

2003年から13年間のアイスランドと日本の大気中宇宙線生成核種 Be-7 濃度変動と太陽活動

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Yearly variations in Be-7 concentrations in the atmosphere in Iceland and Japan during 13 years from 2003 compared with the solar activity

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Be-7 concentrations (BEC) in the air should be correlated to cosmic rays, because Be-7 is produced by interactions between cosmic rays and nitrogen and/or oxygen in the atmosphere. Since cosmic rays which reach the earth are modulated by the solar activities when travelling the heliosphere, the variation in BEC involve some modulation profiles such as 27-day variation and 11-year solar cycle. Daily Be-7 concentrations in surface air have been continuously observed at Yamagata (38° N), Japan since 2000. To investigate the latitude effect of 11-year solar cycle, we set up a daily observation system of Be-7 concentration at Husafell in Iceland located at high latitude (64° N) and have been continuously observed BEC since September 2003 as well as in Japan. Figure 1 shows the yearly variations in the BEC in Iceland and at Yamagata, with the neutrons and the sunspot number (SSN), respectively. Both the BECs and the cosmic ray neutrons produced in the atmosphere inversely vary according to the sunspot number, because the energy spectrum of incoming cosmic rays changes with the variation of the solar magnetic fields. As shown in the SSN, the solar cycle 24 began in 2009, reached its maximum in 2014, and the activity is decreasing to the minimum at present. The decreasing rates of BECs in Iceland from 2008 to 2015 and at Yamagata from 2009 to 2012 are approximately 38% and 26%, respectively, although that of the neutron from 2009 to 2015 is approximately 10%. The larger variability of BECs compared to the neutron indicates the production due to low energy cosmic rays below the threshold energy for the neutron production. Meanwhile, the BEC at Yamagata after 2013 is increasing against the decrease profiles of Iceland BEC and the neutron. The BEC in Iceland is approximately two fifths of that at Yamagata, also, with an indication that the air-mass with thick BEC flow upward from the troposphere to the stratosphere in polar region. These might imply that the global air circulation pattern at the cycle 24 is different from at the cycle 23.

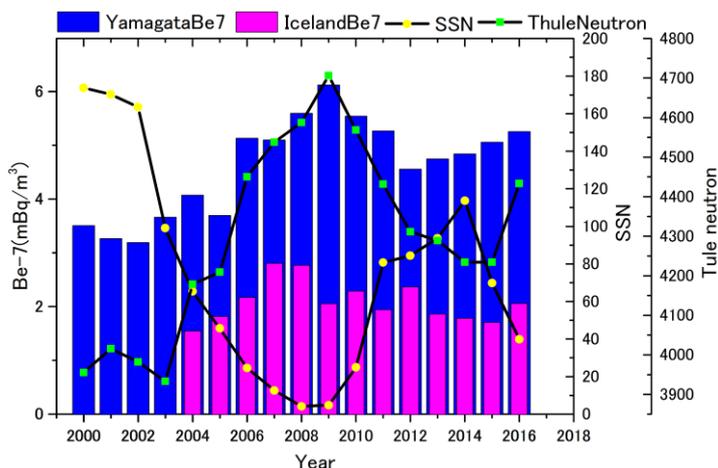


Figure 1. Yearly profiles of the Be-7 concentrations, the sunspot numbers, and the cosmic ray neutrons.

We describe comparison of the Be-7 concentrations between at Yamagata and in Iceland relating to the SSN and neutron monitor data for the solar modulation, involving the response of the BECs to the unusual 24th solar activity after 2012.