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An Idealized Two-dimensional Study of the West African Monsoon

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The West African Monsoon (WAM) is characterized at first order by a strong zonal symmetry of surface conditions (albedo, vegetation, rainfall) and atmospheric conditions leading us to used a two-dimensional numerical to investigate its basic physics. After 15 days of simulation a quasi steady state is reached, comparable to the zonal mean circulation between 10W and 10E during a typical July month. Temperature and humidity advections not represented in a zonally symmetric framework must be taken into account in the model to obtain a monsoon regim with the main characteristics of the WAM. Sensivity tests to the advections and desertic aerosols distributions are performed revealing the main role the heat low plays in the monsoon northward propagation.

The advective terms are prescribed as constant external forcing and tend to cool and moisten the surface in the saharan region and to warm and dry the layer just above. The strong cooling at the surface reinforce the north-easterly wind (harmattan) which has a blocking effect on the monsoon inland penetration. The dry layer alsotends to increase the radiative sink in the heat low thus leading to subsiding motion that inhibits convection. The effect of desertic aerosols is also investigated by shifting the maximum of their distribution at a higher height (700 m for the control run / 2000m in the sensitivity experiment). We thus mimic the effect of dust transport by dry convection when the heat low is active and a non negligeable effect of aerosols is found to affect the thermal balance of the heat low, trough their radiative effect.

This study aimed to better understand the WAM during a well established regim. Our further works will deal with the WAM seasonnal cycle. The way it is influenced by temperature and moisture advections and the interactions with the continental surface will then be explored.