



Vertical profiles of ClNO₂ measured in Utah: dry deposition of N₂O₅ as a source of ClNO₂

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Several recent observations of nitryl chloride (ClNO₂) have suggested that this compound can accumulate to significant levels (several ppb) in the nocturnal boundary layer at night. Its photolytic loss the next day can be a significant source of chlorine atom radicals. The source of ClNO₂ is known to be the heterogeneous reaction of N₂O₅ with aerosol chloride, not just confined to coastal regions but also observed thousands of kilometers inland in urban areas. During the Uintah Basin Winter Ozone Study (2012), we made measurements of ClNO₂ by CIMS on a tower in a remote region of Utah where intensive natural gas extraction operations via hydraulic fracturing were occurring. Levels of ClNO₂ were surprisingly high at night (up to 2 ppb) even though coastal aerosols were not present. Soils in the region were alkaline with high chloride content. To address the potential of N₂O₅ dry deposition as a source of ClNO₂, we measured vertical profiles of ClNO₂ from 1 to 12 m agl with a movable inlet. We observed negative gradients of ClNO₂ and positive gradients of N₂O₅, which suggest that dry deposition of N₂O₅ and reaction with soil chloride as a source of ClNO₂.