TSI Sun-Climate Prediction Theory

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Practical solar-based weather and climate forecasting is now possible due to cumulative advances in TSI, solar, and climate data collection and distribution. Sunspot number and F10.7cm flux forecasts from the NOAA Space Weather Prediction Center (SWPC) were used by the author to successfully predict the onset of the 2015/16 El Nino, the subsequent decline and the year-to year HadSST3 change at year end, based on deviations from his TSI-ocean warming threshold of 1361.25 W/m^2 (SORCE 1AU) determined in 2014/15, and on empirically derived year-year TSI forecasted changes. Early hard winters were forecast in Dec 2018 based on extended low TSI, to last until TSI rises above this threshold. Predictions of future TSI to judge the timing and severity towards either extreme in TSI away from the 90-day mean and 1361.25 W/m^2 threshold are based on solar data, prior history, and center disk coronal holes. The equivalent v2 sunspot number to 1361.25 is 95, and 120 sfu for observed F10.7cm flux. Longer-term forecasts involve projections of a cumulative sum of the indice above or below the respective warming threshold for a realistic range of estimated solar activity indices, modeled on former solar cycles. A typical solar cycle onset El Nino is anticipated from the TSI rise in solar cycle 25, likely in 2020. The role of clouds is connected to the Multi-Variate ENSO Index (MEI) and Central Pacific Outgoing Longwave Radiation (CP OLR), all connected to solar activity. This new cycle onset ENSO ends with a typical La Nina in 2021±1 year, at the lowest point of the cumulative threshold-based solar input. The ocean then warms by 0.5°C/W/yr after TSI reaches the threshold, governed by the rate and strength of ascending phase magnetic activity, followed by TSI declining phase ocean cooling and increasing ice risk if cycle 25 is very weak.