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## Investigation of direct solar proton impact on Arctic stratospheric ozone

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Recent studies reported up to a 10 % average decrease of lower stratospheric ozone at ~ 20 km altitude following solar proton events (SPEs), based on superposed epoch analysis (SEA) of ozonesonde anomalies. Our study uses 49 SPEs that occurred after the launch of Aura MLS (2004–now) and 177 SPEs that occurred in the WACCM-D (Whole Atmosphere Community Climate Model with D-region ion chemistry) simulation period (1989–2012) to evaluate Arctic polar atmospheric ozone changes following SPEs. At the mesospheric altitudes a statistically significant ozone depletion is present. At the lower stratosphere (<25 km), SEA of the satellite dataset provides no solid evidence of any average direct SPE impact on ozone. In the individual case studies, we find only one potential case (January 2005) in which the lower-stratospheric ozone level was significantly decreased after the SPE onset (in both model simulation and MLS observation data). However, similar decreases could not be identified in other SPEs of similar or larger magnitude. We find a very good overall consistency between WACCM-D simulations and MLS observations of SPE-driven ozone anomalies both on average and for the individual cases, including case in January 2005.