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Possible precursors to the 2011 3/11 Japan earthquake:

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The purpose of this paper is to present a possible precursor to the 2011 March 11 Japan earthquake. First of all, we present the results on subionospheric VLF/LF propagation anomaly (ionospheric perturbation) by means of Japan-Russia VLF network. It is found that the ionospheric perturbation is clearly detected on March 4, 5 and 6 on the propagation paths of NLK (Seattle, USA) to Japanese stations and on a path of JJI (Miyazaki, Kyushu) to Kamchatka. Next, we present the results on the ULF depression (horizontal component) on the same days, which is interpreted in terms of the absorption in the disturbed lower ionosphere of the downgoing magnetospheric Alfve'n waves. These two precursors are considered to be due to the same effect of the lower ionospheric perturbation about one week before the earthquake.