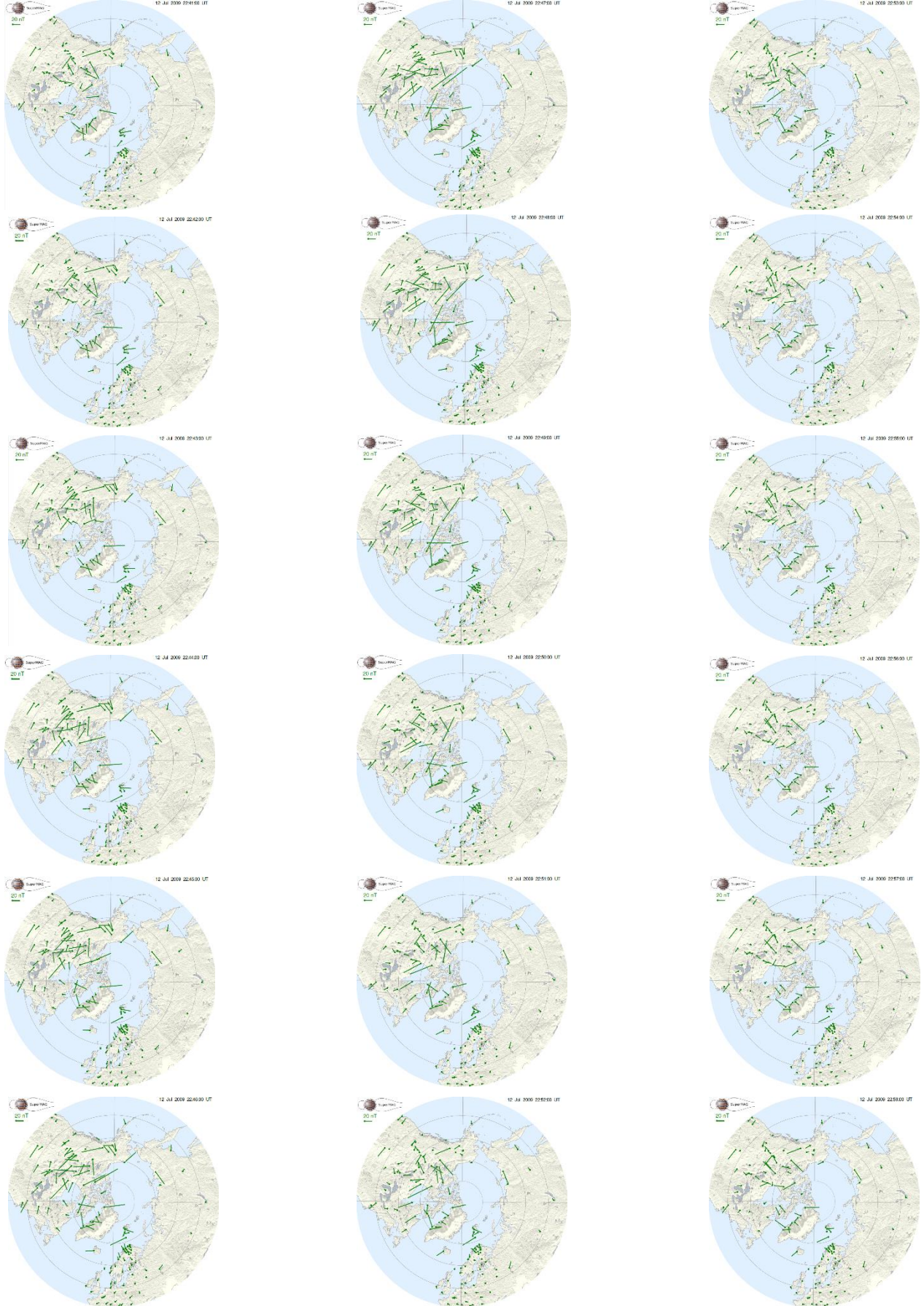
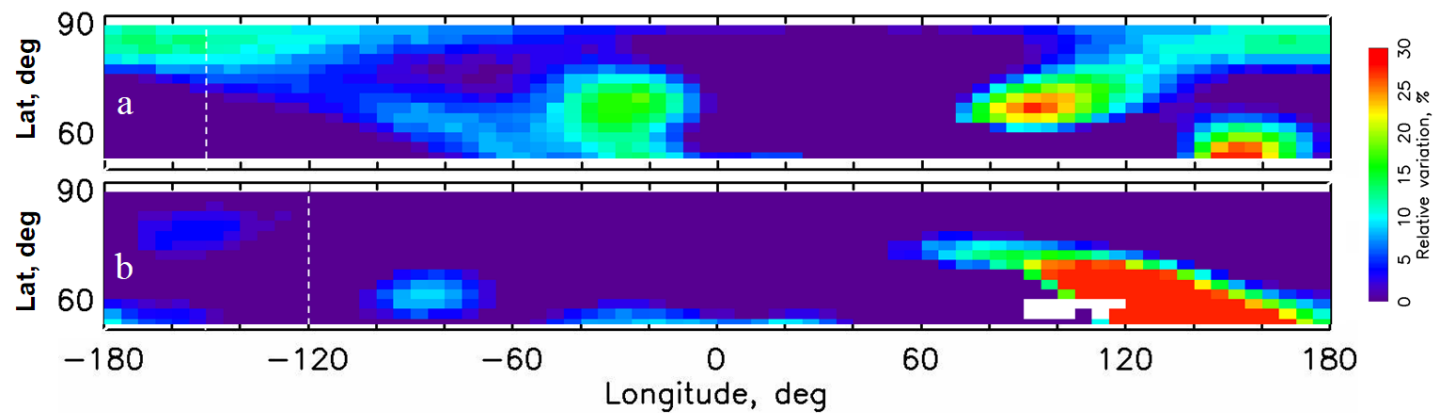


**Figure S1.** Upstream solar wind and geomagnetic conditions on 12 July 2009 (from top to bottom): auroral electrojet (AE) index; geomagnetic Dst index; solar wind velocity  $V$ ; solar wind density  $n$ ; solar wind temperature  $T$ ; interplanetary magnetic field (IMF) strength (blue curve) and  $B_z$  component (black curve) in GSM; (f) IMF components  $B_x$  (black curve) and  $B_y$  (blue curve) in GSM. The upstream solar wind conditions were measured by the ACE satellite near the L1 point.



**Figure S2.** Polar maps of the equivalent ionospheric currents measured by the ground network of magnetometers SUPERMAG from 2241 to 2258 UT on 12 July 2009 with 1-min step. The intensity of disturbances is indicated by green bars with the scale of 20 nT.



**Figure S3.** High-latitude fractions of global ionospheric maps (GIMs) of relative variations in vertical total electron content (VTEC) at 20 UT (a) and 22 UT (b) on 12 July, 2009. The quiet day is July 11, 2009. Vertical white dashed lines indicate local noon.