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PENTICTON SOLAR RADIO FLUX VALUES (from SGD Explanation of Data Reports)

Daily Solar Flux Values - Penticton -- Daily measurements of the integrated emission from the solar disc at 2800 MHz (10.7cm wavelength) have been made by the National Research Council of Canada (NRCC) since 1947. Until May 31, 1991 the observations were made at the Algonquin Radio Observatory, near Ottawa. Over 1990-1991 the program was transferred to the Dominion Radio Astrophysical Observatory, near Penticton, British Columbia. From June 1, 1991, the data have originated from that location.

Accurate spot determinations of the 10.7-cm flux (actually a flux density) are made at local noon; previously 1700 UT at Ottawa and now 2000 UT at Penticton. The flux monitors have 1.8-m paraboloidal antennas, which are equally sensitive to all points on the solar disc, and are equipped to measure emissions which are linearly-polarized in the North-South sense. In calculating the 10.7-cm flux, we assume that the integrated emission from the solar disc at that wavelength has no net linear polarization. The flux values are expressed in solar flux units (1 sfu = 10-22 W*m-2*Hz-1 ). The characteristics of the observations are surveyed in "Solar Radio Emission at 10.7-cm", by A.E. Covington [J. Royal Astron. Soc. Canada, Vol 63, 125, 1969].

The data are tabulated in two forms: the "observed flux" (S), and the "adjusted flux" (Sa). The former are the actual measured values and are affected by the changing distance between the Earth and Sun throughout the year, whereas the latter are scaled to a standard distance of 1 AU. The "observed flux" values are useful in ionospheric physics and other terrestrial consequences of solar activity. The "adjusted fluxes" are more purely descriptive of the Sun's behaviour. Graphs showing the monthly mean adjusted flux and monthly high and low values are shown in SGD Explanation of Data Reports.

Over long periods of time, the r.m.s. relative errors are not more than plus or minus 1% or a sfu, whichever is larger. The absolute accuracy is a more complicated issue. Through extensive recalibrations and comparisons between observatories between 1951 and 1971, best consistency between the 10.7-cm flux and observations at other wavelengths is obtained by multiplying the 10.7-cm flux data by a factor of 0.9. Fluxes scaled in this way are designated URSI Series D. They are not included in these reports but are easily calculated. The history of the solar flux calibration process is reviewed by H. Tanaka of the Research Institute of Atmospherics, Nagoya University, as convener of then Comm. 5 of URSI [H. Tanaka et al., "Absolute calibration of solar radio flux density in the microwave region", Solar Physics, Vol. 29, 243, 1973].

Depending upon the level of activity and possibly the phase of the solar cycle, the fluxes contain contributions from active regions, areas of enhanced emission outside active regions, and a constant contribution from the quiet sun. The sources and emission mechanisms contributing to the 10.7-cm flux are discussed by K.F. Tapping ["Recent Solar Radio Astronomy at Centimeter Wavelengths: The Temporal Variability of the 10.7-cm Flux", J. Geophys. Res., Vol. 92, D1, 829-838, 1987]. The flux determinations sometimes contain contributions from transient events.

Using empirical criteria these can be filtered from the data, although the degree to which they can be removed varies from example to example. However, a study by K.F. Tapping and D.P. Charrois ["Limits to the Accuracy of the 10.7cm Flux", Solar Physics, 150, pp 305-315, 1994, suggests that in general the spot measurements are within 1% of the flux averaged over whole observing days after transient events have been eliminated.

The quiet sun level is the flux density which would be observed in the absence of activity. Extrapolation to zero of plots of the 10.7-cm flux against other activity indices such as plage area or total photospheric magnetic flux in active regions suggest a quiet sun flux density of about 64 sfu. This is rarely attained. Even at solar minimum there is usually some activity; the lowest observed fluxes are usually 65-to-67 sfu. The observed excess of the 10.7-cm flux over the quiet sun level is known as the slowly-varying (S-) component.

The numerical data for the graph shown above and a selected bibliography are given in Algonquin Radio Observatory Report No. 5, "A Working Collection of Daily 2800 MHz Solar Flux Values 1946-1976" by A.E. Covington, Herzberg Institute of Astrophysics N.R.C. of Canada, Ottawa, Canada.

These solar radio noise indices are published in accordance with a CCIR Recommendation originally from the Xth Plenary Assembly, Geneva, 1963 (maintained at XIth through XIVth Plenaries), which states "that the monthly-mean value of solar radio-noise flux at wave- lengths near 10 cm should be adopted as the index to be used for predicting monthly median values of foE and foF1, for dates certainly up to 6, and perhaps up to 12 months ahead of the date of the last observed values of solar radio-noise flux."