



Project INCITE: Tracking the monsoon history before the 20th Century

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A monsoon is usually defined as a seasonal reversal in the low-level winds associated with a large precipitation contrast between wet summers and dry winters. Indices measuring the monsoon strength are essential to characterize its variability and they are usually based on observed winds (at 850 hPa) or gauge precipitation at key areas. Currently, the longest series based on wind are constructed from reanalysis products and they start in the mid 20th century. Monsoon indices based on precipitation are longer and can go back as early as the beginning of the 20th Century in some cases (e.g. the Indian Summer Monsoon or the West African Summer Monsoon). The analyses of these monsoon indices have demonstrated that monsoons exhibit significant interdecadal fluctuations in their strength or onset dates. Due to their high societal and climatic impacts, characterizing the monsoon variability for longer periods than those currently available is essential. However, it is nearly impossible to find systematic instrumental measurement of wind speed or observed precipitation before the 20th century for most of the areas affected by the monsoon.

The only truly instrumental measurement recorded on a regular basis over large areas is the wind direction. Since early times, thousands of sailing ships have circumnavigated the globe, recording in their logbooks, on a daily basis, the observed wind direction at their location. Currently, as a result of several international projects, thousands of these logbooks have been digitized and the corresponding wind directions observations incorporated in databases such as ICOADS (International Comprehensive Ocean-Atmosphere Data Set).

Recently, it has been demonstrated (DOI: 10.1007/s00382-013-1957-8) that indices based on wind direction alone (the so called “directional indices”) are able to characterize with remarkable precision the atmospheric moisture transport related to the wind variability. Monsoons are obvious candidates to be tracked by directional indices and this fact motivated the development of the project INCITE (INstrumental Climatic Indexes. Application to the study of the monsoon-Mediterranean TEleconnection), which among its objectives had the generation of the long instrumental indices for the West African monsoon the Indian Summer Monsoon, the Western North Pacific Summer Monsoon and the relationship of these monsoons with the extratropical climate at secular scale.

The aim of this presentation is to show the fundamentals of directional indices and its relation with moisture transport and, in consequence, their capability to quantify the monsoon strength as early as the 18th Century. We will illustrate the presentation with some of the main results obtained through the INCITE project relative to the West African Monsoon, the Indian Summer monsoon onset, the Australian Monsoon or the Western North Pacific Summer Monsoon.

The results show that the use of the directional indices: i) allow generating monsoon series longer than those previously available and ii) uncover low frequency variability features which were previously unknown, such as a persistent period of strong West African Monsoon during the second half of the 19th Century or the significant change of the relation of the Western North Pacific Summer Monsoon with the El Niño/Southern Oscillation through the 20th Century.

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