The Uinta Basin experiences strong, multi-day inversion episodes during some winters. During these episodes, ozone concentrations can build to levels that exceed the national health standard. The local oil and gas industry is the largest source of ozone precursor emissions in the Uinta Basin. The Basin atmosphere is rich in oil and gas-derived organic compounds, with relatively low concentrations of oxides of nitrogen (NOX).

We have measured ozone, a suite of ozone precursor compounds, and meteorological conditions at two locations in the Uinta Basin, Horsepool and Roosevelt, every winter since 2012. We examined this dataset to determine trends in ozone precursors across different timescales.

On the timescale of an inversion episode, ozone production tends to peak five or six days into an inversion and then decrease thereafter, apparently because overall organic compound reactivity decreases over the duration of episodes.

On the seasonal timescale, ozone production becomes much more efficient later in the winter season, meaning that more ozone is produced for a given concentration of precursors. Also, ozone production becomes more NOX-sensitive later in the winter. This change is likely driven by increased OH radical production as more sunlight becomes available and the warmer atmosphere is able to hold more water vapor. The implication of this finding is that emission controls that target NOX become more effective later in the winter season, and an emission reduction strategy designed for early winter may not be effective for later winter, or vice versa.

On the interannual timescale, NOX and organic compound concentrations, corrected for meteorological conditions, have decreased by roughly half over the past five years at Horsepool, while they have stayed relatively constant at Roosevelt. We attribute this change largely to changes in oil and gas production. Horsepool is at the north end of an area of gas development in the eastern Uinta Basin, while Roosevelt is in an area of oil development in the west. Natural gas production in the Uinta Basin has dropped by about half over the past five years, while oil production has experienced little net change. These shifts in production rates have led to changes in precursor concentrations at our measurement sites, and some evidence exists that the location with highest ozone in the Basin has shifted west also.