threshold intensities for the umbra, penumbra, and faculae are defined so that these features can be identified in the data as a function of \( \mu \). Variations in the integrated continuum intensity due to the presence of these features are then calculated and compared with the corresponding ACRIM measurements.

6.7 SOLAR IRRADIANCE VARIATIONS DERIVED FROM MT. WILSON OBSERVATORY DAILY MAGNETOGRAMS

G. A. Chapman (SFOSUN and MWA), J. E. Boyden (MWA),

Observations of the line-of-sight fields on the sun, obtained with the 150-foot tower, have been converted into a proxy for solar irradiance variations caused by faculae and sunspots. Faculae were defined by the 10 gauss contour and sunspots by the 100 gauss contour. Simple models for faculae and sunspots have been used to convert the proxy into the irradiance variations. The statistical significance of the results, based on PFI and PSF (Chapman 1984) have been fit to daily means in the solar irradiance observed by the Active Cavity Radiometer Irradiance Monitor (ACRIM) for selected periods in 1980, 1982, and 1984. The statistical model is ACRIM = A + B x \( \phi + C x \psi \), where \( \phi \) and \( \psi \) are, respectively, the facular and sunspot fluctuation indices. For 127 days of data we found a statistically significant relationship. The rms residuals were 0.32 W/m², the quiet sun irradiance \( A = 1367.38 \) W/m², the coefficients \( B = 0.31 \) and \( C = -0.35 \) and were 19- and 18-sigma significant, respectively. The values of \( B \) and \( C \) and their meaning will be discussed. That part of this work performed at Mt. Wilson and Las Campanas Observatories was supported by the Carnegie Institution of Washington, NASA grant NGR-09-140-015, and NSF grant AST-8312980.

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REFERENCE

6.8 Solar UV and EUV Temporal Characteristics

Richard F. Donnelly (NOAA ERL ARL, Boulder, Colo. 80303)

Temporal characteristics of full-disk flux measurements were compared for the following wavelengths and stations: UV (NIMBUS-7), 10830Å He I line (NSO), EUV (AE-E) and 1-8 Å X-rays (GOES-2). Short-term variations (days, weeks), caused by solar rotation of plages distributed nonuniformly in solar longitude, have strong periodicities near 27.7 and 13.5 days, where the latter is not simply the second harmonic of the main 27.7-day periodicity. Intermediate-term variations (months) are caused by episodes of major solar activity. These episodes are dominated by 27-day periodicity, others by 13-day periodicity. The 13-day periodicity in soft X-ray flux is 180° out of phase with that occurring in the chromospheric EUV and UV fluxes and photospheric UV fluxes. At these same times, any 13-day periodicity in the coronal EUV fluxes of Fe XV at 284Å and XVI at 335Å is either very small or nonexistent. This suggests that the Fe XV & XVI emissions from active regions near the limb are partially attenuated or occulted while the much shorter wavelength X-rays are optically thin. Consequently, the dependence of Fe XV and XVI line intensities on the solar central meridian distance (CMD) is more like that of F10 than like that of the 1-8 Å X-ray flux. All coronal X-ray and EUV fluxes and R rise to a peak and decay more rapidly during episodes of major activity than do the chromospheric EUV & UV and photospheric UV fluxes. The peak of the solar-cycle variation of the UV flux occurred in late 1981, two years after the peak in the sunspot number, where a strong secondary peak in the UV flux occurred at the time of the sunspot minimum. Assuming that the solar cycle variation of the solar UV flux is linearly related to that of the chromospheric He I flux, and that the coefficients are the same as those for solar EUV and lines, the UV solar cycle variation at 205 nm is about 13Å.

6.9 Variation of the Calcium K Line Profile Over Solar Cycle 21.

O. R. White (NAO) and W. C. Livingston (NSO/Tucson)

Precision full disk measurements of the H and K lines began in 1975 now show solar chromospheric emission at levels characteristic of solar minimum. Since the minimum between solar cycles 21 and 22 is not expected until 1987, the emission probably will not remain at the current low levels. Nevertheless, the data in hand show the profile variation over the full range of solar activity expected for cycle 21. Study of the spectra at the center of the solar disk and for the full disk shows that the observed profile variation is due to the birth and evolution of active regions. There is no detectable variation of the quiet sun in our measurements, and this in turn suggests that there are no global changes in the quiet photosphere and chromosphere over an activity cycle.

6.10 Atmospheric Distortion and Blurring

L. J. November and R. B. Dunn

The atmospheric turbulence problem is described in terms of the effects of distortion and blurring. A technique for distortion correction is presented: The Continuous Correlation technique. The effects of blurring and its variation cause a focal change in the optical system. These effects are compared to speckling.

6.11 The Scintillation Theory of Eclipse Shadow Bands

J. L. Codona (UCSD, LIT/CEMD)

The results of a theoretical investigation of solar eclipse shadow bands are presented. The study provides both quantitative and qualitative insight into the factors governing the visibility of shadow bands. Without using of auxiliary hypotheses such as solar limb darkening or turbulence enhancements caused by the passage of the lunar shadow, all of the salient features of the shadow bands are explained by standard scintillation theory. The contrast is found to be greater for shorter wavelengths, and the band spacing to scale like the square root of the wavelength very near totality. For times greater than about 10 seconds before (or after) totality, the band spacing becomes frequency independent and the scintillations are dominated by turbulence near the ground. The turbulence mainly responsible for shadow bands is found to be below two kilometers in altitude. Turbulence at the tropopause is found to have no impact on shadow bands until 2-3 seconds from totality. Longer eclipses are expected to show bands with greater contrast and linearly. Intensity correlation scales are typically less than 10 cm within 30 seconds of totality. The scintillation theory predictions for shadow band structure, motion, and evolution are found to be in remarkable agreement with both visual and photoelectric observations.

6.12 Progress on Solar Opacity

Robert F. Kurucz (Harvard-Smithsonian CfA)

In 1983, working with Lucio Rossel from Fraunhofer and with John Drake at Los Alamos, we finally completed line lists for all the molecules that are important to computing statistical opacities for energy balance and for radiative rate considerations in the sun (except perhaps for monopole). Once the line data were ready, we computed new opacity tables for use in our solar modelling. The calculations involved 17,000,000 atomic and molecular lines, 3,500,000 wavebands, 50 temperatures, and 20 pressures, and took a large amount of computer time.

The opacities were used to compute a theoretical model photosphere, to predict solar fluxes and intensities from empirical models, and (with modification) to produce