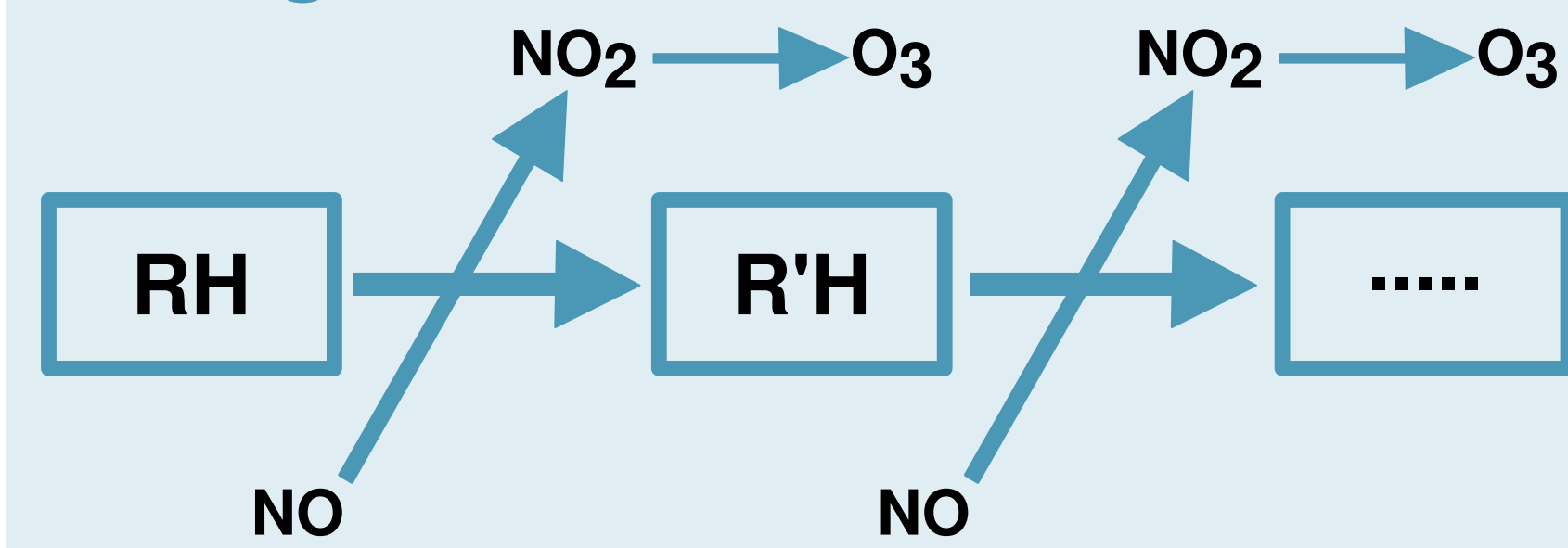


The Influence of Atmospheric Conditions on the Production of Ozone during VOC Oxidation

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Background



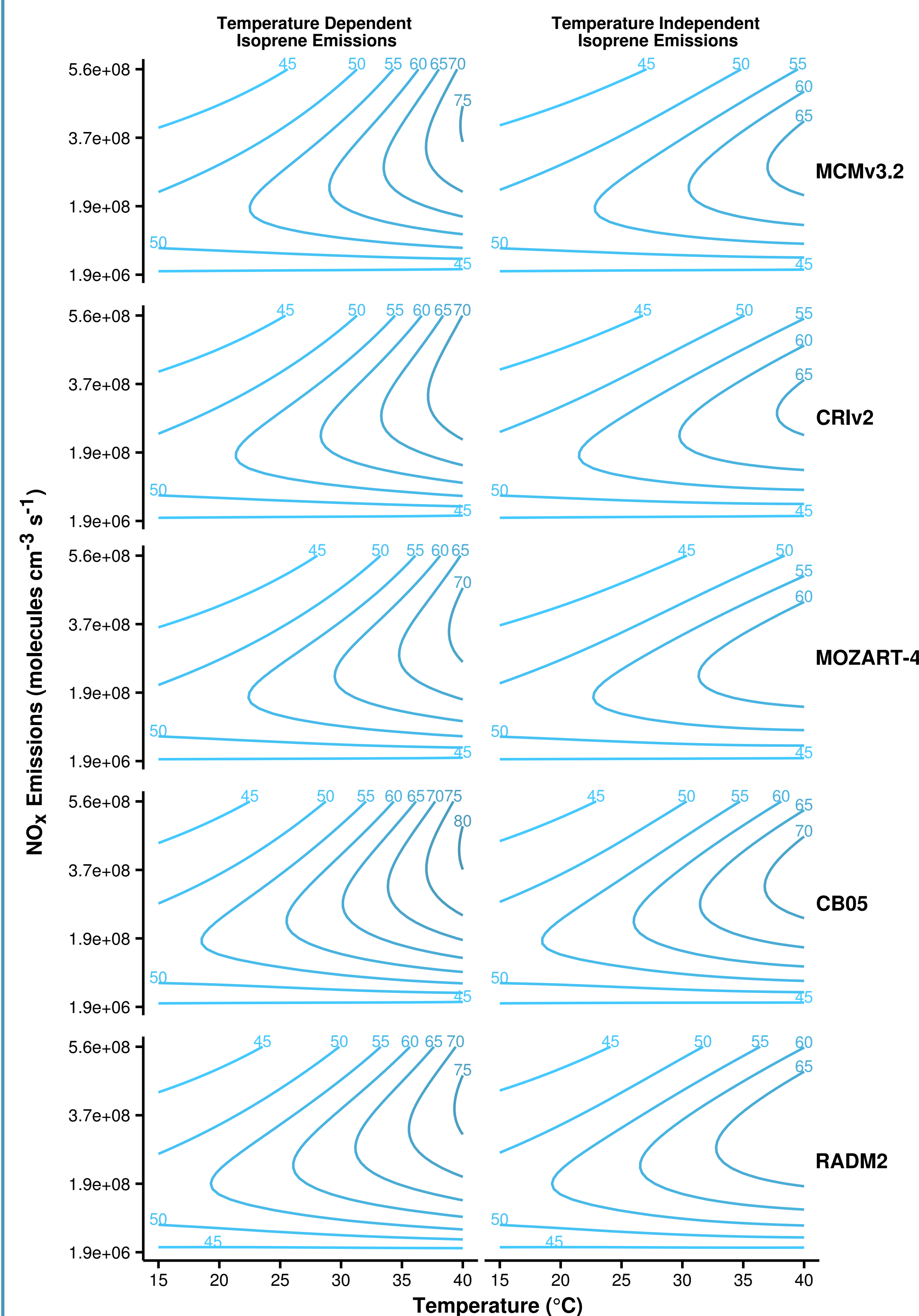
- ▶ Ozone is produced from photochemistry of emitted VOC and NO_x , VOC is the “fuel” and NO_x the “catalyst”.
- ▶ Temperature drives surface ozone in many areas.
- ▶ Temperature influences ozone production by
 - ▶ increasing BVOC emissions from vegetation,
 - ▶ increasing reaction rates of many atmospheric chemistry processes.
- ▶ Is increased BVOC emissions or increased chemistry more important for increasing ozone with temperature?
- ▶ Do chemical mechanisms used in models reproduce the relationship between ozone and temperature across NO_x gradients?

Approach

- ▶ Box model simulating Benelux region using temperature dependent and independent source of isoprene emissions.
- ▶ NO_x systematically varied over 15 – 40 °C.
- ▶ Experiments repeated using different chemical mechanisms: MCMv3.2, CRIV2, MOZART.4, RADM2, CB05.

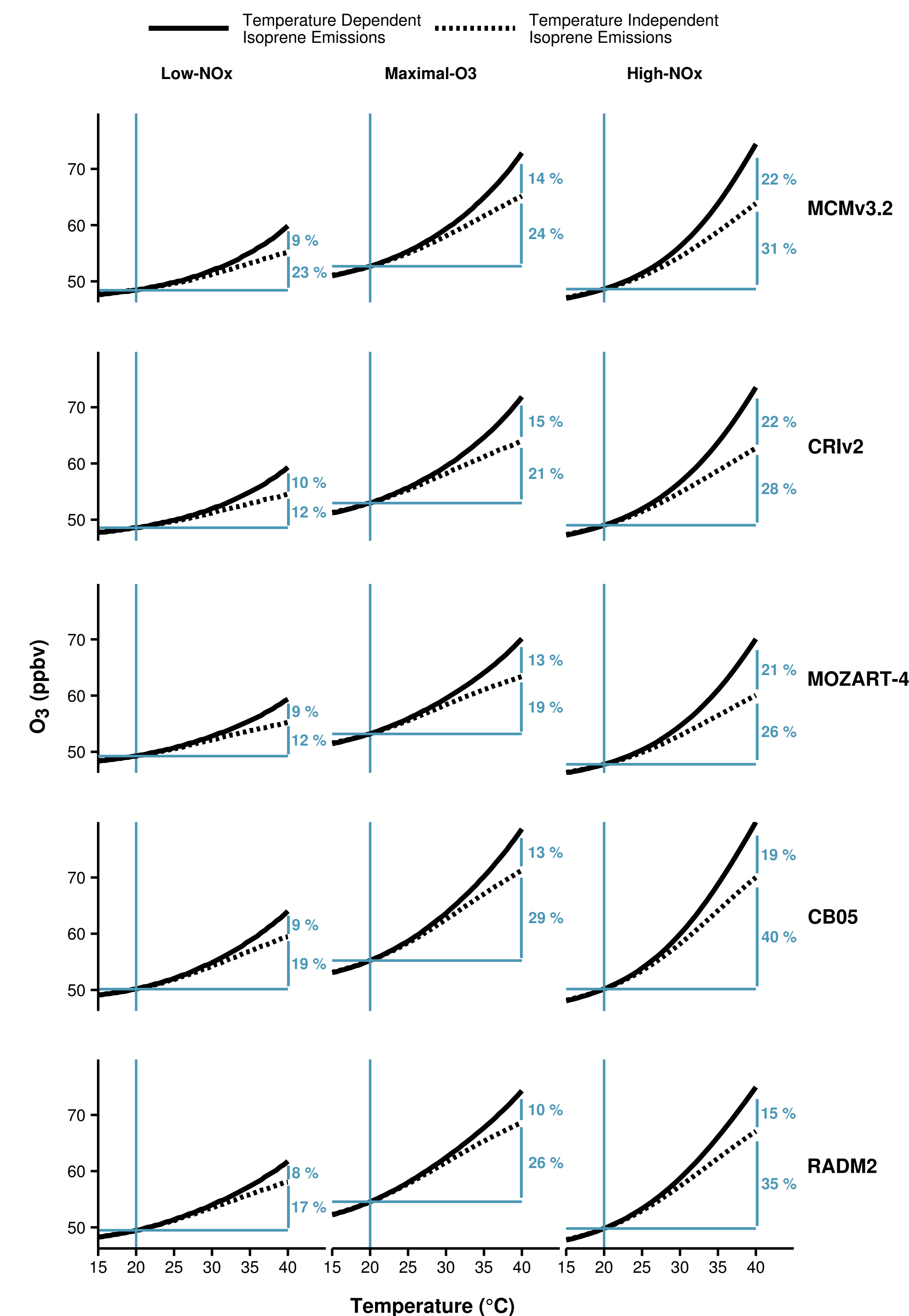
Results

Ozone Mixing Ratios in ppbv as a Function of NO_x and Temperature



- ▶ Highest ozone with temperature dependent source of isoprene and high NO_x .
- ▶ Lowest ozone with low NO_x levels.
- ▶ Non-linear relationship of ozone with NO_x and temperature reproduced by all chemical mechanisms.
- ▶ Highest ozone produced using RADM2 and CB05 chemical mechanisms.

Percent Increase from 20 °C from Chemistry and Emissions



- ▶ Largest increases in ozone at 40 °C due to increased reaction rates not higher isoprene emissions.
- ▶ Largest increases in ozone with high NO_x conditions.
- ▶ CB05 and RADM2 have lowest increase in ozone due to isoprene emissions but highest increase due to chemistry.

Conclusions

- ▶ Lower NO_x levels produces the least amount of ozone regardless of the increases of emissions and chemistry.
⇒ Reducing NO_x minimises ozone production despite projected increases in isoprene emissions from vegetation.
- ▶ All chemical mechanisms reproduce the non-linear relationship of ozone on NO_x and temperature.
- ▶ Percent increase in ozone with temperature from chemistry is larger than that from increased isoprene emissions. Largest increases in ozone with temperature under high- NO_x conditions.

Future Work

- ▶ Compare rate of change of ozone with temperature in simulations and observations.
- ▶ Which aspects of the increased chemistry is the most important? Decreased PAN lifetime? Increased radical production?
- ▶ Determine why CB05 and RADM2 produce more ozone than other mechanisms.

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