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Using CALIOP Aboard CALIPSO to Quantify the Impacts of the 2010 Russian Fires on Stratospheric Aerosols

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Although the 2010 Russian heat waves and fires directly affected millions of people on the Earth's surface, smoke from the fires also made its way into the lower stratosphere, where it can persist for days and affect the Earth's radiation budget. Pyrocumulonimbus (pyroCbs), or thunderstorms formed or augmented by the heat from large fires, were abundant during the event and transported large amounts of smoke into the stratosphere. The Cloud-Aerosol Lidar with Orthogonal Polarization, or CALIOP, instrument aboard the polar-orbiting CALIPSO satellite is the ideal platform from which to study these tiny stratospheric aerosols. Algorithms already exist that objectively locate atmospheric aerosols from the Lidar measurements, but they are tuned specifically to find mostly lower tropospheric aerosols, and the aerosol typing for stratospheric particles does not distinguish among ash, dust, sulfates, and polar stratospheric clouds. In this paper, we develop a new method to identify stratospheric aerosols from the CALIOP measurements, then use these observations to quantify the amount of smoke sent into the stratosphere by the Russian pyroCbs.