

SC19 Kodaikanal maps

In 1986 V.I. Makarov and K.R. Sivaraman published their 'Atlas of H-alpha Synoptic Charts for Solar Cycle 19 (1955-1964): Carrington solar rotations 1355 to 1486', the Kodaikanal Observatory Bulletin #7 with data from the Kodaikanal Solar Observatory (KSO). This was after McIntosh had published his 'Annotated Atlas of H-Alpha Synoptic Charts for Solar Cycle 20 (1964-1974), Carrington Solar Rotations 1487-1616' in February 1979. Makarov and Sivaraman made their synoptic charts based on the approach of McIntosh and acknowledged this in their publication. KSO H-alpha filtergrams and CaK spectroheliograms were used in the form of CaK and H-alpha image data. CaK data was mainly used around active regions to estimate the magnetic polarities and their large-scale boundaries (Chatterjee et al. 2017). The procedures they used for producing the SC19 maps, especially for inferring magnetic polarities and polarity inversion lines (PILs), are documented in that bulletin and two earlier papers (Makarov et al. 1983; Makarov and Sivaraman 1983) and closely follow those of McIntosh (e.g., 1972, 1979).

In 2011 when McIntosh was moved to a memory care facility, Hewins and McFadden kept all important scientific papers, maps and data in McIntosh's home office. These included a copy of the Kodaikanal Atlas of Synoptic maps for SC19 annotated by McIntosh. Due to the similarity of the maps, we have included the synoptic maps from Makarov and Sivaraman's SC19 Atlas with the Archive and in some of our analysis. The SC19 Kodaikanal maps precede and extend the collection in the true McIntosh Archive.

Although the CaK images were used to determine the polarities around active regions, the SC19 synoptic maps only contain PIL lines and filaments. Filament channels were not marked as filaments (Makarov and Sivaraman 1983), and often filaments are missing in our digitized Kodaikanal maps at the highest latitude PILs in solar maximum. In the SC19 Atlas, filaments were marked with solid lines, and PILs with dashed lines, so that it was hard to distinguish short filaments from dashed PIL lines (Emery, et al. 2020).

Although McIntosh used magnetograms for his mapping, Kodaikanal Observatory did not produce magnetograms themselves and Makarov and Sivaraman did not use them. However, they found close agreement between these synoptic charts and Mt. Wilson magnetograms and therefore the positions of PILs and filaments that they show can be trusted in terms of position, if not for filament length. They did not include active regions or the complexity that PILs can take around these regions as McIntosh and his cartographers did.

Since we found differences in how the filaments and PILs are drawn, we compared 5 of their maps with those made with our techniques. McFadden recreated 5 Carrington

Rotations using Muedon H Alpha data for the filaments (CR's 1391kb, 1397kb, 1433kb, 1440kb and 1444kb) which were digitized and included in the archive. Due to the lack of availability of magnetograph data prior to the mid 1960's, we were unable to confirm or refute PIL positions. To differentiate the Kodaikanal maps from the true McIntosh Archive maps, Kodaikanal is indicated in the fits header, on the LVL3gif and all CR#'s are followed by a "k" (CR1355k), whereas the 5 maps McFadden modified with Muedon H-Alpha data are designated with a "kb" after the CR# (CR1391kb). On average McFadden found that often he saw two or more smaller filaments in the H-Alpha than what was shown as a very long filament in the Kodaikanal original map. We also found short filaments on high latitude PILs where there were no previous filaments in the original maps in the northern hemisphere for CR1391kb and CR1550kb and in the southern hemisphere for CR1433kb and CR1446kb.

Disclaimer:

The Kodaikanal Solar Observatory (KSO) maps only showed filaments as solid lines and PILs as dashed lines. Filament channels were not marked as filaments, and short filaments were hard to distinguish from dashed filament lines. Therefore, many of the digitized KSO maps showed hyper-long filaments instead of regular short filaments, and filaments were absent especially in the rush to the pole maps at the highest polarity inversion lines (PILs).

References

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