Land-Atmosphere Interaction: The case for dust

Presented by

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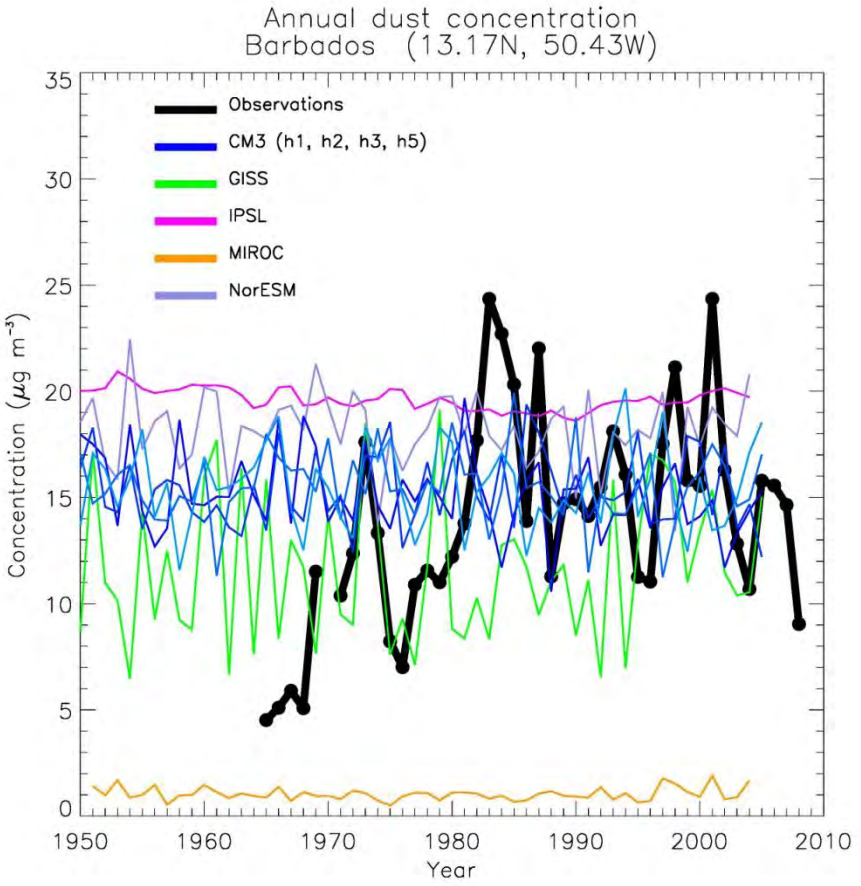
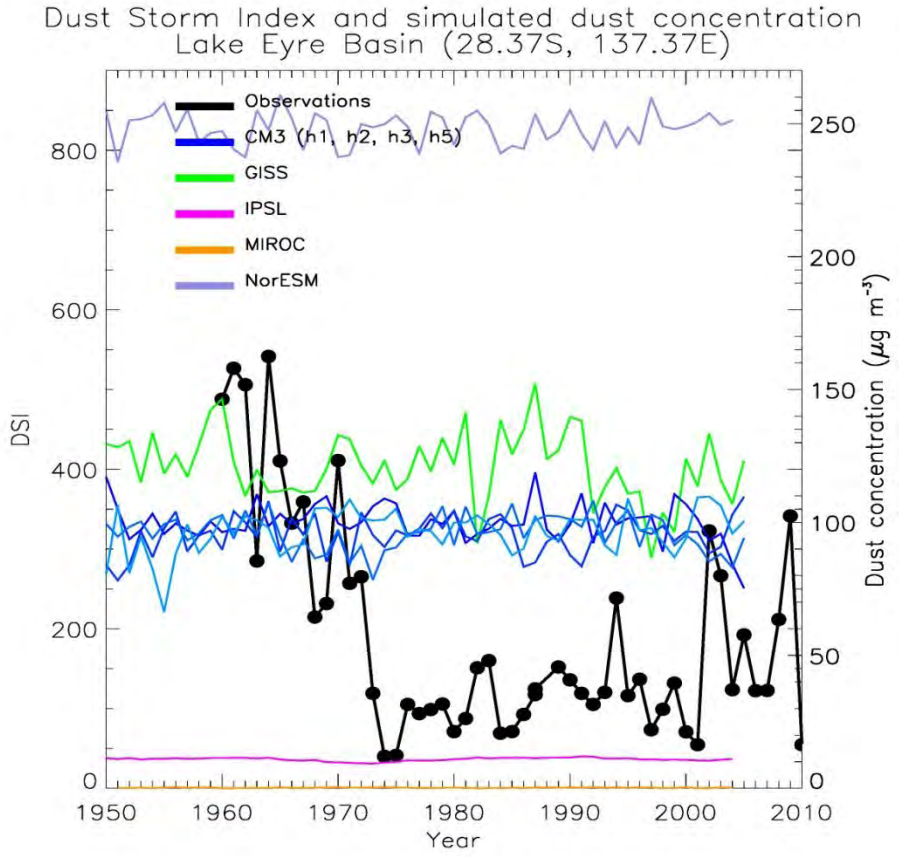
Anthropogenic dust and IPCC reports

- **TAR**: "…up to 50% of the current atmospheric dust load … should be considered anthropogenic in origin…"
- **AR-4**: "A best guess of 0 to 20% anthropogenic dust burden … is used here…"
- **AR-5**: "Anthropogenic sources, including road dust and mineral dust due to human land use change, remain ill quantified although some recent satellite observations suggest the fraction of mineral dust due to the latter source could be 20 to 25% of the total (Ginoux et al., 2012a, 2012b)."

CMIP5 dust and Observations



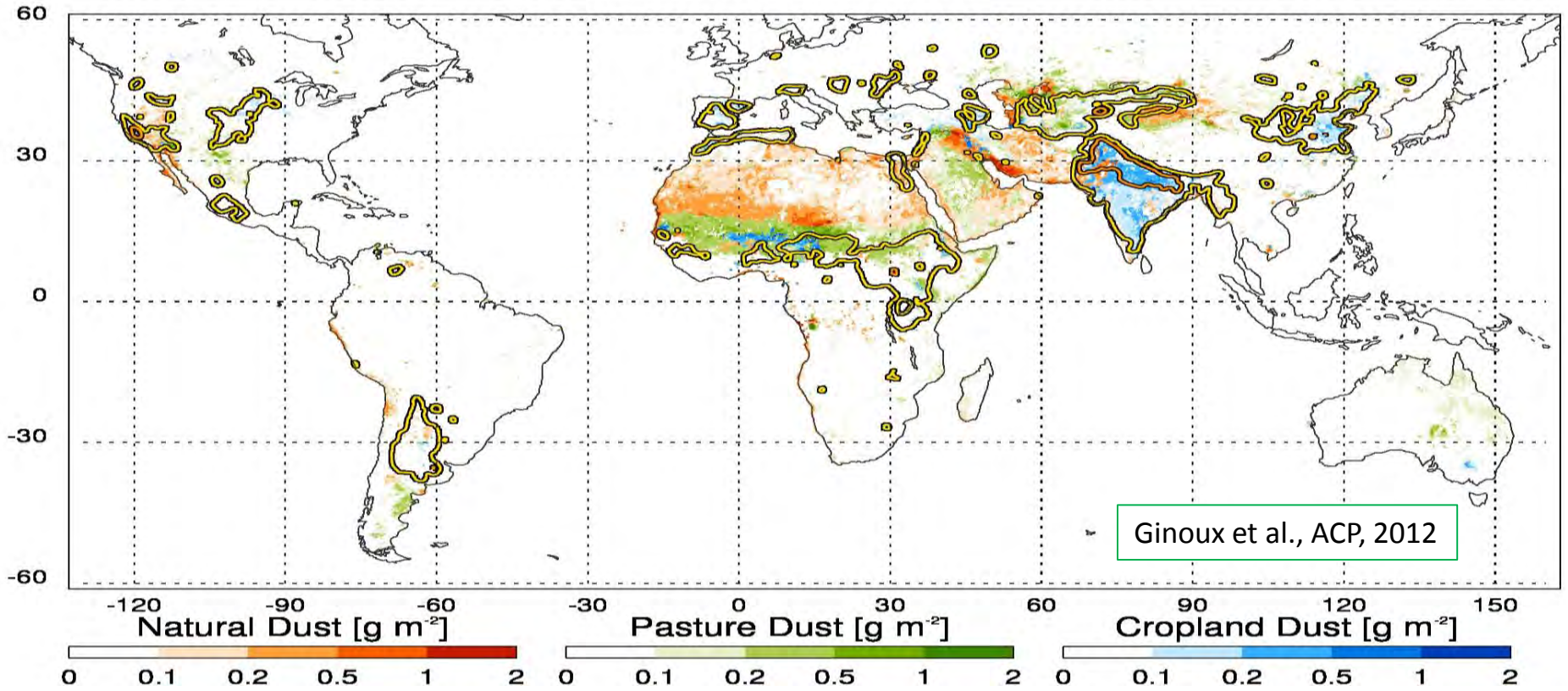


There is a large spread between CMIP5 surface dust concentration, but they have all in common to lack decadal variation.

We will show that this can be resolved by including vegetation and landuse changes.

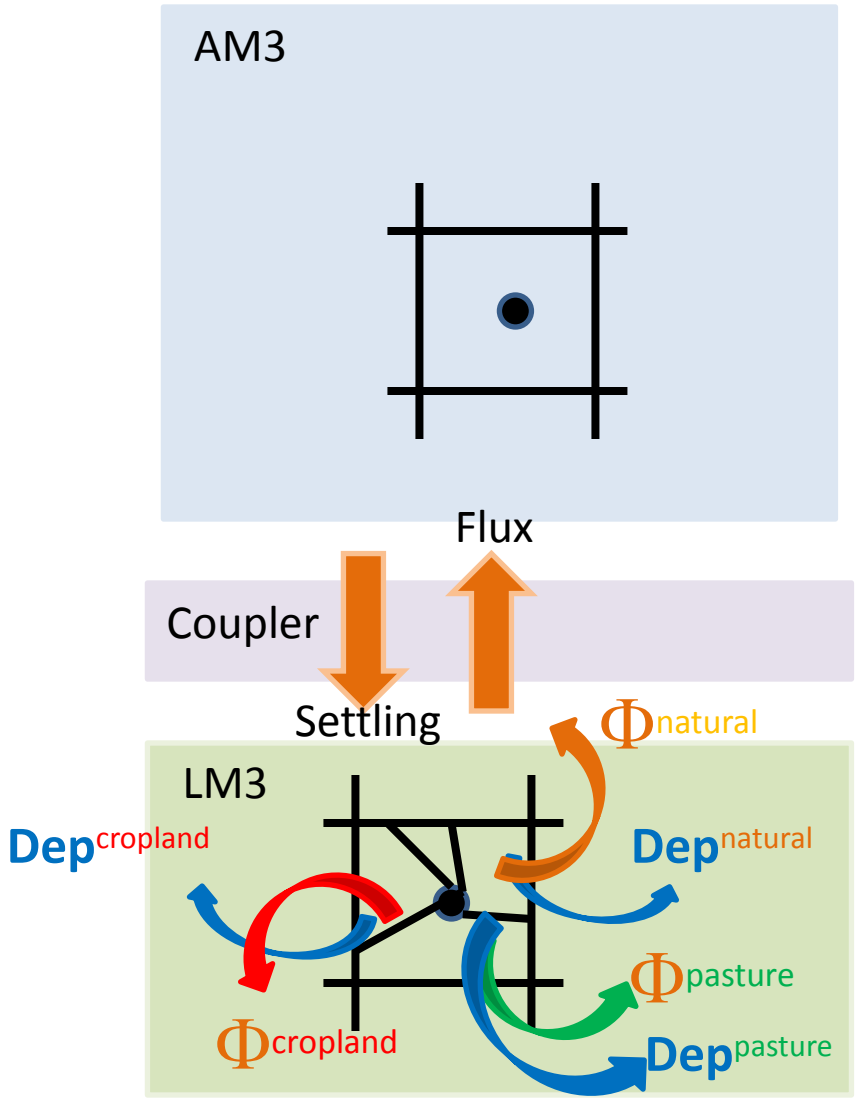
NH_3 hot spots collocated with dust

Annual mean MODIS DB dust (Ginoux et al., RoG 2012) and IASI NH3 (Clarisse et al., 2009)



Over one year of daily global observations of dust and NH_3 by MODIS and IASI, it appears that NH_3 hot spots (yellow contours) are collocated with dust load over pasture and cropland, which represents 20% of total dust load.

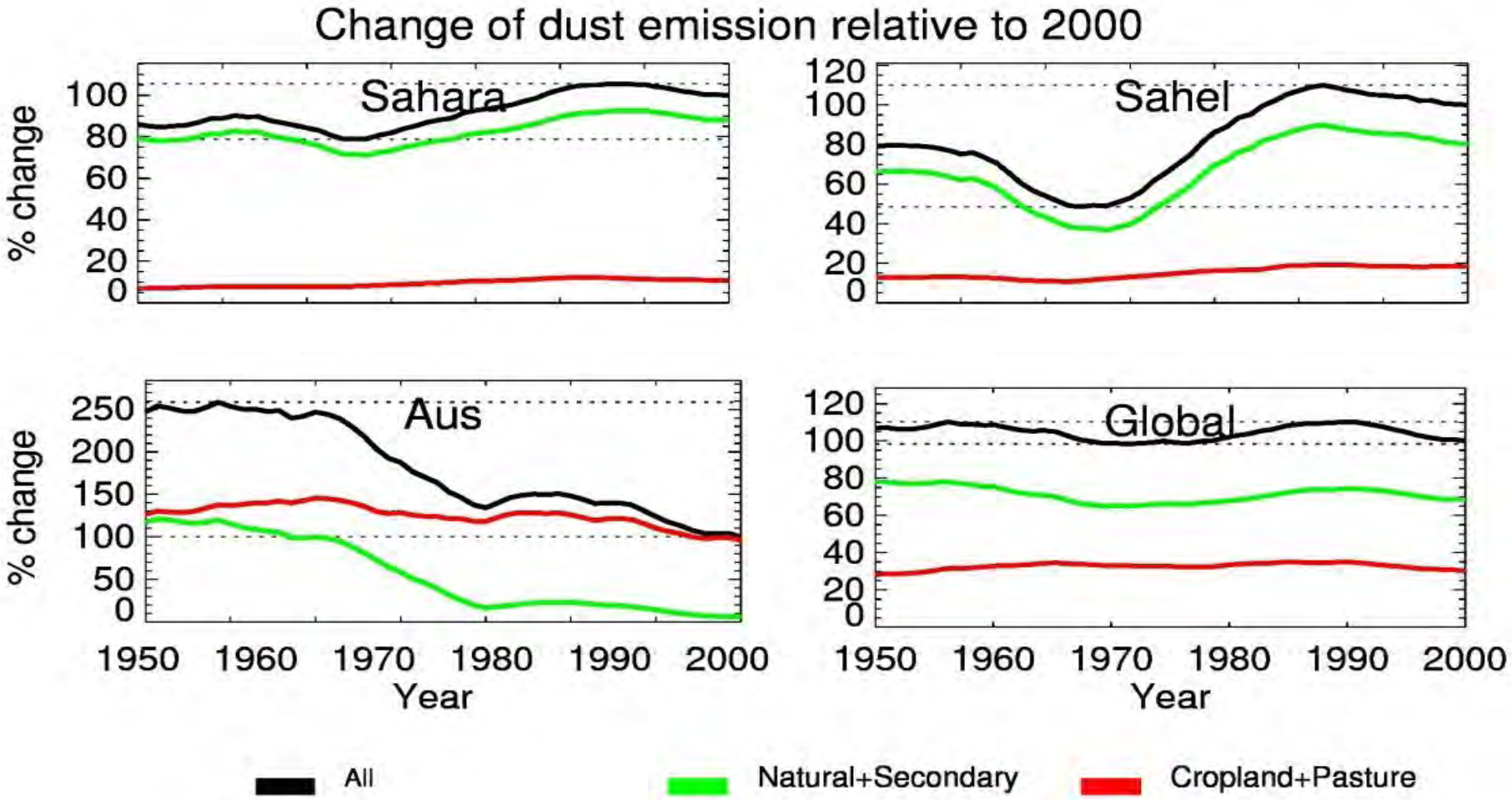
Implementing dust emission in LM3



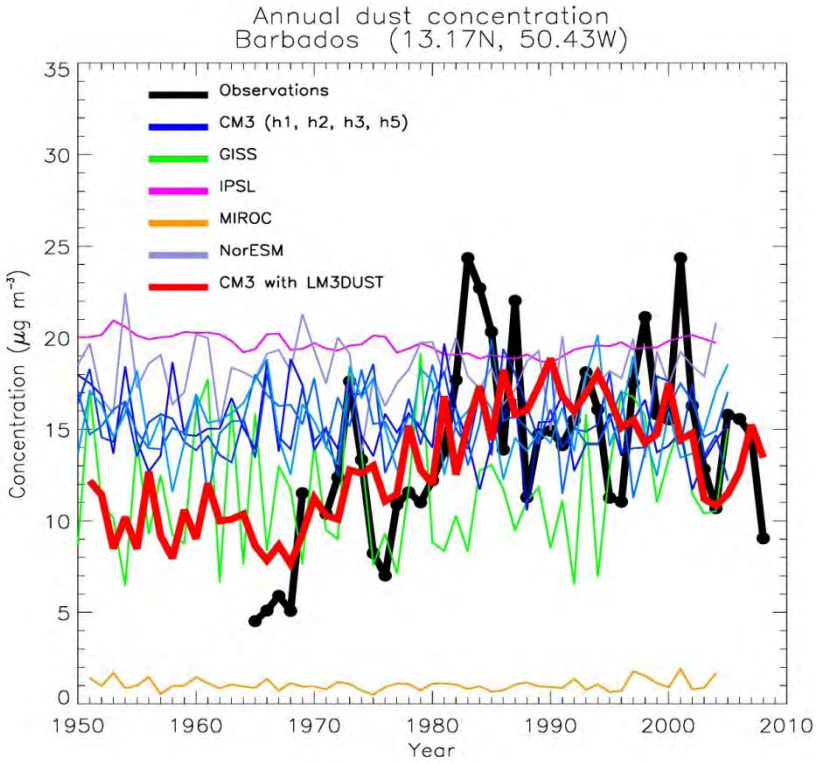
- Dust emission and deposition are calculated within each sub-grid tiles (natural, secondary vegetation, pasture and cropland) of LM3,
- Settling and convective fluxes are exchanged between the atmosphere and the canopy,
- The emission parameters were tuned to match present day dust properties with observations

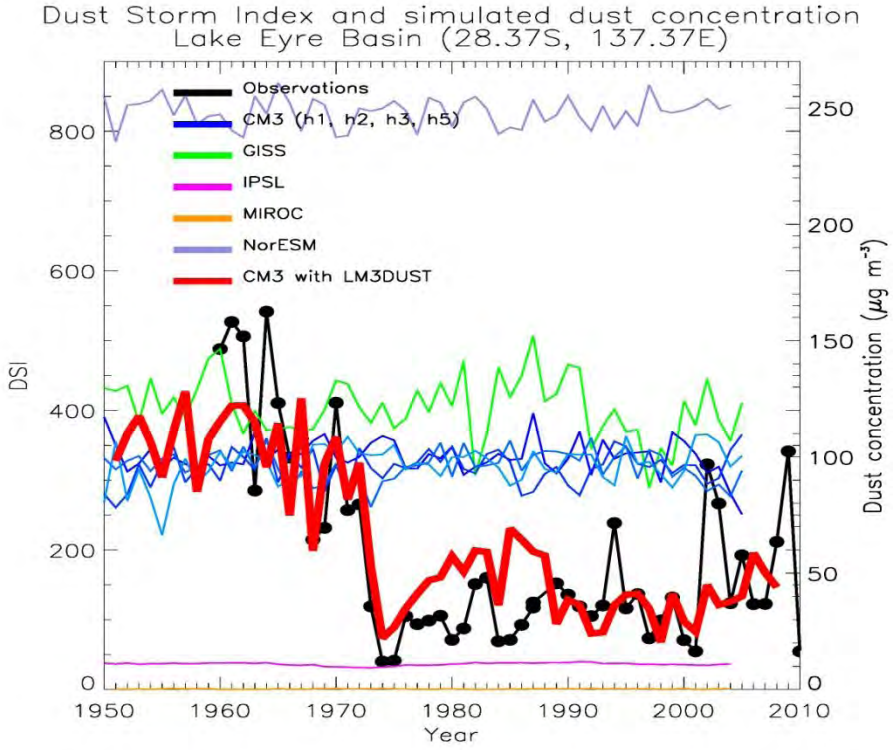
Ginoux P., Malyshev S., and E. Shevliakova, manuscript in preparation.

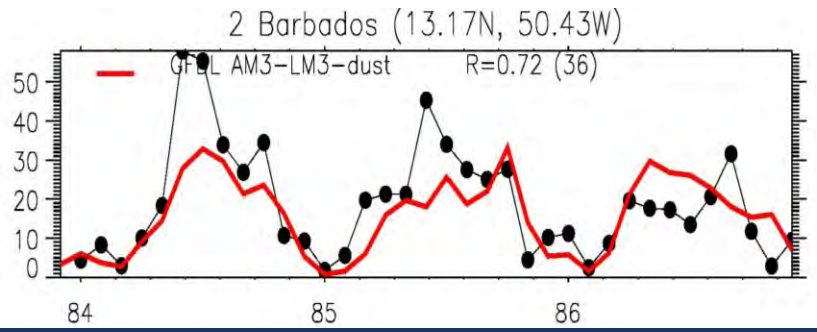
Time series of dust emission

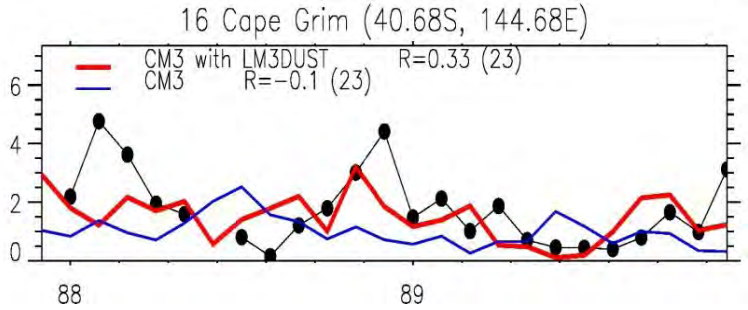


Dust decadal variability









Conclusions

- Satellite observations suggest a 20-25% contribution of dust from landuse to global emission, with large continental variability.
- GFDL dust source inventories have been shared with NOAA NWS, NASA GSFC and GISS, US Navy, US Air Force, and other national and international laboratories.
- Landuse and vegetation are two major drivers of dust decadal variability, which is now handled more correctly by implementing dust emission and deposition in LM3.

Aerosol Radiative Forcing