



## Instrumental evidence of an increasing trend of the Australian monsoon strength since the 19th Century

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Northern Australia experiences a strong monsoon cycle. Beginning in October, the winter southward wind regime starts to decline and by December and up to March, a strong westerly regime is steadily established in northern Australia originating the monsoonal rainfalls. The strength of this monsoon is usually measured by the zonal wind at the 850 hPa level averaged over the 5S–15S, 110E–130E area, but prior to the mid 20th Century, direct wind observations are scarce over this region and the index is considered to be unreliable. There have been attempts to construct monsoon indices using precipitation at Darwin, but the correlation between the monsoon strength measured by the winds and the Darwin precipitation is not very large and the use of dynamical indices based on wind is preferred to characterise the Australian Monsoon.

In this work we present the first instrumental index (AMDI) of the Australian Summer Monsoon covering two centuries (1816–2014) based in wind direction observations taken aboard sailing ships, stored in logbooks and distributed in the ICOADS database (International Comprehensive Ocean-Atmosphere Data Set). We show that the monthly persistence of westerly winds (wind direction between 225 and 315 degrees from the true north) in the equatorial Indian Ocean is well correlated with the average zonal wind at 850 hPa ( $r=+0.71$ ,  $r=+0.69$  and,  $r=+0.74$  for December, January and February respectively,  $p<0.01$  in all cases) and is highly representative of the monsoonal moisture advection related to precipitation occurrence in Northern Australia. The AMDI series reproduces the known tendency toward stronger monsoons along the second part of the 20th Century and interestingly, it suggests that during the 19th century the Australian monsoon was significantly weaker than today.

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