Press Releases

January 7, 2016
JAMSTEC

"Dakar Niño/Niña" Phenomenon Identified for First Time off West African Coast
~A new path to seasonal predictability~

Overview

Dr. Pascal Oettli, Dr. Yushi Morioka and Dr. Toshio Yamagata from the Application Laboratory at the Japan Agency for Marine-Earth Science and Technology (JAMSTEC: Asahiko Taira, President) identified the existence of an ocean-land-atmosphere coupled phenomenon off the coast of Senegal for the first time. Similar to coastal Niño/Niña, the phenomenon is called Dakar Niño/Niña.

In this region trade winds transport coastal surface water toward the open ocean. This is counterbalanced by upwelled cold and nutrient-rich water, generating one of the major eastern boundary upwelling systems. This coastal upwelling system makes the area a rich fishing ground. However, a warming of the upper ocean may significantly impact the coastal ecosystem.

Using reanalysis data over the period of 1982-2011, the study group investigated the interannual variability of the sea-surface temperatures (SST). As a result, six warm events (1983, 1984, 1997, 1998, 2008 and 2010) and five cold events (1985, 1986, 1999, 2003 and 2009) have been identified. A warm event is described as Dakar Niño, and a cold event Dakar Niña. Moreover, the group also found that the atmospheric pressure anomaly above the warm SST anomaly may generate ocean-land pressure contrast that maintains the alongshore wind anomaly and thus induce the ocean-land-atmosphere coupled feedback (coastal Bjerknes feedback).

JAMSTEC's Application Laboratory has identified similar coupled ocean-atmosphere phenomena such as Ningaloo Niño/Niña (as reported on October 8, 2013) and California Niño/Niña (as reported on April 25, 2014). Like these phenomena, the Dakar Niño/Niña is likely to have impacts on regional weather and wider climate, which might affect marine ecosystems and the fishery industry along the coast. If the mechanism of these costal Niño/Niña phenomena is further clarified and incorporated into prediction models along with large-scale phenomena such as El Niño in the Pacific Ocean and the Indian Ocean Dipole Mode, it is expected to lead to more accurate prediction of climate variability that causes extreme weather phenomena.

The above results were published in *Scientific Reports* on January 7, 2016 (JST).
Title: A Regional Climate Mode Discovered in the North Atlantic: Dakar Niño/Niña
Authors: OETTLI Pascal[1], Yushi Morioka[1], Toshio Yamagata[1]
1 Application Laboratory, JAMSTEC

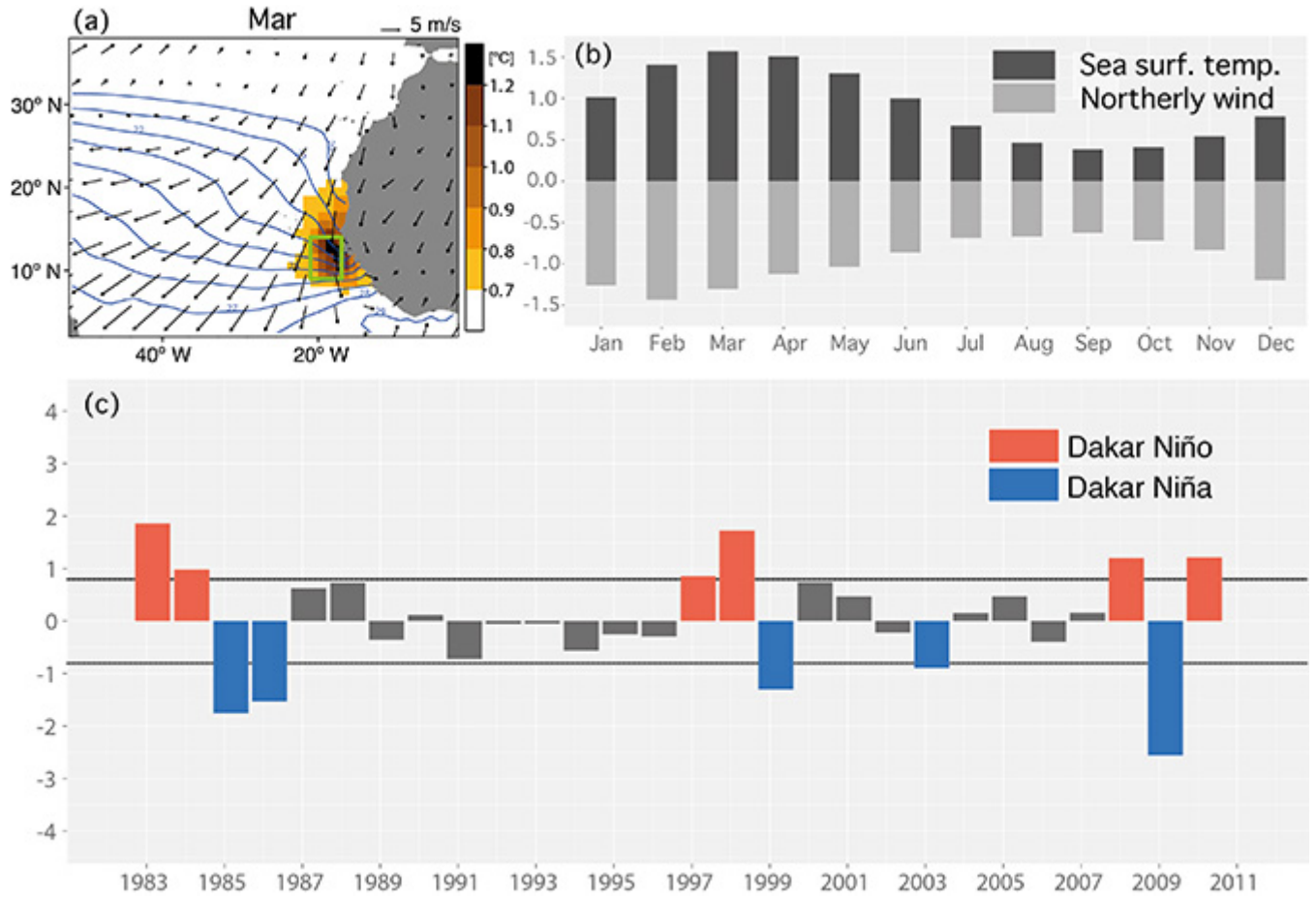

Figure 1: (a) Mean of SST (contour) and costal wind (arrows), and standard deviation of SST (colored) in March; (b) Monthly standard deviation of area-averaged SST (shown with green in the figure a) in the coast off Dakar and meridional wind. The values are normalized with standard deviation. For the interpretation, positive values of meridional wind correspond to northerly wind; (c) Normalized Dakar Niño/Niña index in March. The values are normalized with standard deviation. The solid line shows 0.8 standard deviation. Years above the solid line are defined as Dakar Niño/Niña.

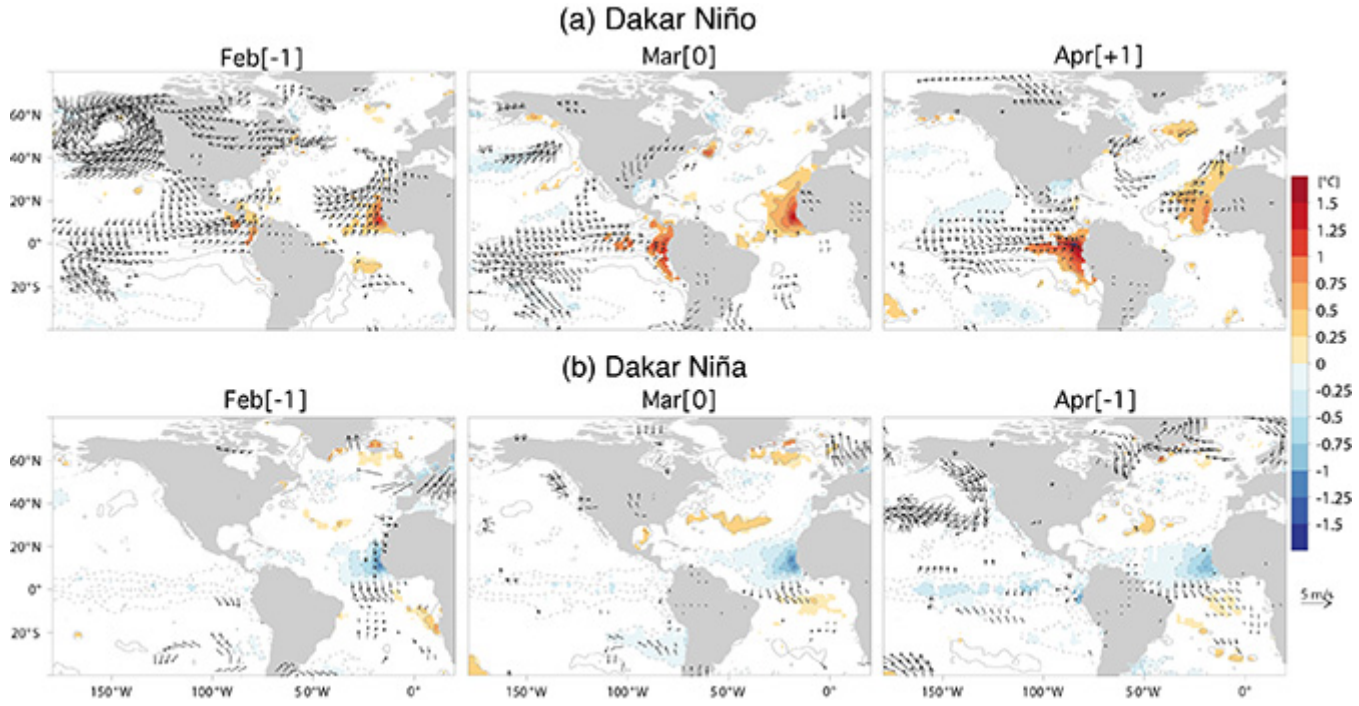

Figure 2: Composite analysis of SST (contour and shading) and surface wind (arrows) anomalies (deviation from normal value) during (a) Dakar Niño and (b) Dakar Niña

from February to April. Significant SST anomalies are shaded. Only wind values significant at the 95% confidence level are shown here.

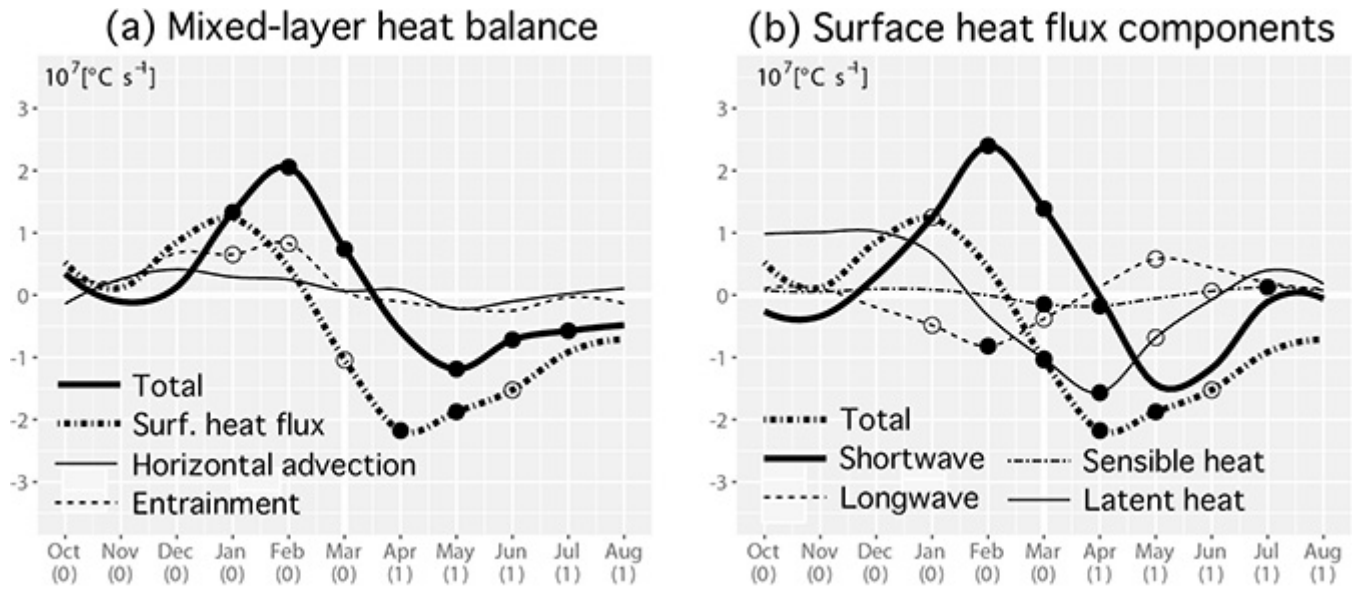

Figure 3: (a) Mixed-layer heat balance during Dakar Niño. Values significant at the 90% and 80% confidence level are denoted by a filled circle and an open circle, respectively; (b) surface heat flux contribution during Dakar Niño.

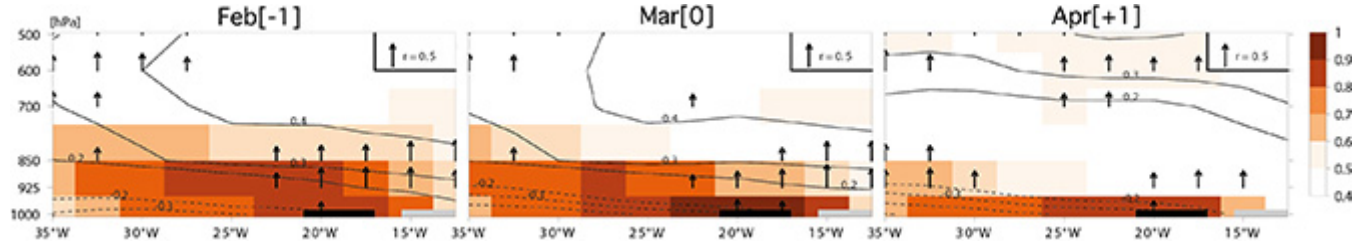

Figure 4: Vertical cross-section of lead-lag correlation coefficients between the Dakar Niño/Niña index in March and anomalies in air temperature between February and April (color), geopotential height (contour) and vertical velocity (arrow). The location of the Dakar Niño/Niña is shown with a black rectangle, and that of the land a grey rectangle.

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