We analyzed neutral winds, diffusion coefficients, and neutral temperatures observed by the Nippon/Norway Tromsø Meteor Radar (NTMR) and ion temperatures observed by the European Incoherent Scatter (EISCAT) UHF radar at Tromsø (69.6°N, 19.2 E), during a major stratospheric sudden warming (SSW) occurred in January 2009. The neutral zonal winds at 80-100 km height reversed about 10 days earlier than the zonal wind reversal in the stratosphere and the neutral temperature at 90 km decreased simultaneously with the zonal wind reversal at the same altitude. We found an anticorrelation between geomagnetically quiet nighttime ion temperatures at 100 km and 120-142 km. Our results from the ground-based observations agree well with the satellite observations shown in an accompanying paper. However, significant differences from the previous studies on other SSW events indicate that impacts of a SSW on the upper atmosphere and ionosphere are highly variable with lower atmospheric conditions.