

The Southern Oscillation was discovered in India

History Article

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Introduction

This year's ENSO episode has been very much in the news because of its unusually high intensity and the adverse impact it has had on the Indian summer monsoon rainfall. For the public at large, the warming of the waters of the equatorial Pacific Ocean, is better known as El Nino which is the Spanish word for Baby Jesus, as the warming near the Peru coast generally peaks around Christmas. The pressure component of ENSO, however, is not much talked about, and it is not commonly known that the Southern Oscillation was in fact discovered in India in the 1920s by Gilbert Walker.

Sir Gilbert Walker

The India Meteorological Department was established in the year 1875 and it was headed by British meteorologists until 1944. Gilbert Walker was the Director General of IMD for 20 years from 1904 to 1924. Gilbert Thomas Walker was born on 14 June 1868 and grew to be a brilliant mathematics scholar at Cambridge, a Senior Wrangler in 1889, and a Fellow of Trinity College in 1891. Walker worked in many fields, including the path of projectiles and boomerangs, but his main interest was in electromagnetism and one of his papers in this subject got him the coveted Adams Prize in 1899.



Soon after assuming charge as the Director General of IMD, Walker was elected a Fellow of the Royal Society and received the Sc. D. degree from Cambridge University. In 1918, Walker was elected as President of the Asiatic Society of Bengal and President of the Indian Science Congress. Walker had also been a member of the Board of Governors of the Indian Institute of Science, Bangalore. In 1911, Walker was awarded the title of Companion of the Order of the Star of India (CSI) and he was knighted in 1924, the year of his retirement.

Monsoon teleconnections

Gilbert Walker, the mathematician-turned-meteorologist, lived decades ahead of his times. During Walker's tenure the headquarters of IMD were in Simla, a hill station in north India. Communication with the outside world was through postcards and letters, and telegrams were the fastest means of acquiring meteorological data. There were no weather satellites, no computing aids, and no numerical models. Notwithstanding this situation Walker collected and analysed voluminous data recorded over land and ocean from across the world. He was able to establish the fact that the Indian monsoon was not an isolated system but had strong teleconnections with the global climate. He applied statistical techniques to the foreshadowing of Indian monsoon rainfall using antecedent parameters measured in different parts of the world. Walker used parameters as varied as the Himalayan snowfall, Zanzibar rainfall, South American pressure, level of the river Nile, sunspot activity, and icebergs in the southern Indian Ocean, and built sound statistical models for long range forecasting of Indian monsoon rainfall.

Southern Oscillation

During the course of his research on the Indian monsoon, Walker studied the variations of various weather elements worldwide. What he found was that there were see-saw connections of the atmospheric pressure at different places and he gave them the name "oscillations". These oscillations did not have an exact periodicity but they did have an association with global weather. Walker's research brought out the existence of three different oscillations, which he described as the Southern Oscillation, the north Atlantic Oscillation and the north Pacific Oscillation.

Walker described the Southern Oscillation as a tendency of pressure at stations in the Pacific (San Francisco, Tokyo, Honolulu, Samoa, and south America) and rainfall of India (and Java, Australia and Abyssinia) to increase, and the pressure in the region of the Indian Ocean (Port Darwin, Mauritius, SE Australia and the Cape) to simultaneously decrease. By computing the correlation coefficients between various pairs of parameters Walker found that south America was an active centre that controlled subsequent conditions in other regions. Walker observed that conditions in the Indian Ocean also affected each other closely but they exercised comparatively little influence on the region of the Pacific Ocean. He also expressed the need to have data over the Antarctic and also upper air data for more definitive results to be obtained.

Northern Oscillations

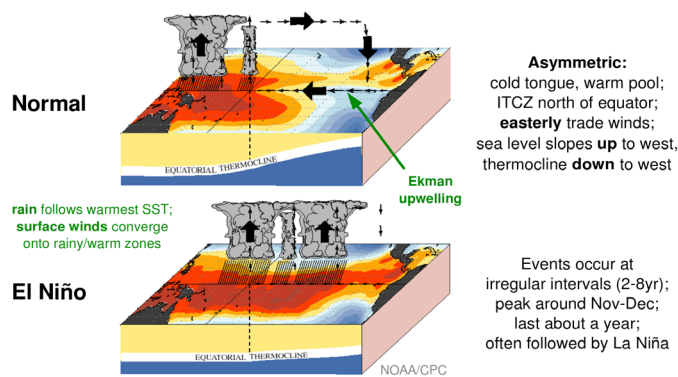
Walker named two Northern Oscillations, one over the north Atlantic ocean and the other over the north Pacific ocean. Even at that time some work had already been done in this field by a few other scientists. The general observation was that an accentuated pressure difference between the Azores and Iceland in autumn and winter was associated with a strong circulation of winds in the Atlantic and a strong Gulf stream, among other things. Conditions in the north Pacific showed a close resemblance to those in the north Atlantic. However, Walker was able to establish strong correlation coefficients between various elements.

Walker's memory

Sir Gilbert, on his retirement from IMD and return to England, worked as Professor of Meteorology at the Imperial College

of Science and Technology, London. Here he continued his research on varied subjects like convection in unstable fluids, formation of clouds, and flight of birds. He was the President of the Royal Meteorological Society in 1926-27. Sir Gilbert died at the age of 90, on 4 November 1958.

Walker's memory has been perpetuated by the global meteorological community by naming the east-west circulation over the eastern Pacific Ocean as the "Walker Circulation". In 2006, the University of Reading established a research institute dedicated to the memory of Sir Gilbert Walker, and named it as the Walker Institute for Climate System Research.



Schematic of the El Niño Southern Oscillation

Further Reading

1. Indian Met. Soc. 1986, "The two northern oscillations" and "The southern oscillation", Sir Gilbert Walker Selected Papers Long Range Forecasting of Monsoon Rainfall, 223-240.
2. Royal Met. Soc. at www.rmets.org/publication/classics/cp2.php.
3. Royal Met. Soc. at www.rmets.org/pdf/walkergt.pdf
4. Walker Institute at www.walker-institute.ac.uk/media/GILBERT_WALKER.pdf.