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Solar differential rotation in the period 1954–1964 determined by the Kanzelhöhe data set

Kanzelhöhe Observatory for Solar and Environmental Research (KSO) provides daily multispectral synoptic observations of the Sun. The synoptic observations allow us to study the subsurface dynamics of the Sun, such as the profile of solar differential rotation, meridional and zonal flows, and their variability, which are crucial for understanding the solar dynamo. Our goal is to extend the analysis of differential rotation from the KSO data (Poljančić Beljan et al., A&A 606, A72, 2017) to years before 1964. Previous analyses showed that the KSO data set is in a good agreement with the Debrecen Photoheliographic Data and Greenwich Photoheliographic Results (GPR), making it suitable for investigating long-term variations of the solar rotation profile. So, completing the catalog of KSO sunspot group positions and velocities is essential for further long-term analysis of the photospheric differential rotation. In this work, we present the results of solar differential rotation during the solar cycle No. 19 (1954–1964), derived by tracing sunspot groups on KSO sunspot drawings. The positions of sunspot groups were determined using a special software, Sungrabber. Sunspot groups were identified with the help of the GPR. We used two methods to determine synodic angular rotation velocities: the daily shift (DS) method and the robust linear least-squares fit (rLSQ) method. These velocities were then converted from synodic to sidereal ones and used in the least-squares fitting for the solar differential rotation law. Our analysis focused on velocity patterns relative to the solar cycle phases and latitudes.

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