3.113 A Ten-year Remote Sensing Based Estimate of Dust Deposition and Loss Frequency into Tropical Atlantic Ocean and Caribbean Sea .

Presenting Author:
Hongbin Yu, NASA Goddard Space Flight Center, Greenbelt, MD, USA, hongbin.yu@nasa.gov

Co-Authors:
Mian Chin, NASA Goddard Space Flight Center, Greenbelt, Maryland, USA
Qian Tan, Bay Area Environmental Research Institute, Petaluma, California, USA
Huisheng Bian, University of Maryland Baltimore County, Baltimore, Maryland, USA
Dongchul Kim, USRA, Columbia, Maryland, USA
Zhibo Zhang, University of Maryland Baltimore County, Baltimore, Maryland, USA
Tianle Yuan, University of Maryland Baltimore County, Baltimore, Maryland, USA
Ali Omar, NASA Langley Research Center, Hampton, Virginia, USA
Dave Winker, NASA Langley Research Center, Hampton, Virginia, USA
Lorraine Remer, University of Maryland Baltimore County, Baltimore, Maryland, USA
Robert Levy, NASA Goddard Space Flight Center, Greenbelt, Maryland, USA
Ralph Kahn, NASA Goddard Space Flight Center, Greenbelt, Maryland, USA
Olga Kalashnikov, NASA Jet Propulsion Laboratory, Pasadena, California, USA
Laurent Crepeau, Laboratoire de Météorologie Dynamique, Palaiseau, France
Virginie Capelle, Laboratoire de Météorologie Dynamique, Palaiseau, France
Alain Chedin, Laboratoire de Météorologie Dynamique, Palaiseau, France

Abstract:

Massive dust emitted from North Africa can transport long distances across the tropical Atlantic Ocean, reaching the Americas. Dust deposition along the transit adds microorganisms and essential nutrients to marine ecosystem, which could increase the productivity of the ecosystem and CO_2 uptake, modulate biogeochemical cycle, and influence climate. Assessment of the dust-ecosystem–climate interactions has been hindered in part by the paucity of dust deposition measurements particularly in open oceans, and large uncertainties associated with representing dust processes in models. Over the past decades, satellite remote sensing capabilities of measuring aerosol optical depth (AOD) and particle size and shape properties have been significantly enhanced, which offers an opportunity of distinguishing dust from other types of aerosol and derive the dust deposition into ocean. In this study, we combine CALIOP 3-D distributions of dust extinction with dust optical depth (DOD) from MODIS, MISR, and IASI to quantify dust transport and deposition over the tropical Atlantic Ocean and Caribbean Sea from 2007 to 2016. On the basis of the ten-year average, the yearly dust deposition into tropical Atlantic Ocean and Caribbean Basin is 84-135 Tg. The dust deposition shows large spatial

and temporal (on seasonal and interannual scale) variability. The satellite observations also yield an estimate of annual mean dust loss frequency of 0.052 ~ 0.073 d^{-1}, which is higher in winter than summer. This satellite-based estimate of dust loss frequency is 2-8 times lower than model simulations of 0.16 – 0.42 d^{-1}, which is being used to constrain parameterizations of dust removal processes in the GEOS-5 model. Preliminary result shows that such constraint significantly improves agreement between the GEOS-5 simulations and aircraft observations of trans-Atlantic dust transport during the AToM campaign.