



Detection of lower stratospheric SO₂ pollution induced by injection from the polluted planetary boundary layer followed by intercontinental transport

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We report on the detection of a case of lower stratospheric SO₂ pollution above Central Europe. Simultaneously measured O₃, CO, and water vapour data along with model simulations and meteorological analyses indicate that the observed SO₂ stemmed from the polluted planetary boundary layer of the north-eastern USA where it was injected into the lower stratosphere by a warm conveyor belt with embedded deep convection. After injection the SO₂-rich lower stratospheric air mass traveled within 9 days to Central Europe where it was intercepted by a research aircraft on board of which the SO₂-measurements took place. These measurements were made using a novel aircraft-based CIMS (chemical ionisation mass spectrometry)-instrument equipped with an ion trap mass spectrometer. Importantly the very sensitive and fast-response CIMS-instrument was continuously calibrated employing isotopically labeled SO₂. Our findings have interesting implications for the injection of SO₂ from the planetary boundary layer into the lower stratosphere, for lower stratospheric long-range SO₂-transport, and also for lower stratospheric SO₂-induced aerosol particle formation and growth.