

# GLOBAL SOLAR ACTIVITY IN CYCLE 24

Kiyoto Shibasaki  
(Solar Physics Research Inc.)

2015/9/29

SCOSTEP-WDS@NICT

1

## Outline

1. Status of solar activity in Cycle 24 shown by total radio flux
2. Status of global solar activity in Cycle 24 shown by a radio butterfly diagram
  1. Northern hemisphere
  2. Southern hemisphere
3. Summary and inferred near future activity

2015/9/29

SCOSTEP-WDS@NICT

2

# Nobeyama Radio Polarimeters

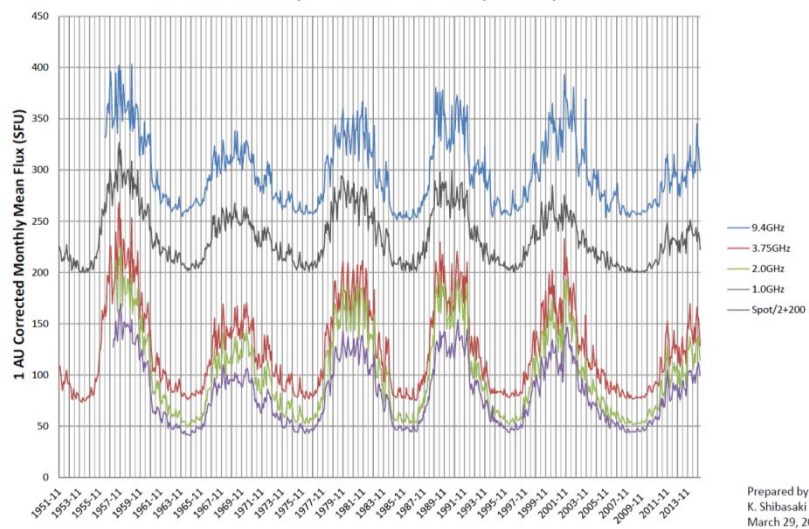


2015/9/29

SCOSTEP-WDS@NICT

3

### Microwave Flux (1951 Nov. - 2015 Feb.) & Sunspot Number



Prepared by  
K. Shibasaki  
March 29, 2015

2015/9/29

SCOSTEP-WDS@NICT

4

## Status of solar activity in Cycle 24 shown by solar activity indices

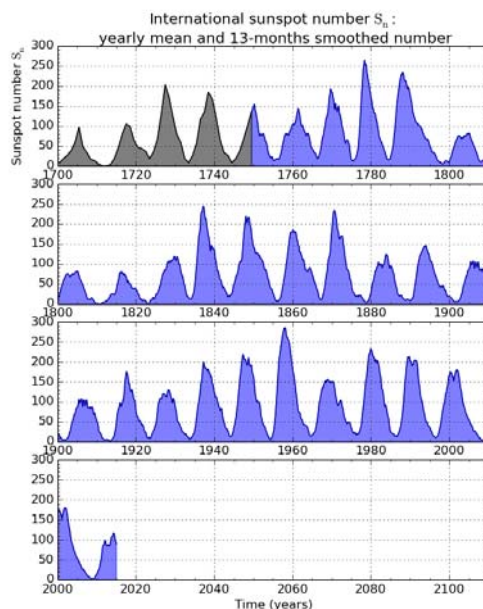
- Microwave monthly mean total flux (1.0 ~ 9.4 GHz, 1 AU corrected) observed at Toyokawa / Nobeyama
  - Cycle 24 has two peaks (1<sup>st</sup>: ~2012, 2<sup>nd</sup>: ~2014)
  - Fluxes around 2<sup>nd</sup> peak are comparable to the level of cycle 20
- Relative sunspot number (WDC-SILSO) monthly mean
  - 1<sup>st</sup> and 2<sup>nd</sup> peaks are at similar level and lower than cycle 20 (levels around 100 years ago)
- Relation between microwave total flux and relative sunspot number seems to be changing

**(New series of sunspot numbers (V. 2) started July 1, 2015)**

2015/9/29

SCOSTEP-WDS@NICT

5

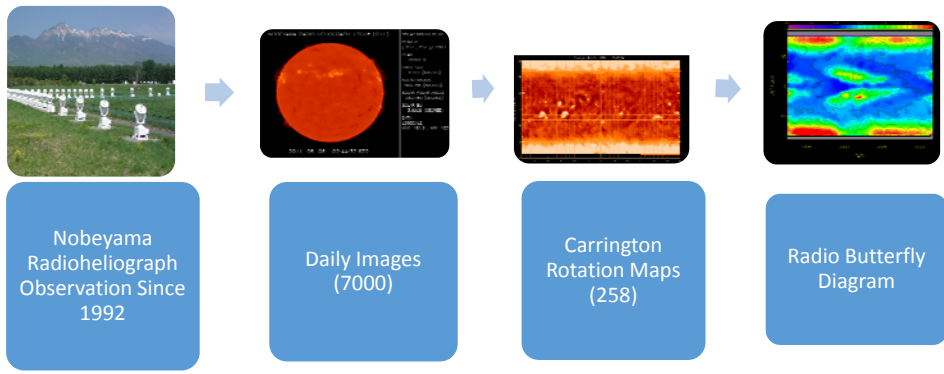


2015/9/29

SCOSTEP-WDS@NICT

6

## Synthesis of Radio Butterfly Diagram

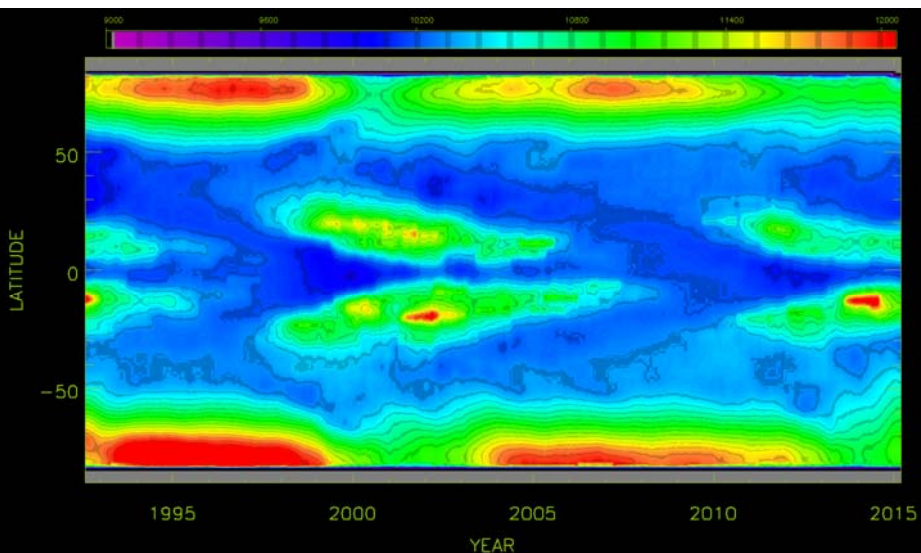


2015/9/29

SCOSTEP-WDS@NICT

7

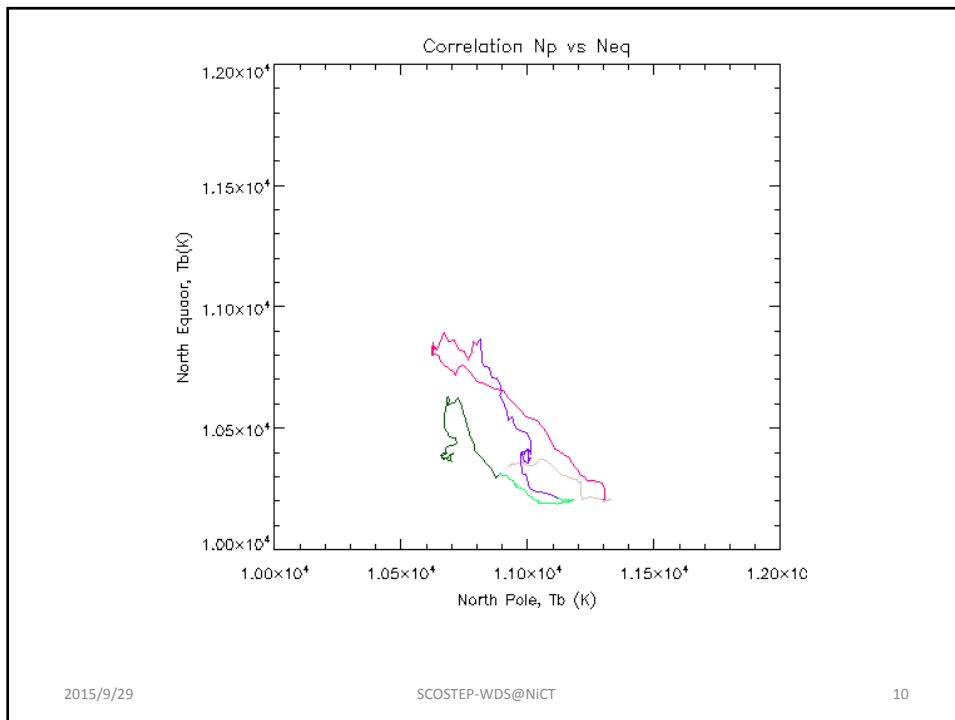
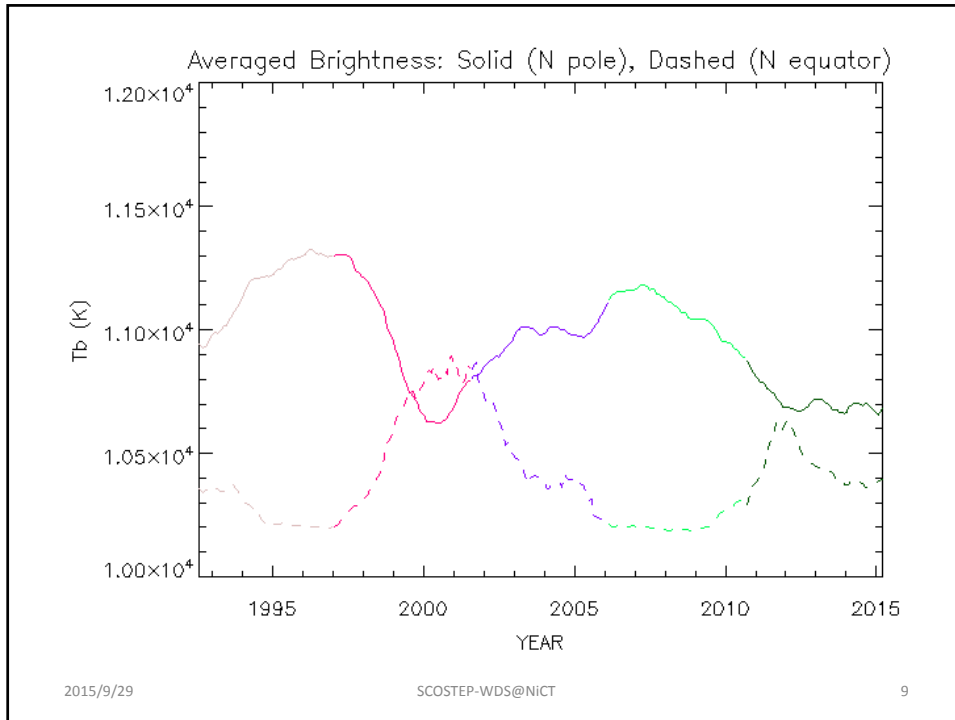
## Radio Butterfly Diagram (1992/7 – 2015/2)



2015/9/29

SCOSTEP-WDS@NICT

8



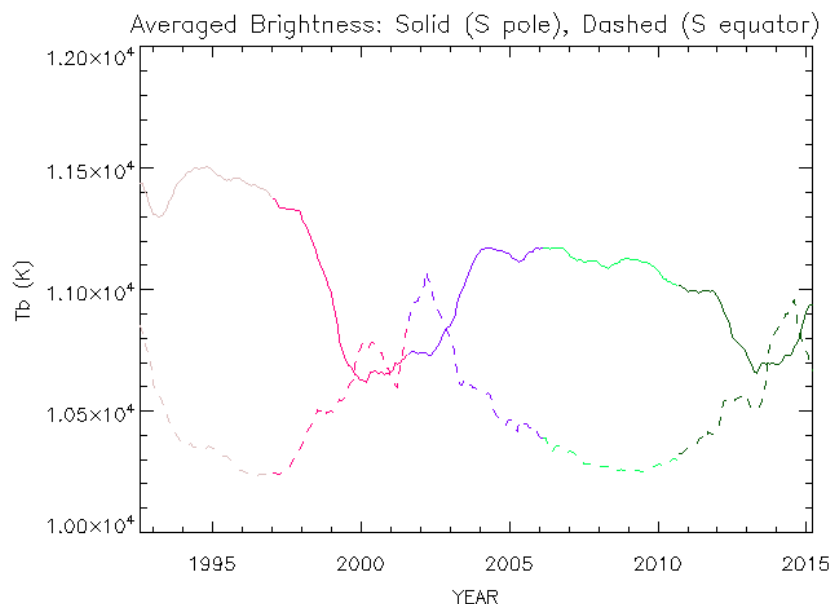
## Northern Hemisphere Activity

- Comparison between low latitude mean brightness temperature (5 – 35 deg., dashed line) and high latitude mean Tb (55 – 80 deg., solid line) shows:
  - Northern activity peak in 2012 (low latitude Tb is at maximum and high latitude Tb is at minimum)
  - Tb at low latitude stays constant after 2013, and Tb at high latitude does not increase after 2012
- The hysteresis curve extends toward lower-left corner (northern hemispheric activity is decreasing as a whole)

2015/9/29

SCOSTEP-WDS@NICT

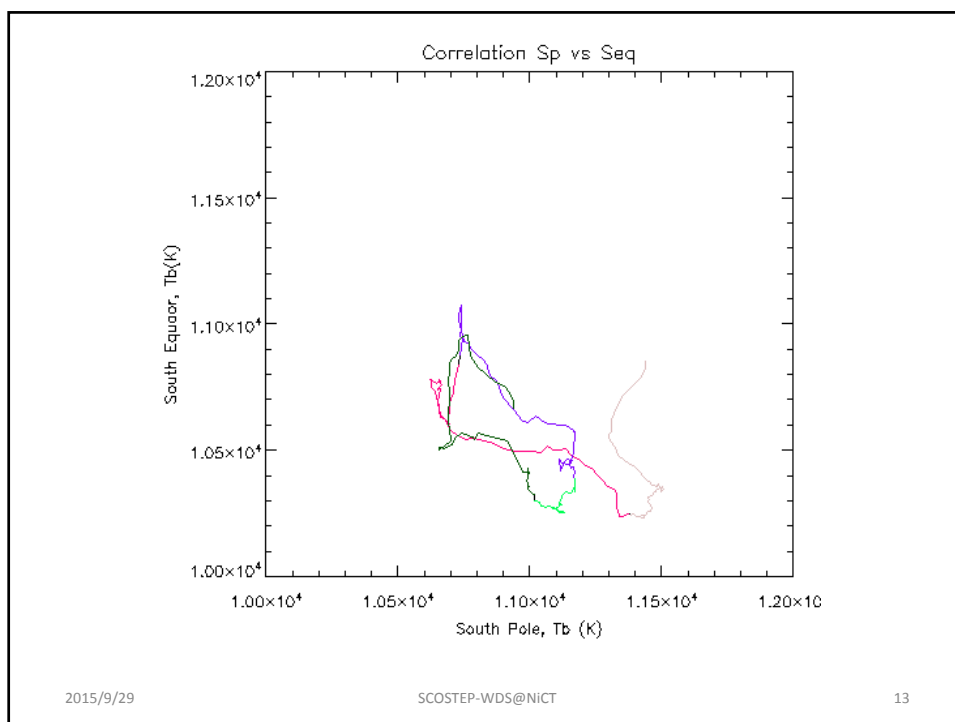
11



2015/9/29

SCOSTEP-WDS@NICT

12



## Southern Hemisphere Activity

- Comparison between low latitude mean Tb (5 – 35 deg., dashed line) and high latitude mean Tb (55 – 80 deg., solid line) shows:
  - Southern low latitude activity maximum is in 2014 and decrease smoothly afterwards
  - High latitude Tb minimum is in 2013-2014 and increase smoothly afterwards
- The hysteresis curve overlaps with cycle 23  
(southern hemispheric activity is recovering as a whole)

## Summary

- Solar Activity cycle 24 has 2 peaks
  - 1<sup>st</sup> peak in 2012 is dominated by northern hemisphere
  - 2<sup>nd</sup> peak in 2014 is dominated by southern hemisphere
- Activity level of 24 cycle shown by sunspot number is similar to the level of 100 years ago
- Activity level shown by microwave total fluxes is similar to the level of 20 cycle (45 years ago)
- Deviation of the relation between sunspot number and microwave flux becomes evident
- The radio butterfly diagram shows that:
  - Northern hemispheric activity continues to decrease
  - Southern hemispheric activity returns to cycle 23

2015/9/29

SCOSTEP-WDS@NICT

15

## Near future solar activity

- Hysteresis curves shows that:
  - Northern hemispheric activity keeps decreasing
  - Southern hemispheric activity returns to the previous cycle
- Large north-south activity asymmetry is expected if we assume that the current trend continues.
- If we assume that the deviation between microwave flux and sunspot number increases further, we need to think about which index should be used (or, which index represents solar activity better).

2015/9/29

SCOSTEP-WDS@NICT

16