

# **Reduction of atmospheric N deposition and new primary productivity in the Yellow Sea coasts of the Northeastern Pacific Ocean for COVID-19 period**

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Since the Yellow Sea is located between Northern China and the Korean Peninsula, the abundant atmospheric N has been deposited in the Yellow Sea, implying an increase in new primary productivity (NPP). We monitored atmospheric inorganic N deposition in total suspended particle (TSP) samples and analyzed isotopes of  $\text{NO}_3^-$  in TSP before (2018) and during COVID-19 (2021) to investigate how the lockdown of human activities affected the N deposition and NPP in the Yellow Sea. During COVID-19, the inorganic N deposition decreased by 71% for summer and 81% for winter compared to before COVID-19, which was mainly caused by the reduction of transportation due to the lockdown. The NPP calculated by converting deposited nitrogen to carbon has been decreased by  $88.6 \text{ mmol C m}^{-2} \text{ yr}^{-1}$  from 2018 to 2021. This result indicated that the reduction of N deposition could decrease the amount of  $\text{CO}_2$  absorbed from the atmosphere by the phytoplankton. The isotopic values of  $\text{NO}_3^-$  were not changed significantly, implying no change in the main sources of atmospheric N, such as fossil fuel combustion for winter and vehicle exhaust for summer. However, the  $\delta^{15}\text{N-NO}_3^-$  values in winter 2021 are slightly lower compared to 2018, reflecting the fact that decreased coal consumption in South Korea in 2021 likely contributed to a slight reduction in  $\delta^{15}\text{N-NO}_3^-$  values in winter 2021 compared to 2018. Therefore, our study suggests that the lock-down of COVID-19 may have reduced N deposition to the Yellow Sea, which in turn presumably decreased the new primary productivity and  $\text{CO}_2$  uptake from the atmosphere.