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Aerosol patterns and aerosol-cloud-interactions off the West African Coast based on the A-train formation

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In this study, spatial and temporal aerosol patterns off the Western African coast are characterized and related to cloud properties, based on satellite data
Atmospheric aerosols play a key role in atmospheric processes and influence our environmental system in a complex way. Their identification, characterization, transport patterns as well as their interactions with clouds pose major challenges. Especially the last aspect reveals major uncertainties in terms of the Earth's radiation budget as reported in the IPCC's Fourth Assessment Report (IPCC, 2007). Western and Southern Africa are dominated by two well-known source types of atmospheric aerosols. First, the Saharan Desert is the world's largest aeolian dust emitting source region. Second, biomass burning aerosol is commonly transported off-shore further south (Kaufman et al., 2005). Both aerosol types influence Earth's climate in different manners and can be detected by the MODIS (MODerate resolution Imaging Spectrometer) sensor onboard the EOS platforms as they propagate to the Central and Southern Atlantic.
The motivation of this study was to reveal the seasonal pattern of the Saharan dust transport based on an observation period of 11 years and trying to explain the meteorological mechanisms. North African dust plumes are transported along a latitude of 19°N in July and 6°N in January. The seasonally fluctuating intensities adapt to the annual cycle of wind and precipitation regimes. A strong relationship is found between the spatial shift of the Azores High and the Saharan dust load over the middle Atlantic Ocean. Monthly Aerosol Optical Thickness products of Terra MODIS and NCEP-DOE (National Centers for Environmental Predictions) Reanalysis II data are used for this purpose. The relationship between aerosol and cloud droplet parameters is blurred by high sensitivities to aerosol size and composition (Feingold, 2003; McFiggans et al., 2006) as well as meteorological context (Ackerman et al., 2004). Satellite data from the A-train formation, including the Aqua, CloudSat and CALIPSO (Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation) are used to analyze aerosol-cloud-interactions in detail, along with re-analysis data to constrain by meteorological conditions. Information about the vertical and geographical distribution of different aerosol types and cloud parameters will lead to a process-oriented understanding of these issues on a regional scale.

Ackerman, A., Kirkpatrick, M., Stevens, D., & Toon, O. (2004). The impact of humidity above stratiform clouds on indirect aerosol climate forcing. Nature, 432(December), 1014–1017. doi:10.1038/nature03137.1.

Feingold, G. (2003). First measurements of the Twomey indirect effect using ground-based remote sensors. Geophysical Research Letters, 30(6), 1287. doi:10.1029/2002GL016633

IPCC. (2007). Climate Change 2007: The Physical Science Basis. Contribution of Working group I to the Fourth Assessment Report of the Interfovernmental Panel on climate Change. Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Kaufman, Y. J., Koren, I., Remer, L. A., Tanré, D., Ginoux, P., & Fan, S. (2005). Dust transport and deposition observed from the Terra-Moderate Resolution Imaging Spectroradiometer (MODIS) spacecraft over the Atlantic Ocean. Journal of Geophysical Research, 110(D10), 1–16. doi:10.1029/2003JD004436

McFiggans, G., Artaxo, P., Baltensperger, U., Coe, H., Facchini, M. C., Feingold, G., Fuzzi, S., et al. (2006). The effect of physical and chemical aerosol properties on warm cloud droplet activation. Atmospheric Chemistry and Physics, 6(9), 2593–2649. doi:10.5194/acp-6-2593-2006