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Wave and wave-particle processes induced by interplanetary high-speed stream impact on the magnetosphere under conditions of the moderate and very low solar activity

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Unusually prolonged minimum of solar activity in 2008–2009 gave to scientists a unique opportunity to retrace solar-magnetospheric phenomena in their pure form, without a superposition of concurrent events or extraneous disturbances. In this work, we study a wave aspect of the solar wind – magnetosphere interaction by way of two examples of high-speed streams flowing around the magnetosphere. One of these streams was observed in January 2005 when the solar activity was moderate during the declining phase of the 23rd sunspot cycle. The other event occurred in March 2009 against the background of very low solar activity. In the latter case we found a clear demonstration of direct penetration of the ULF waves from the solar wind into the magnetosphere. In the January 2005 event, however, indications of the direct wave penetration are far less evident. The reason is a high level of magnetic disturbance caused by an interplanetary shock wave forestalling the high speed stream in January 2005. In spite of different kinds of conditions for magnetospheric ULF wave generation in these two cases, both events launch similar chains of processes leading to enhancement of relativistic electron flux at the geosynchronous orbit within two days after a peak of a high-speed solar wind stream. This suggests that even with the very low solar activity the high energy particles can present problem for satellite electronics. The mechanisms of particles acceleration under the action of Alfvèn waves in the magnetosphere are discussed briefly. The work was partly supported by RFBR grants 09-06-00048 and 10-05-00661.