VARIATION OF THE SOLAR CONSTANT DURING 1983 AND 1984

JUDIT PAP

Department of Astronomy, Eötvös University, H-1083 Budapest, Kun Béla tér 2., Hungary

(Received 11 November, 1986; in revised form 8 May, 1987)

Abstract. Measurements of the Nimbus-7/ERB and SMM/ACRIM radiometers indicated several dips in the total solar irradiance in 1983 and in the first part of 1984. The dips in 1983, which should have a real solar origin, were selected according to the peaks of the projected areas of the active sunspot groups above the 2σ error limit of their data set. In the first part of 1984 the sunspot activity was strong and few irradiance dips with relatively large amplitudes were observed. In the second part of 1984 the sunspot activity disappeared and at that time the solar constant only fluctuated around its mean.

1. Introduction

Irradiance records of the Nimbus-7 and Solar Maximum Mission satellites indicated modulations of the value of the solar constant within time-scales from days to weeks (Willson et al., 1981; Hickey et al., 1982; Willson, 1982, 1984a, b). The different investigations, mainly referring to the time interval of the most precise irradiance measurements of the SMM/ACRIM radiometer in 1980, showed that the large dips of the order of a few tenths of a percent in the total irradiance were mainly caused by sunspot groups (Willson et al., 1981; Hudson et al., 1982; Willson, 1982, 1984a, b). Our investigation indicated that the variation of the solar constant was first of all in connection with the age, state of development and magnetic structure of the active regions (Pap, 1985, 1986a, b).

The purpose of this paper is to investigate the variation of the solar constant in 1983 and 1984, near the solar minimum. For this investigation the irradiance records of the Nimbus-7/ERB and SMM/ACRIM radiometers are compared. The connection between the variation of the solar constant and the projected areas of the different types of the sunspot groups is also investigated. Moreover, because of the noise of the irradiance data sets, we tried to identify the real irradiance dips on the basis of the peaks in the projected areas of the active sunspot groups.

The irradiance records of the Nimbus-7 and SMM satellites were taken from NOAA’s Solar Geophysical Data, Comprehensive Reports 485 and 489 (1985). The daily mean values of the projected areas of the sunspot groups with different properties were determined on the basis of the Solnechnye Dannye Bulletin (Solar Data).
2. Variation of the Solar Constant in 1983

2.1. Comparison of the Nimbus-7/ERB and SMM/ACRIM Data

Figures 1(a) and 1(b) show the values of the solar constant measured by the Nimbus-7/ERB and SMM/ACRIM radiometers. The Nimbus-7 data are available between 1 January and 31 December, 1983, the SMM irradiance data are given from 1 January to 31 October, 1983. On the basis of these figures we can see that the variation of the solar constant was not so regular in 1983 as in 1980, at the time of the solar maximum.

Comparing the two different data sets of the solar constant values on Figure 1 we can see some differences between the irradiance dips and their amplitudes. These differences can partly be traced back to the different measuring methods of the two satellites. On the other hand, as we can see, because of the limited accuracy of the measurements both...