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## VARIATION OF SOLAR MICROWAVE SPECTRUM IN THE LAST HALF CENTURY

*M Shimojo<sup>\*1</sup>, K Iwai<sup>2</sup>, A Asai<sup>3</sup>, S Nozawa<sup>4</sup>, T Minamidani<sup>5</sup> and M Saito<sup>5</sup>*

*\*<sup>1</sup> National Astronomical Observatory of Japan Mitaka, Tokyo, 181-8588, Japan*

*Email: masumi.shimojo@nao.ac.jp*

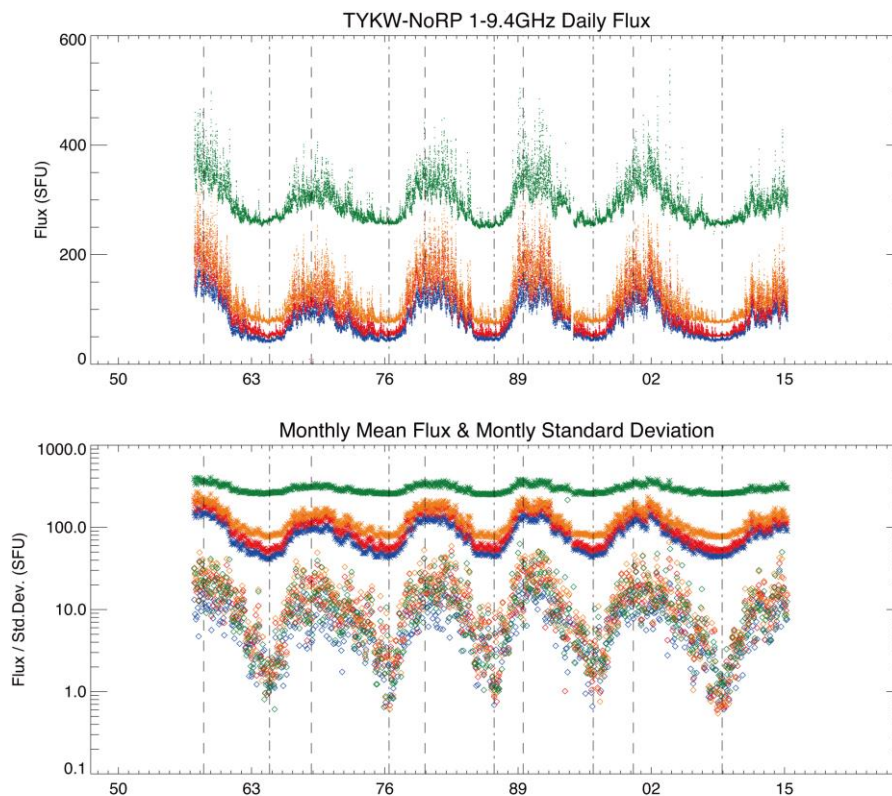
*<sup>2</sup> National Institute of Information and Communications Technology Koganei, Tokyo, 184-8795 Japan*

*<sup>3</sup> Unit of Synergetic Studies for Space, Kyoto University Sakyo, Kyoto, 606-8502, Japan*

*<sup>4</sup> Department of Science, Ibaraki University Mito, Ibaraki 310-8512, Japan*

*<sup>5</sup> Nobeyama Radio Observatory Nobeyama, Minamimaki, Nagano 384-1305, Japan*

The total solar fluxes at 1, 2, 3.75 and 9.4 GHz have been observed continuously from 1957 to 1994 at Toyokawa, from 1994 at Nobeyama, Japan. We examined the multi-frequencies and long-term dataset, and found that monthly standard deviation of total solar flux in microwave can indicate an actual minimum state of solar activity rather than sunspot number. Therefore, we define "radio solar minimums" from the value. Comparing the microwave spectrums of the radio solar minimums of Cycle 20~24, we found that they match within 7%. It shows that the average atmospheric structure above transition region in quiet sun didn't vary during the half a century, and suggest that the energy input for atmospheric heating from sub-photosphere to corona didn't change in quiet sun though the strength of solar cycles variation changed significantly.



The variation of the total solar flux in microwave. Upper panel: The daily total solar fluxes at 1 (Blue), 2 (Red), 3.75 (Orange) and 9.4 (Green) GHz. Middle Panel: The monthly mean flux (Asterisks) and monthly standard deviation (diamonds) of each frequency.