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Tittle : Perturbations in the Earth's atmosphere over Indian region during total solar eclipse on 22ndJuly 2009

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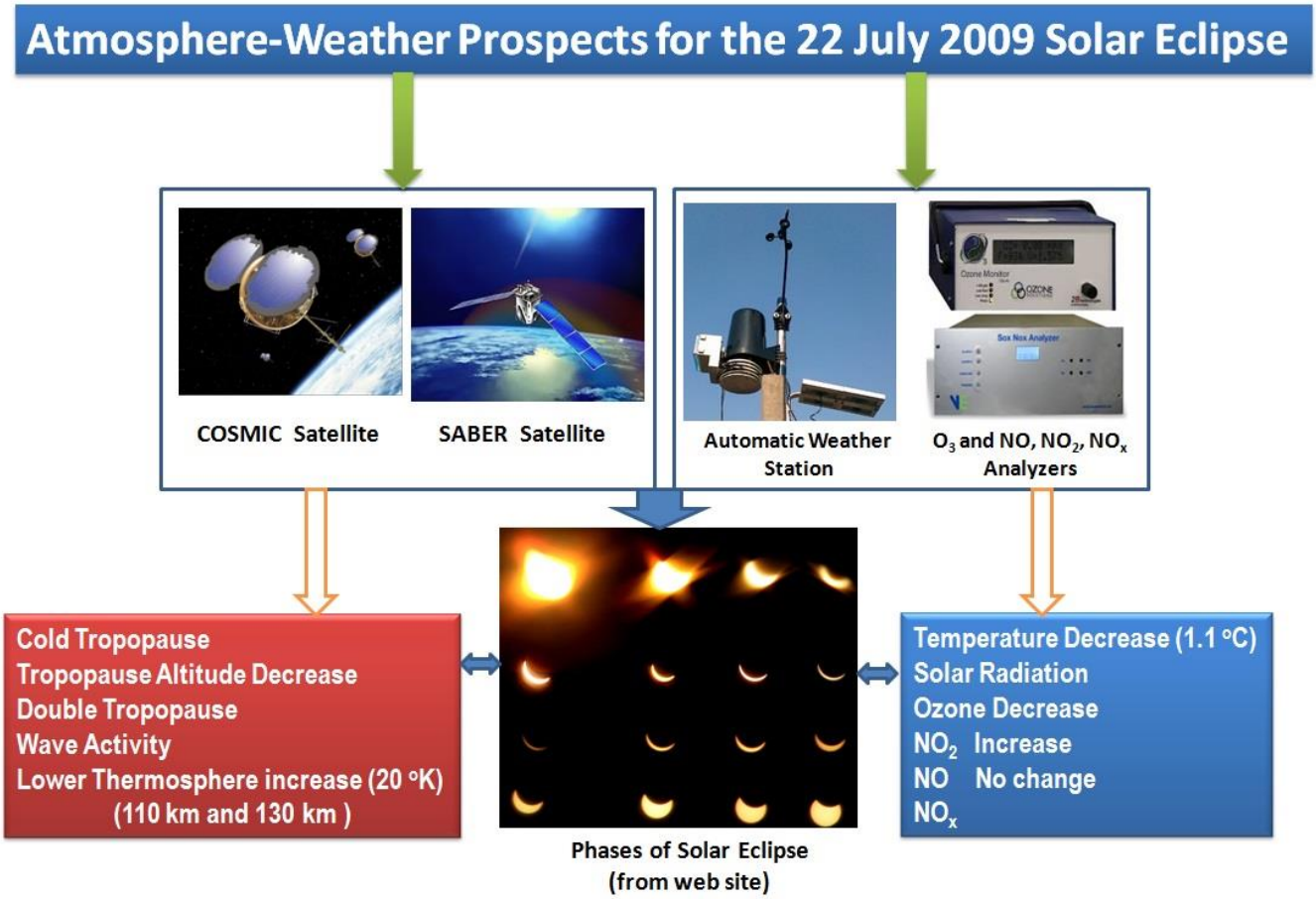
Abstract:On Wednesday, 2009 July 22, an exceptionally long total eclipse of the Sun is visible from within a narrow corridor that traverses the Eastern Hemisphere. The path of the Moon's umbral shadow begins in India and crosses through Nepal, Bangladesh, Bhutan, Burma, and China. After leaving mainland Asia, the path crosses Japan's Ryukyu Islands and curves southeast through the Pacific Ocean where the maximum duration of totality reaches 6 min 39 s. The main objectives of this research article is to understand the atmospheric effects on solar eclipse mainly focusing on meteorological parameters, photochemistry, boundary layer physics, surface and total columnar ozone. To understand the behavior of 22 July, 2009 solar eclipse event an emphasis is also given to understand the response of the atmosphere to the abrupt change of the solar radiation by means of surface meteorological (such as temperature, wind speed, direction and strength, humidity, and cloudiness), physical and chemical parameters (Ozone) and on the signals found in the ionosphere and the stratosphere. For this purpose, an experiment was conducted on 22 July, 2009 total solar eclipse by using Automatic Weather Station, Magnetometer, Ozone analyzer observations at Kadapa and Constellation Observing System for Mesosphere, Ionosphere and Climate (COSMIC) Global Positioning System (GPS) radio occultation (RO) and Sounding of the Atmosphere using Broad Emission Radiometry (SABER) on-board the Thermosphere Ionosphere Mesosphere Energetics and Dynamics (TIMED) satellite. Atmospheric perturbations due to the total solar eclipse were monitored to understand its influence on the meteorological parameters from surface to the Mesosphere over Indian region. Surface observational results over Kadapa indicate reduction of temperature resulted in the decrease in the solar radiation intensity is 1.1^{o}C when compared with the control [preceding and succeeding (21 July, 2009 and 23 July, 2009)] days. The mixing ratio of O_3 started to increase again with the increase of solar radiation. NO_x mixing ratios are observed to increase gradually from the onset of the eclipse, reached to their maximum value during the maximum obscurity phase of the eclipse, and then decreased towards the end of eclipse. In addition, radio occultation temperature profiles by COSMIC/FORMASAT-3, and Thermosphere Ionosphere Mesosphere Energetics and Dynamics (TIMED) satellite data are also used to explore the impact of solar eclipse on the dynamics of atmospheric region from tropopause to thermosphere. High vertical resolution satellite data fromCOSMIC observations revealed that during solar eclipse day, tropopause was bit cooler with twin peaks (double tropopause). The lower thermosphere between 110 and 130 km became warmer during the eclipse day, which is attributed to dynamical response of the region induced by solar eclipse. Current observations provide very fine scale variation of the atmospheric parameters both in time and height a few hundred km away from the solar eclipse path, which constitutes a new set of results.

Mind map:


Atmosphere-Weather Prospects for the 22 July 2009 Solar Eclipse
COSMIC Satellite
SABER Satellite
Automatic Weather Station
O_3 and NO, NO_2, NO_x Analyzers
Cold Tropopause
Tropopause Altitude Decrease
Double Tropopause
Wave Activity
Lower Thermosphere increase (20 °K)
(110 km and 130 km)
Phases of Solar Eclipse
(from web site)
Temperature Decrease (1.1 °C)
Solar Radiation
Ozone Decrease
NO_2 Increase
NO No change
NO_x