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Estimating wildfire emissions of ammonia using Cross-track Infrared Sounder (CrIS) profile information

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Ammonia plays an important role for air, soil and water quality, as well as aerosol formation and plant growth. Accurate estimates of emission rates of ammonia from wildfires are crucial to understand the impact on human health and ecosystems. However, ground-based measurements of ammonia are sporadic. Satellite measurements can help address this monitoring gap. The Cross-track Infrared Sounder (CrIS) product provides a unique tool because some information on the vertical distribution of ammonia is derived from the profile retrievals in addition to vertical column densities (VCDs). Emission rates are retrieved by fitting measured vertical column densities (VCDs) to a three-dimensional function of the wind speed and spatial coordinates. This method requires VCDs to be rotated given the wind-direction to remove wind-direction as a fitting variable. The vertical information given by CrIS provides the potential for more accurate emission estimates as wind-direction and -speed at each profile level can be taken into account. The application of the vertical profile of wind also allows more accurate estimates of plume width, which can vary significantly in the traditional VCD rotation depending on the altitudes of wind used for the rotation. This approach was developed and validated using synthetic satellite measurements of plumes simulated by the FLEXPART (v10.0) model to better understand the impact of variability in the vertical profile of the wind. The methodology was then applied using CrIS satellite observations to estimate forest fire emissions of NH₃. Preliminary results of this study will be presented.