



Correlation between economic trends in satellite-derived NO₂ concentrations over shipping lanes

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In recent years it has been shown that space-borne spectrometers can detect shipping emissions of nitrogen oxides. As the global economy expanded, these emissions have been increasing for several decades, but few attempts have been made to detect these trends with satellite measurements. Here we use satellite data to detect non-linear trends in ship-emitted NO₂ on a monthly to yearly basis. For this purpose a method is used that amplifies the shipping signal in satellite measurements of NO₂ by removing background variations that obscure shipping trends. With this method non-linear trends in NO₂ can be detected over major shipping lanes in the Mediterranean Sea, the Red Sea, the Indian Ocean and the South Chinese Sea. The shipping signal displays a large increase between 2003 and the summer of 2008 and a sharp decline afterwards, corresponding to the global economic recession of 2008-2009. These two trends are detected over all four shipping lanes by several space-borne spectrometers. Because of high correlations between satellite data mutually and between satellite data, shipping statistics and international trade volumes, we conclude that the detected trends are caused by actual changes in shipping emissions. It is therefore possible to detect short-term economic fluctuations in satellite measurements of NO₂ over major shipping lanes.