

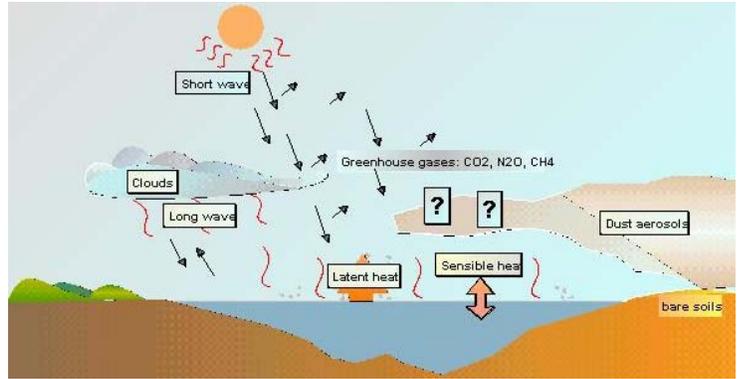
Sea Surface Heat Flux in the North Tropical Atlantic and aerosol deposition

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Dust Aerosol and Climate

- The North Tropical Atlantic is subject to wind transported dust aerosol affecting the radiative properties of the atmosphere and to some extent controlling the air-sea interface energy budget and regional climate.



Radiative impact of mineral dust

- Despite the recent notable advances in dust studies, radiative effects of dust remain poorly quantified due to both limited data and incomplete understanding of relative physical and chemical processes.
- It is recommended to perform comprehensive studies at targeted regions affected by mineral dust of both natural and anthropogenic origin.

JGR special section on mineral dust (08-2001)

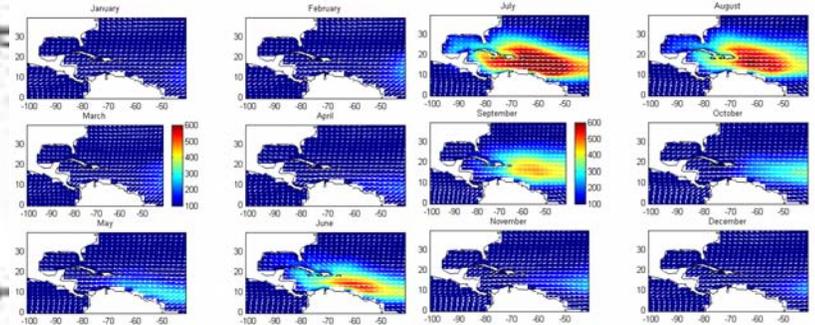
Our approach

- We combine 1981-1997 dust aerosol modeling results and concurrent energy balance computations to explore the regional relationship between sea surface heat exchange and dust.

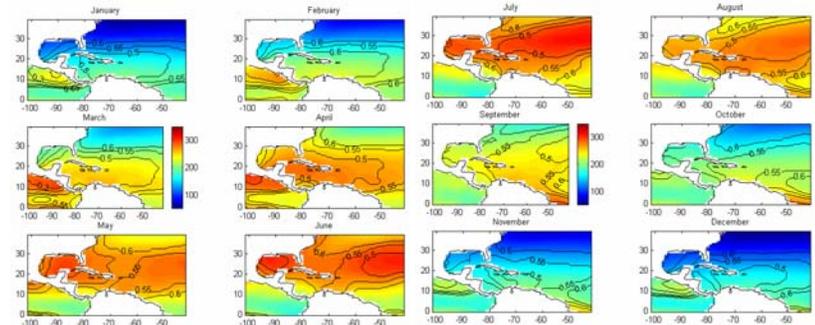
Modeled Dust Aerosols

- GOCART model (P. Ginoux, et al, 2001):
 - * Simulate global distributions of dust aerosols.
 - * All topographic lows with bare ground (e.g. Sahara dessert) are potential dust sources
 - * Reproduce the observed seasonal cycle of African dust plume over the Atlantic.

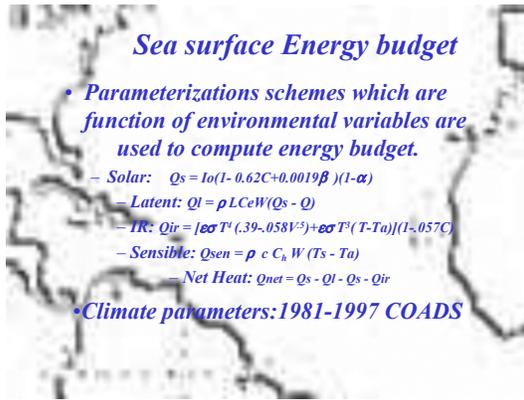
17 years Monthly Climatology: Modeled Dust Deposition



UWM-COADS Monthly Climatology



Solar radiation (Wm^{-2} , shade colors)
Clouds cover (tenths, contours)

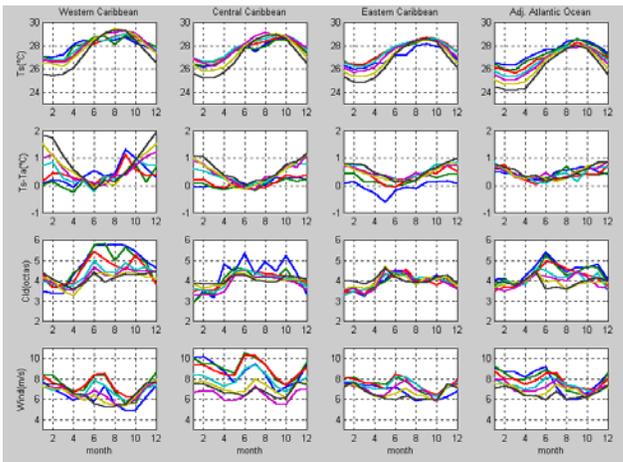


Sea surface Energy budget

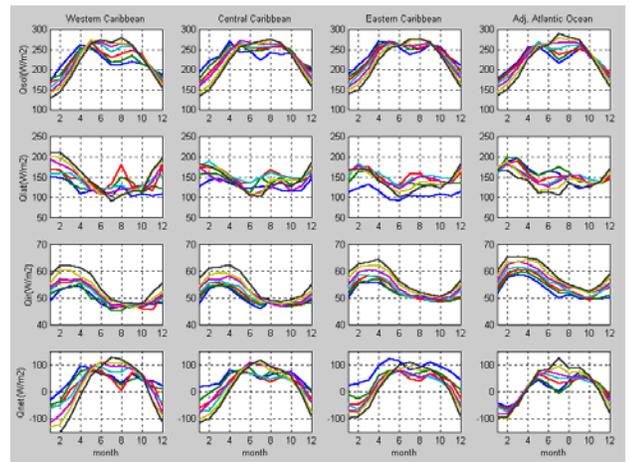
- Parameterizations schemes which are function of environmental variables are used to compute energy budget.
 - Solar: $Q_s = I_0(1 - 0.62C + 0.0019\beta)(1 - \alpha)$
 - Latent: $Q_l = \rho L C_e W(Q_s - Q)$
 - IR: $Q_{ir} = \epsilon \sigma T^4 (.39 + .058V^{.75}) + \epsilon \sigma T^3(T - T_a)(1 - .057C)$
 - Sensible: $Q_{sen} = \rho c C_h W(T_s - T_a)$
 - Net Heat: $Q_{net} = Q_s - Q_l - Q_s - Q_{ir}$
- Climate parameters: 1981-1997 COADS

1981-1997 COADS Climatology

Climate parameters

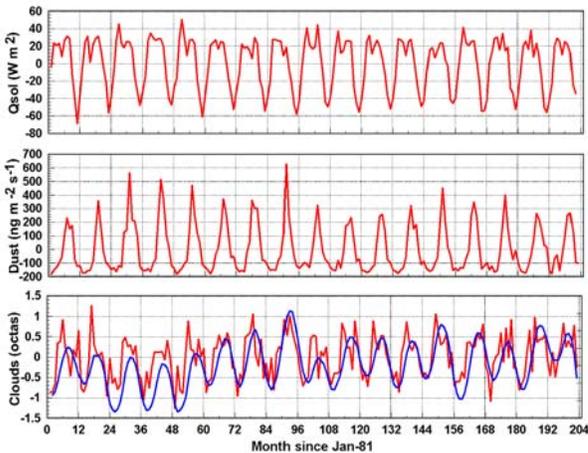


Sea surface energy balance



Conclusions

1981-1997 Anomalies Time Series



- 17 years COADS cloud cover shows interannual variability more pronounced in coastal than oceanic regions, while dust presents strong annual variation.

- When 6 months and lower periodicities are removed from clouds time series, the annual variation display good agreement with regional dust deposition.

- A positive correlation [0.6 - 0.8] was found between clouds and dust time series, suggesting that COADS cloud data include mineral dust aerosols in their observations.

- Existing parameterizations for short and long wave radiation does not consider aerosol effects by the time of this investigation. Keeping in mind the inclusion of dust in COADS clouds, we use bulk parameterization to compute sea surface energy.

- Since maximum in observed cloud cover, and dust concur with depressions in computed solar radiation and net heat flux we conjecture that mineral aerosols have a blocking effect on solar radiation affecting the sea surface heat flux in the Northwestern tropical Atlantic.