The COVID-19 impact on the O&G respect to 2019 in the Permian basin.

Unprecedented scenario to evaluate the contribution of the O&G industry to NO$_2$ and CH$_4$ emissions.

NO$_2$ (mole m$^{-2}$ s$^{-1}$) emissions annual average

2019

2020

- 13 % decrease in NO$_2$ emissions in areas of Production
- 68 % decrease in NO$_2$ emissions in areas of Production + Drilling

Decrease in most productive basins but not during COVID19 lockdown

- 32% in NO$_2$ emissions in areas of Production + Drilling

- 67% in NO$_2$ emissions in areas of Production + Drilling during the lockdown

0.3–1.5 % of max [CH$_4$] values

7% decrease of NO$_2$ emissions in 2020 respect 2019
The United States is the largest O&G producing country, with the Permian basin being the second largest hydrocarbon-bearing area.

In March 2020, the COVID-19 pandemic caused an historic collapse in fossil fuel demand and unprecedented scenario for fossil fuel emission analysis.

For this study, level 2 offline data of total columns of methane (CH\textsubscript{4}) and nitrogen dioxide (NO\textsubscript{2}) obtained from the Tropospheric Monitoring Instrument TROPOMI on board the Copernicus Sentinel 5P satellite were used.
Nitrogen dioxide was more impacted by the COVID-19 not only during the lockdown period, but also in 2020 mean concentrations respect to the 2019. In the case of methane concentrations, due to the life time and the previous high emissions during winter months in 2020, the COVID-19 effect was not appreciated, specially in Delaware basin (the most productive basin in the Permian).
COVID-19 impact on Oil and Gas industry emissions: A case study of the Permian Basin (US)

Raquel Serrano, Barbara Dix, Joost de Gouw, Pietermel Levelt, Pepijn Veefkind

Median NO$_2$ emissions in pre and post COVID-19 lockdown

- 30% average in NO$_2$ emissions in all the sub-basins of the Permian

Most productive basins (April-June) 2020

<table>
<thead>
<tr>
<th>Basin</th>
<th>Mean + SD 2019</th>
<th>Mean +SD 2020</th>
<th>COVID19 impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delaware</td>
<td>3.5 e-09 ± 2.5e-09</td>
<td>2.5e-09 ± 1.8e-09</td>
<td>- 28%</td>
</tr>
<tr>
<td>Midland</td>
<td>3.9 e-09 ± 2.2e-09</td>
<td>2.6e-09 ± 2.2e-09</td>
<td>- 33%</td>
</tr>
<tr>
<td>Central</td>
<td>3.2e-09 ± 1.7e09</td>
<td>2.6e-09 ± 1.9e-09</td>
<td>- 18%</td>
</tr>
</tbody>
</table>

Less productive basins (April-June) 2020

<table>
<thead>
<tr>
<th>Basin</th>
<th>Mean + SD 2019</th>
<th>Mean +SD 2020</th>
<th>COVID19 impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ozona arc</td>
<td>2.3e-09 ± 1.7e-09</td>
<td>1.6e-09 ± 2e-09</td>
<td>- 30%</td>
</tr>
<tr>
<td>Valverde</td>
<td>1.8e-09 ± 1.4e-09</td>
<td>1.3e-09 ± 1.9e-09</td>
<td>- 27%</td>
</tr>
</tbody>
</table>
NO\textsubscript{2} emissions and concentrations are more related to oil production (higher R coeff) and methane concentrations with gas production.

Decrease of all spatial relationships in 2020
Conclusions

- Tropomi can track downturn production and drilling activity in the Permian basin tracking the NO2 emissions.
- NO2 tropospheric concentrations have the highest values in the most productive regions (Delaware, Midland and Central basin).
- Concentrations of methane seems to increase during the COVID-19 lockdown for a posterior decrease during the summer months in 2020.
- NO2 emissions calculated with the divergence method show a significant reduction during COVID-19 in the Permian basin.
- The divergence method seems to help to locate the emission source and identify the oil and gas related activity.
- Places where production and drilling activities occurred at the same time had the highest NO2 emission rates and experienced the largest decrease during the COVID-19 lockdown.

Acknowledgements

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