# Analysis of the Third and Fourth Stokes Parameters by Fully Polarimetric Microwave Radiometer Measurement over Antarctic Sea Ice

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## Introduction:

WindSat is the first spaceborne fully polarimetric microwave radiometer in the world. It can measure the third and fourth Stokes parameters of the target and provide a new way for sea ice remote sensing. By using WindSat data in 2004, we studied on the brightness temperature characteristics of the third and fourth Stokes parameters over Antarctic sea ice.

## Methods:

The regional distribution, time variation and anisotropy of the brightness temperatures were analyzed. For time series analysis, six areas (arc1-arc6) were chosen.

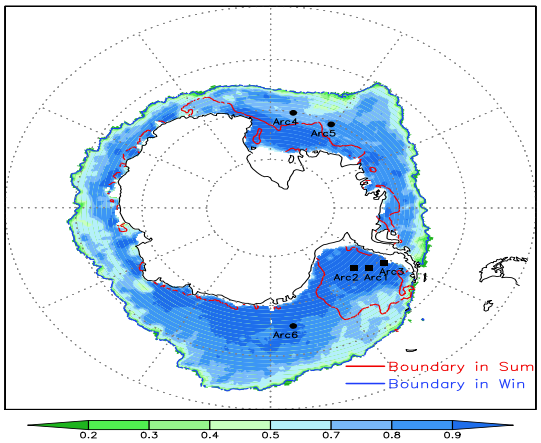


Fig1 Six areas for time series analysis

## Results:

- The brightness temperatures of the third and fourth Stokes parameters could describe the regional distribution of sea ice in a certain extent. The third Stokes parameter reflected the ice water line well in winter. The brightness temperature differences of sea water and sea ice could reach above 3K. However, in summer, brightness temperatures both of the third and fourth Stokes parameters were near 0K. We could hardly find the difference between sea water and sea ice.

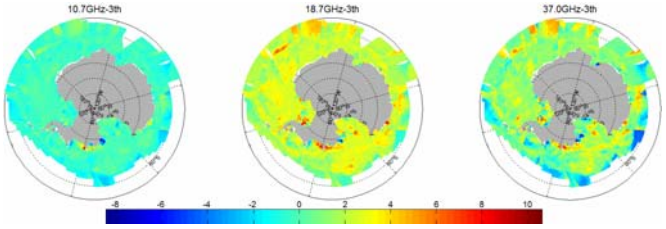


Fig2 The regional distribution of the third Stokes parameter in winter

- The brightness temperatures of the third and forth Stokes parameters had correlation with sea ice concentration. In summer, because sea ice melted, the concentration decreased and the amplitude of the brightness temperature was quickly increased. In winter, the situation was the opposite. This characteristic of first-year ice was more evident than multi-year ice.

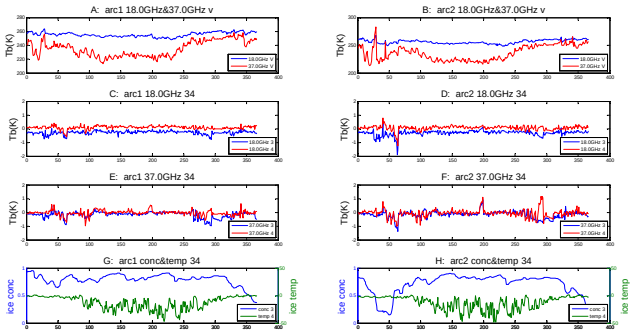


Fig3 The time series of brightness temperatures and concentration of multi-year ice

- The third Stokes parameter signal variation with azimuth was more obvious in first-year ice area than that in multi-year ice area. However, the anisotropy of the fourth Stokes parameter was weak in each area.

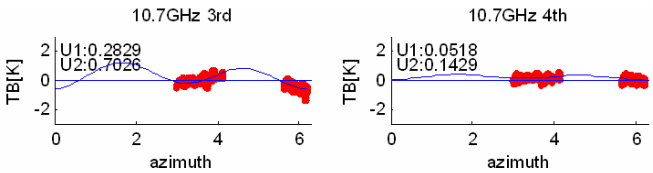


Fig4 The third and fourth Stokes parameters variation with azimuth of 10.7GHz in arc4

## Conclusion:

Using these time-varying and anisotropic properties of brightness temperatures, we could distinguish first-year ice and multi-year ice.