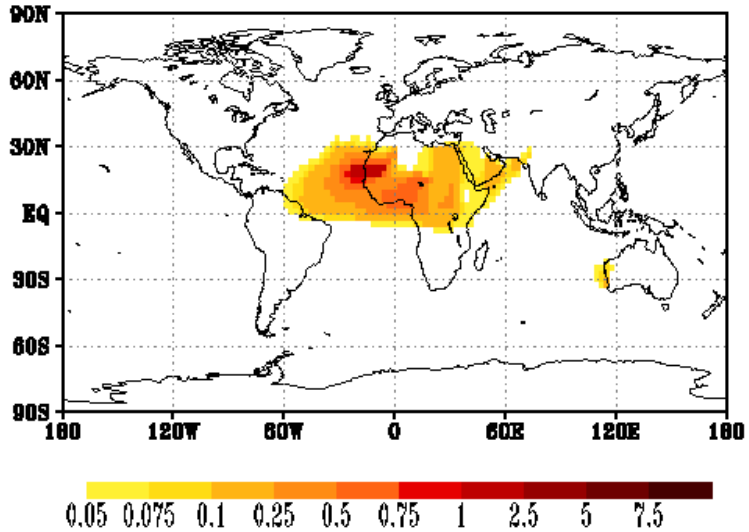

Lifetime is higher in NUDGE
(except in May and September)

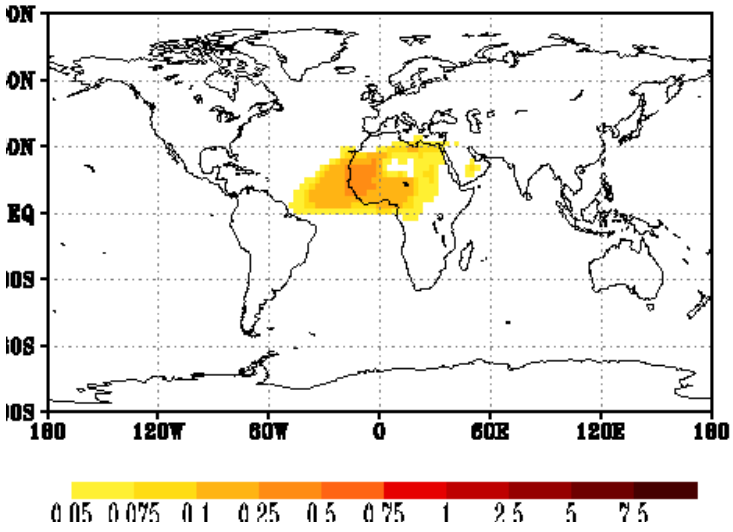
# Mineral Dust Column Burden [g/m$^2$]

## CLIM

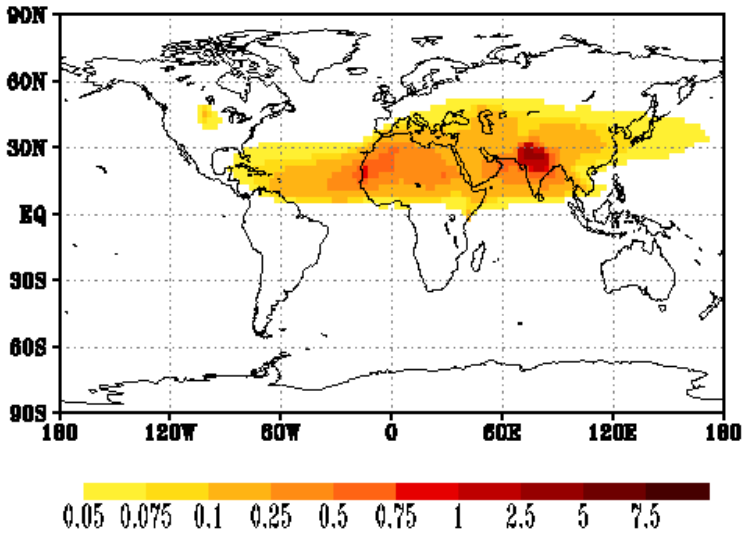
## NUDGE

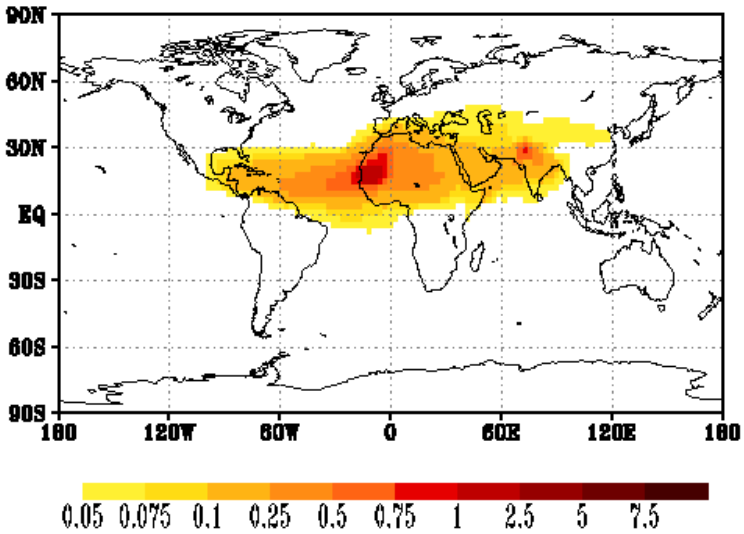
**DJF**



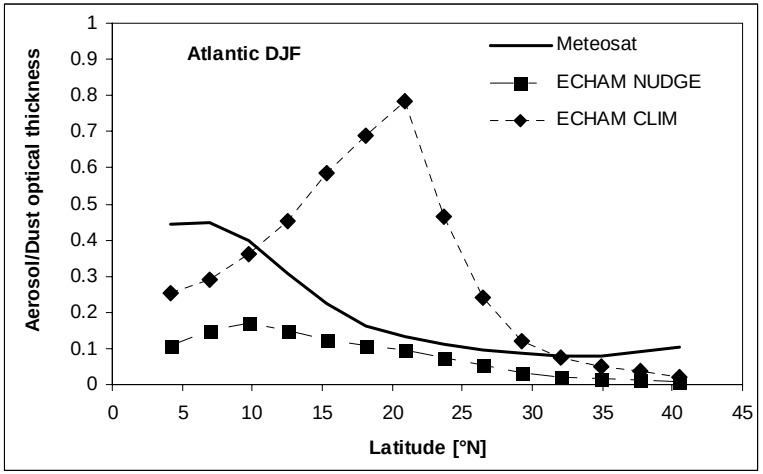

**JJA**

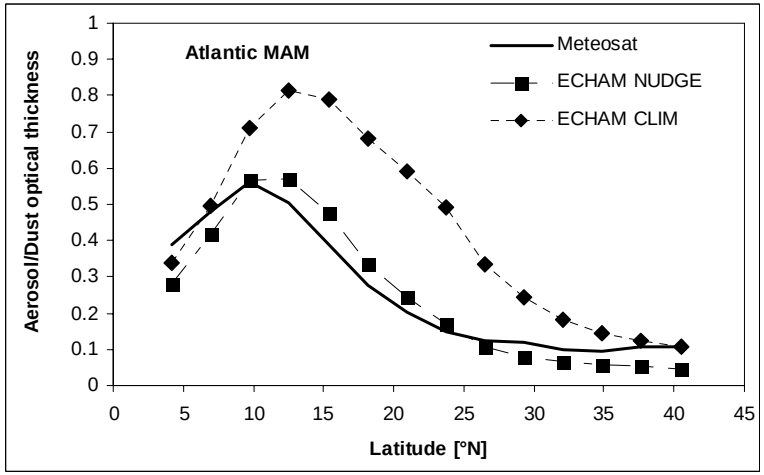


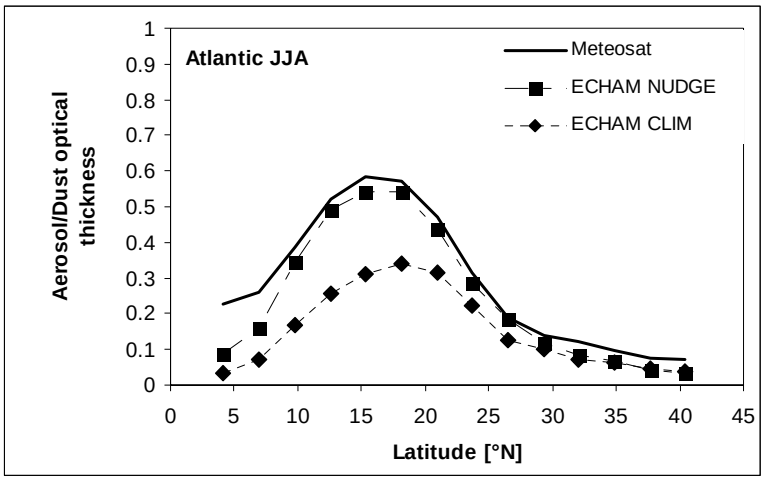



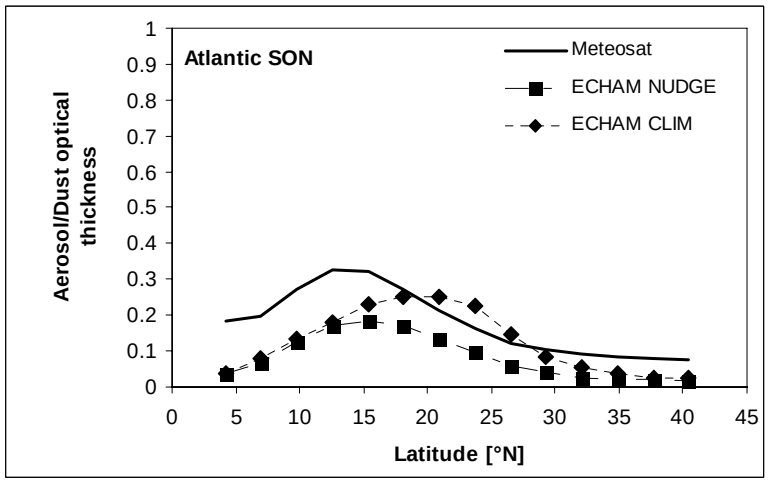
# Optical Depth over the Atlantic

## Comparison with METEOSAT



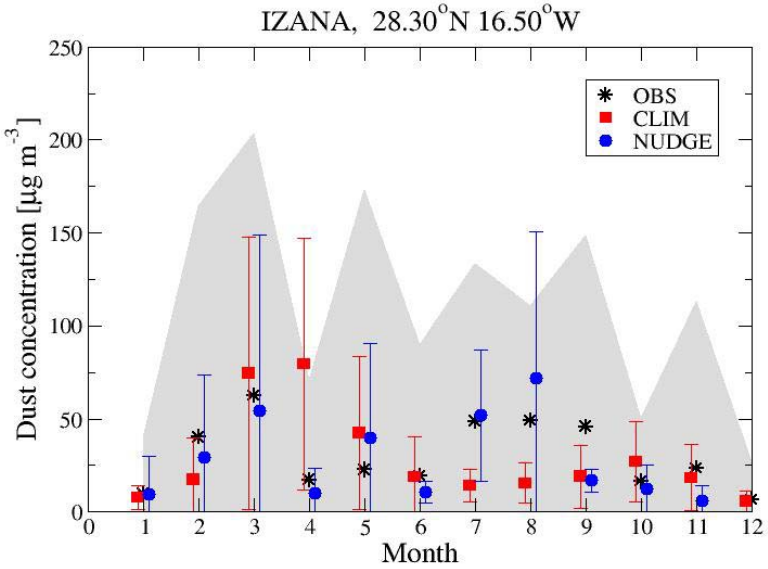



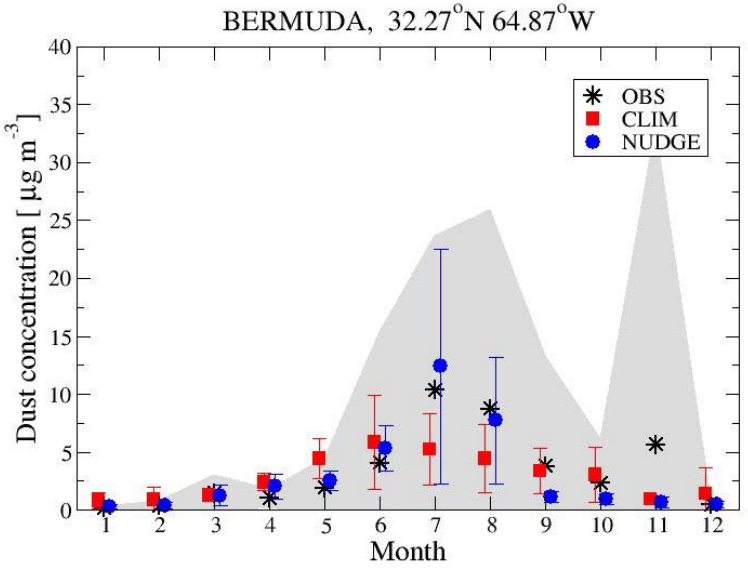



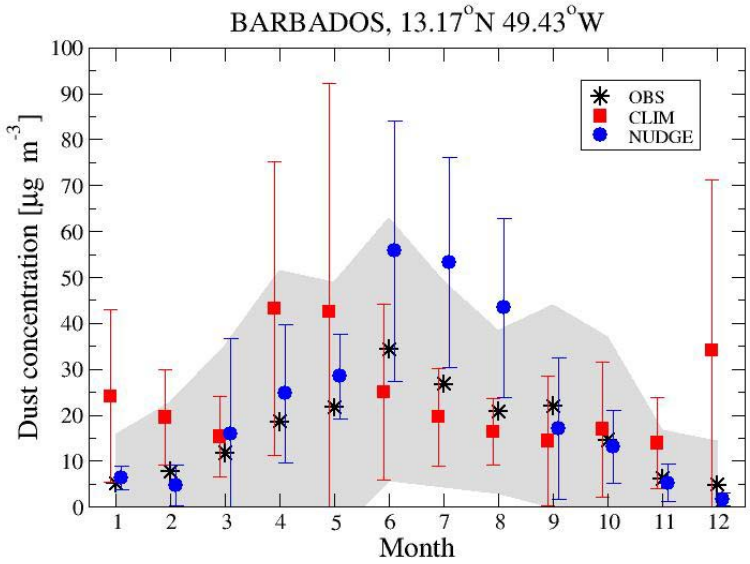

Timmreck and Schulz in prep.

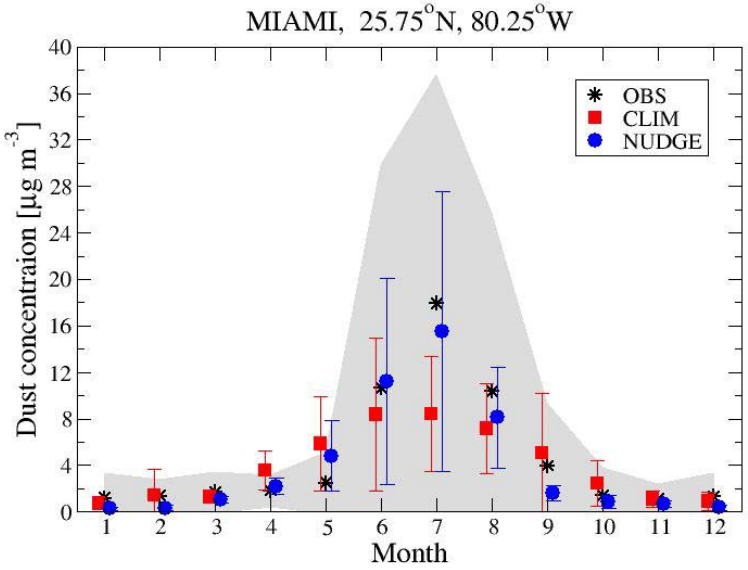
# Comparison with Station data

## (Courtesy of J.Prospero and D. Savoie)



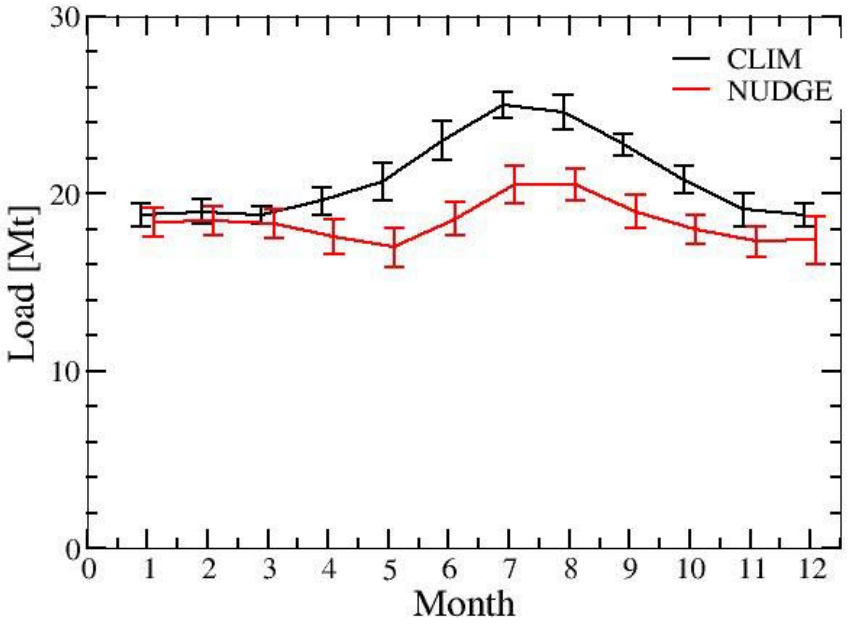
- Reason for the difference between the two experiments is the position and the strength of the Azores high.

- *In ECHAM4 the Azores high is too strong and extended to far eastward over the Mediterranean in NH winter.*

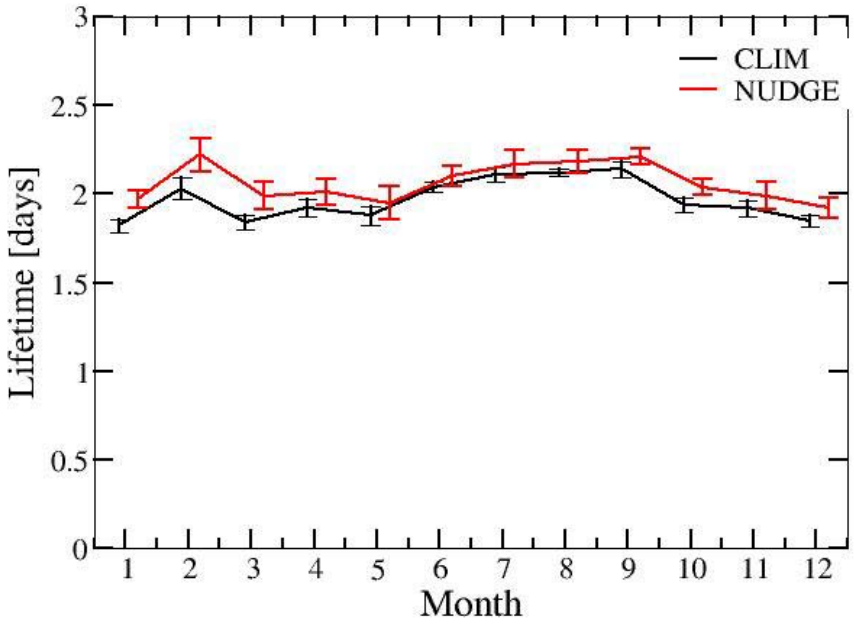
# Sea salt global budget

| | **CLIM** | | **NUDGE** | |
|---|---|---|---|---|
| Load (Mt) | 20.9 | | 18.4 | |
| Source (Mt) | 3816 | | 3211 | |
| Sink(Mt) | 3828 | 100% | 3223 | 100% |
| T-Deposition (MT) | 795 | 21% | 718 | 22% |
| Sedimentation (MT | 2043 | 53% | 1690 | 54% |
| Wet dep. CS (MT) | 207 | 5% | 121 | 4% |
| Wet dep. LS (MT) | 783 | 21% | 694 | 22% |
| Lifetime (d) | 2 | | 2.09 | |

# Annual Cycle of sea salt aerosol load and lifetime

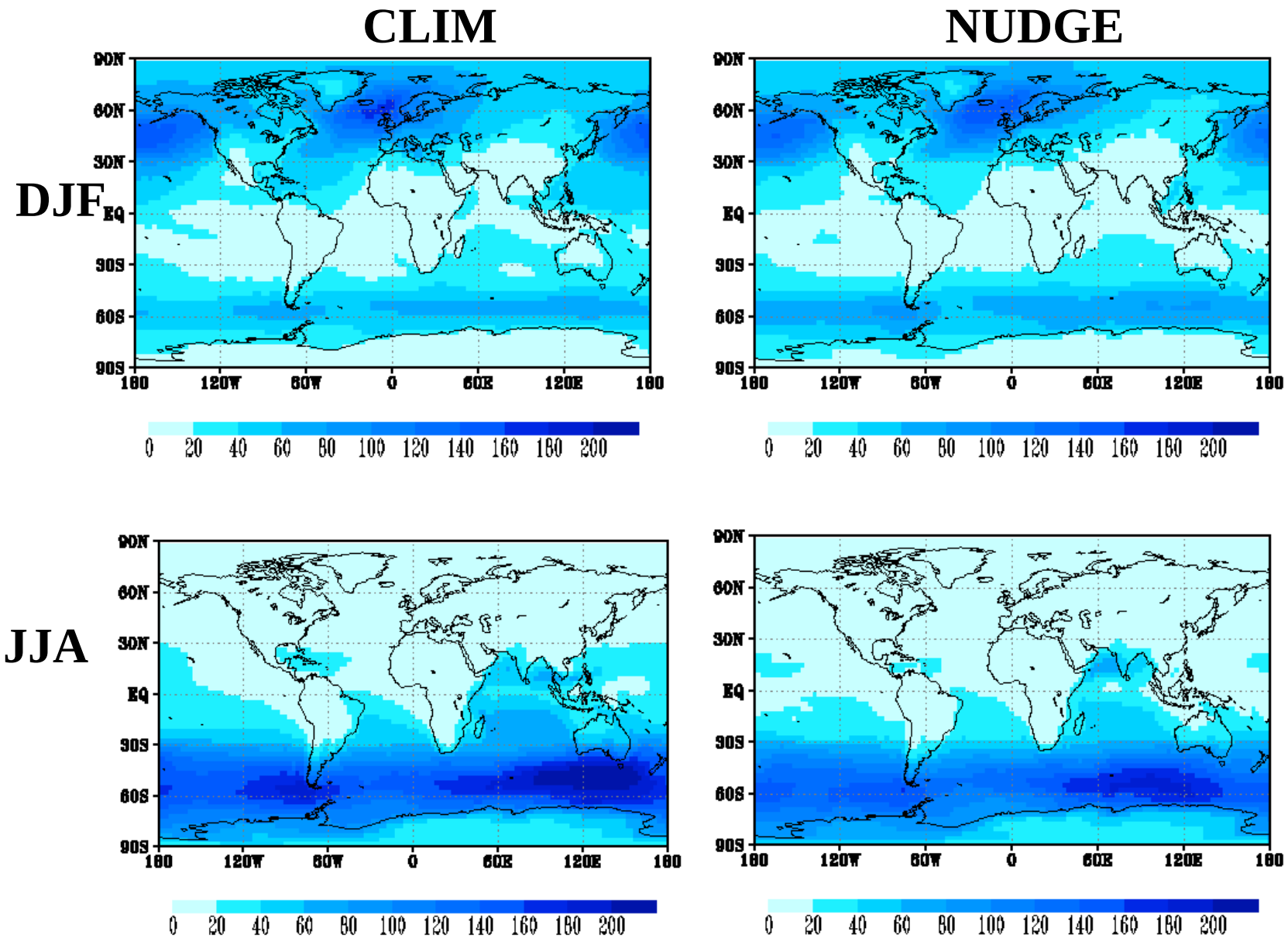



Load is higher in CLIM




Lifetime is slightly higher in NUDGE

# Seasalt Column Burden [mg/m$^2$]



# Comparison with Station data

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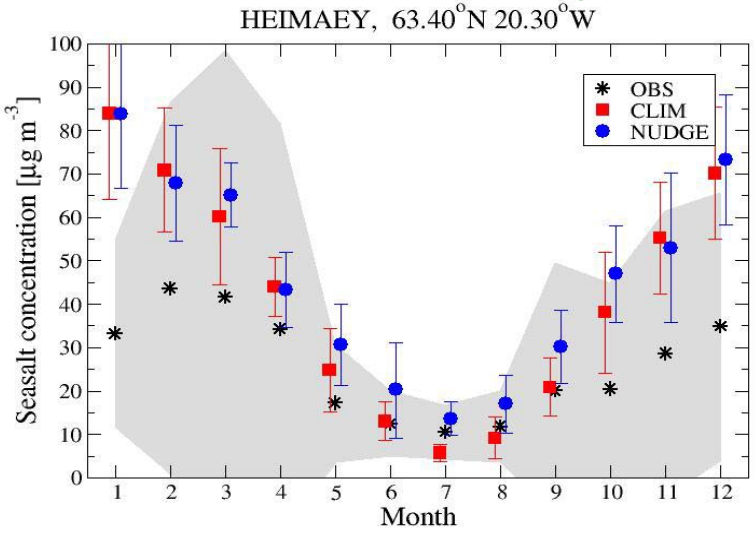


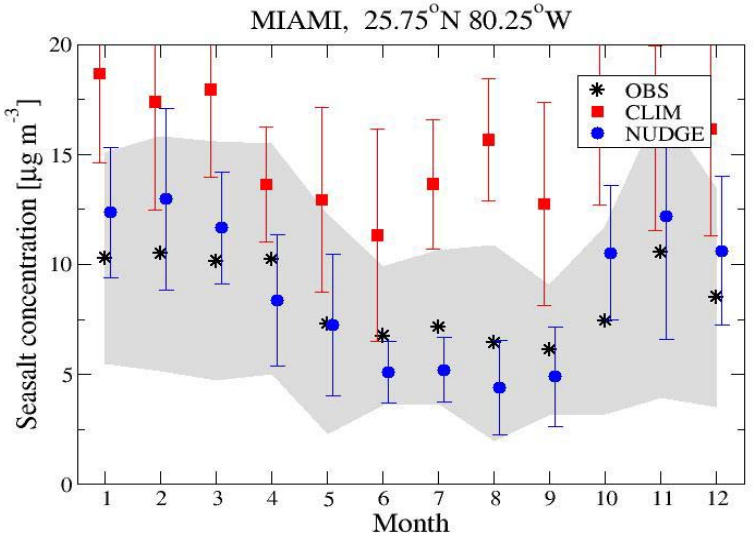


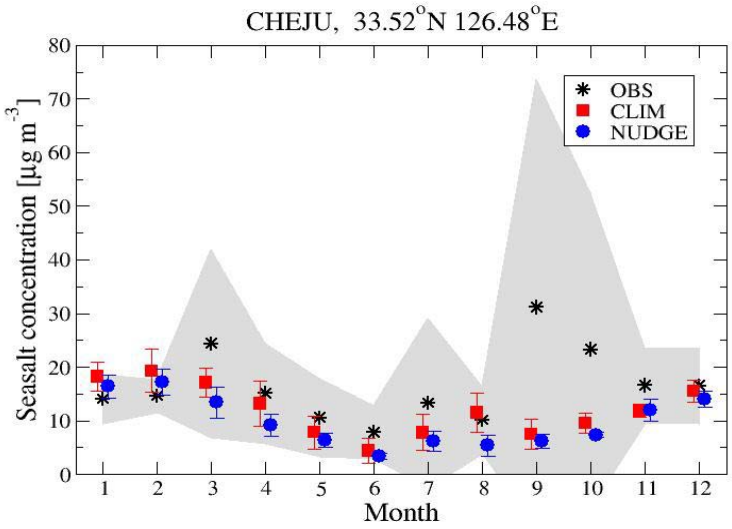


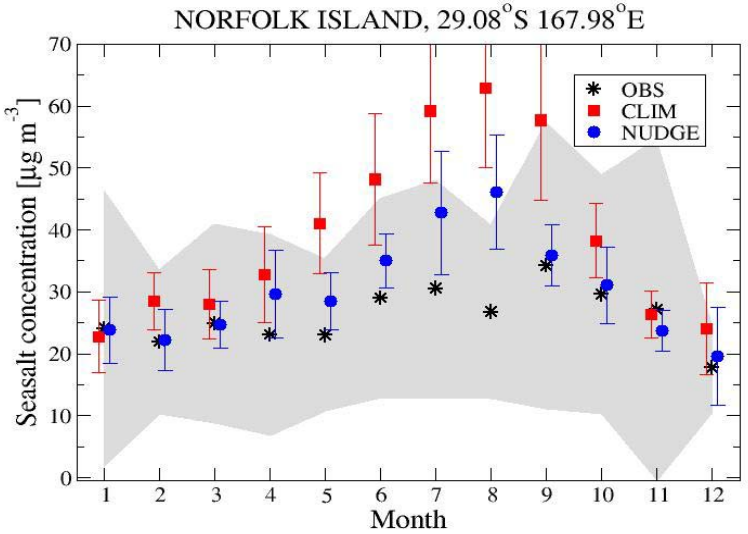

**It appears that the mode of operation of the climate model seems to be as important as the interannual variability by climate variations alone for the simulation of natural aerosol components. This is especially important for mineral dust due to the local point sources. These uncertainties have to be taken into account when climate change experiments are performed.**

**Models should be validated in both modes**