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Dynamic aspects of the ozone anomalies formation in the Antarctic region

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The ozone layer is a unique shield protecting all living creatures on our planet. However, it has become subject of active research only after the first ozone hole was discovered over Antarctica.
Ozone layer depletion over Antarctica is an even more acute problem, since Antarctica is the only continent having a very endemic, rich nature with least human impact.
It has been shown that extreme temperature conditions in polar stratosphere and polar stratospheric clouds formation in addition to photochemical reactions involving ozone and ozone-depleting substances act as a primary cause of ozone-layer depletion.
In the present study we review the dynamic aspects of ozone anomalies formation in the Antarctic region by numerical simulation. For that purpose we consider the ozone hole which formed over Antarctica in the period of September-October 2011. Using the WRF modelling system and its PolarWRF modification, we simulate meteorological situation over Antarctica in the time periods of ozone hole formation and destruction, and also in the time period when the ozone hole is absent.
Based on the modelling results, we argue that a cold air mass (anticyclone) formed over the territory of Antarctica during the formation of the ozone hole. Absence of solar irradiation and strong cooling of the atmosphere contribute to formation of such meteorological conditions during the Antarctic winter. In the stratosphere there is a region of low atmospheric pressure, which is clearly visible on a pressure topography map. Under the effect of the tropospheric and the stratospheric vortices, air patches movement leads to ozone concentration decrease and formation of the ozone anomalies.
From the WRF system modelling results we calculate several basic meteorological characteristics and analyze surface maps and aerological (skew-T) diagrams for atmospheric variables with the NCL scripting language. We conclude that atmospheric dynamics has an impact on ozone depression. Also, we evaluate the feasibility of mesoscale weather simulation with WRF for the area where Belarusian Antarctic expedition base is situated (Gora Vechernyaya, Enderby Land).
Stratosphere-troposphere interactions pose a complicated and a very actual problem. Search and identification of patterns in natural processes of these interactions is a cross-disciplinary area of research, being of a significant interest for scientists working in different fields.