Bright spot aurorae and magnetic fields at Uranus

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One of the two ice giants in our solar system, Uranus, is as far as ~20 astronomical units away from the Earth and has been flown by Spacecraft Voyager 2 alone.
The unique spacecraft provided legendary vector magnetic data of the planet to reveal that Uranus has a strong magnetic field of its own. However, it was also found that its dipolar magnetic field, if any, is peculiar in the sense that it is not only offset from the centre of the planet but also tilted from the rotation axis as large as 60 degrees (Ness et al., 1986). Since discovery of the peculiar intrinsic magnetic field, a couple of higher-degree magnetic field models than Ness et al's (1986) offset and tilted dipole model have been proposed by analyzing the vector magnetic data precisely (Connerney et al., 1987) or adding other kind of data such as auroral ultraviolet emission observed by Voyager 2 (Herbert, 2009).
The peculiar magnetic fields at Uranus may tell us what dynamics takes place inside the ice giants, if fully understood. Which part of the Uranus' interior is responsible for its dynamo actions? What kind of conductive fluid is the major constituent of that part? Is that part a globally distributed shell? Why is the planet's magnetic field different from the dipolar magnetic fields like the one that the Earth bears? Doesn't the fast rotation of the planet as fast as a slightly longer rotation period than 17 hrs influence the dynamo regime?
Lamy et al. (2012) recently reported the very first detection of the Uranus' aurorae by Hubble Space Telescope. Their far-ultraviolet images captured two bright spot aurorae occurred in November, 2011, both of which were results of a pair of large CME events traced all the way from the Sun to the region of outer planets by the authors. The estimated latitudes of the aurorae on Uranus are between 5 degrees S and 15 degrees S, which overlaps the larger northern auroral oval of either Q3 Model (Connerney et al., 1987) or AH5 Model (Herbert, 2009) of the planet's magnetic field. Because Lamy et al. (2012) conclude that the bright spot aurorae were results of dayside reconnections, it is possible to use the far-ultraviolet images as constraints of the magnetic field at Uranus by assuming L-values of the reconnection locations and utilizing the knowledge of the interplanetary magnetic field provided by the mSWiM simulation code (Zieger and Hansen, 2008).
This paper reports the attempt of the magnetic field modelling at Uranus using the new constraints.

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