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On the unstable ENSO-Western North Pacific Monsoon relation during the 20th Century

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The concept of the Western North Pacific Summer Monsoon (WNPSM) appeared for the first time in 1987. Unlike the Indian Summer Monsoon and the East Asian summer monsoon, the WNPSM is an oceanic monsoon driven essentially by the meridional gradient of sea surface temperature. Its circulation is characterized by a northwest-southeast oriented monsoon trough with intense precipitation and low-level southwesterlies and upper-tropospheric easterlies in the region [100º-130º E, 5º-15ºN]. Although this monsoon is mainly oceanic, it modulates the precipitation of densely populated areas such as the Philippines.

To date, the WNPSM has been quantified by the so-called Western North Pacific Monsoon Index (WNPMI), an index based on wind anomalies over large domains of the Western Pacific. The requirement of continuous observed wind over remote oceanic areas to compute the WNPMI has limited its availability to the 1949-2014 period. In this work we have extended the index by almost 100 years by using historical observations of wind direction taken aboard ships. Our Western North Pacific Directional Index (WNPDI), is defined as the sum of the persistence of the low-level westerly winds in [5º–15ºN, 100º–130ºE] and easterly winds in [20º–30ºN, 110º–140ºE]. The new WNPDI index is highly correlated to the existent WNPMI for the concurrent period (1948-2014). ($r=+0.88$, $p<0.01$), indicating that the new approach based in the use of wind direction alone (a variable that can be considered instrumental even before the 20th Century), captures most of the monsoonal signal.

Previous studies found that, during the second part of the 20th Century the WNPSM exhibited two basic characteristics: first a large interannual variability and second, a significant relation between the WNPSM and the El Niño/Southern Oscillation (ENSO) in a way in which a strong (weak) WNPSM tends to occur during the El Niño (La Niña) developing year or/and La Niña (El Niño) decaying year. The analysis of our extended series suggests a more complex scheme. We have found evidences of a persistently strong WNPSM during 1918-1948, a period in which the WNPSM was considerably less variable than today and a change in the ENSO-WNPSM relation during the first half of the 20th Century, with a reversal in the sign of the WNPSM-ENSO correlation for ENSO decaying years. These changes seem related to an alteration in the timing of the ENSO events between the first and the second parts of the 20th century.

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