Tropospheric Ozone and Climate Interactions in the Satellite Era (TOCISE)

Dr Richard Pope

ESA CCI Research Fellow

School of Earth of Environment, University of Leeds, Leeds, UK

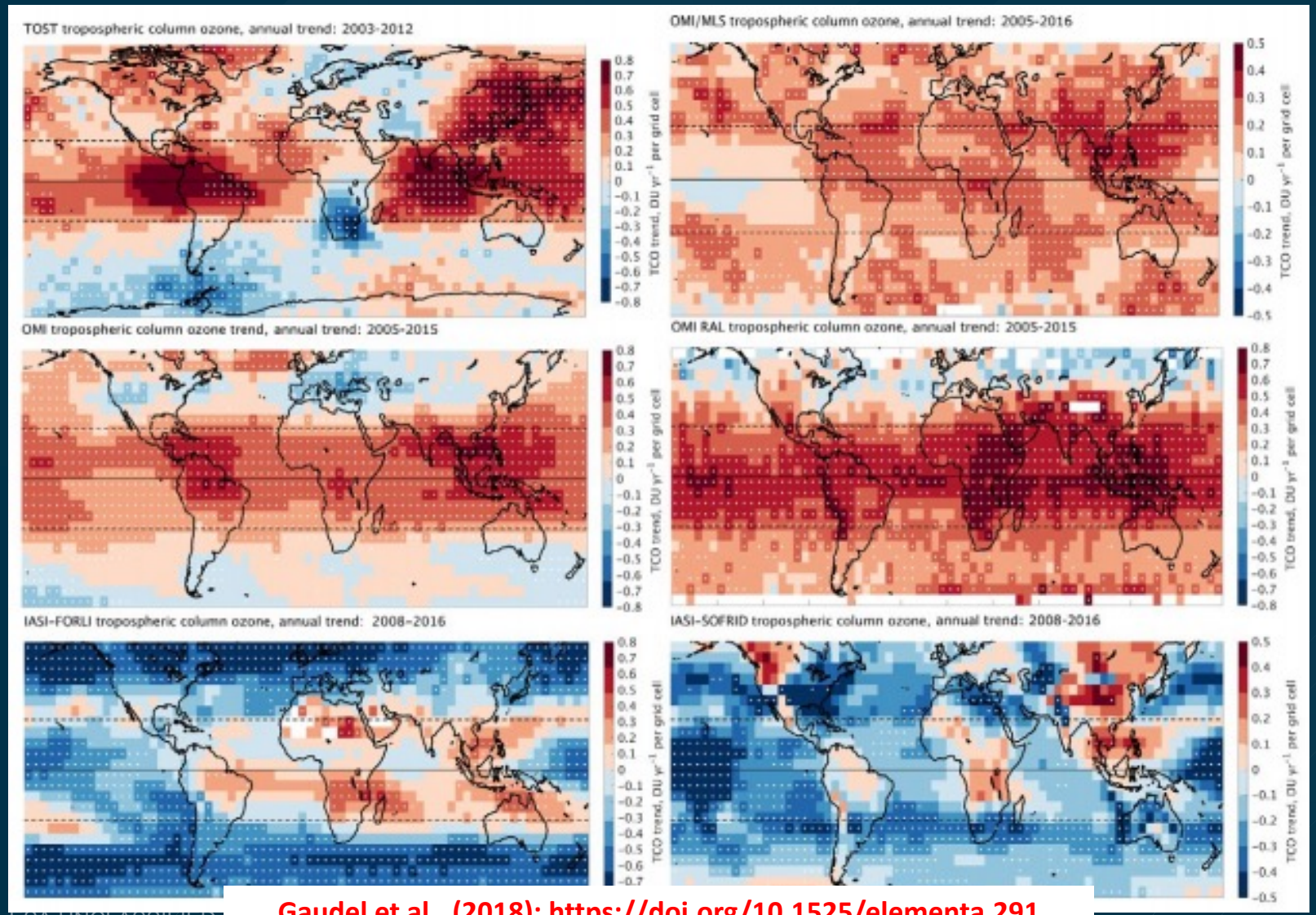
National Centre for Earth Observation, University of Leeds, Leeds, UK

National Centre for Earth Observation
NATURAL ENVIRONMENT RESEARCH COUNCIL

ESA CCI Colocation Meeting: Wednesday 5th October 2021

UNIVERSITY OF LEEDS

Satellite Tropospheric Ozone Trends



- As shown by Gaudel et al., (2018), there are inconsistencies in the magnitude and spatio-temporal variability of tropospheric ozone (TO_3).
- This project will inter-compare different satellite TO_3 products to identify regions of consistency in the seasonality, trends and spatial distribution.
- TOCISE will also exploit other data sets and tools such as ozonesonde records and the UK Met Office Earth system model (UKESM) to investigate the impact of instrument vertical sensitivity on satellite retrieved zone.

Gaudel et al., (2018): https://doi.org/10.1525/elementa.291

TOCISE Work Packages

WP1: *Quantify and evaluate TO_3 spatio-temporal variability and uncertainty through inter-comparison of original and updated ESA-CCI products (1995-present day).*

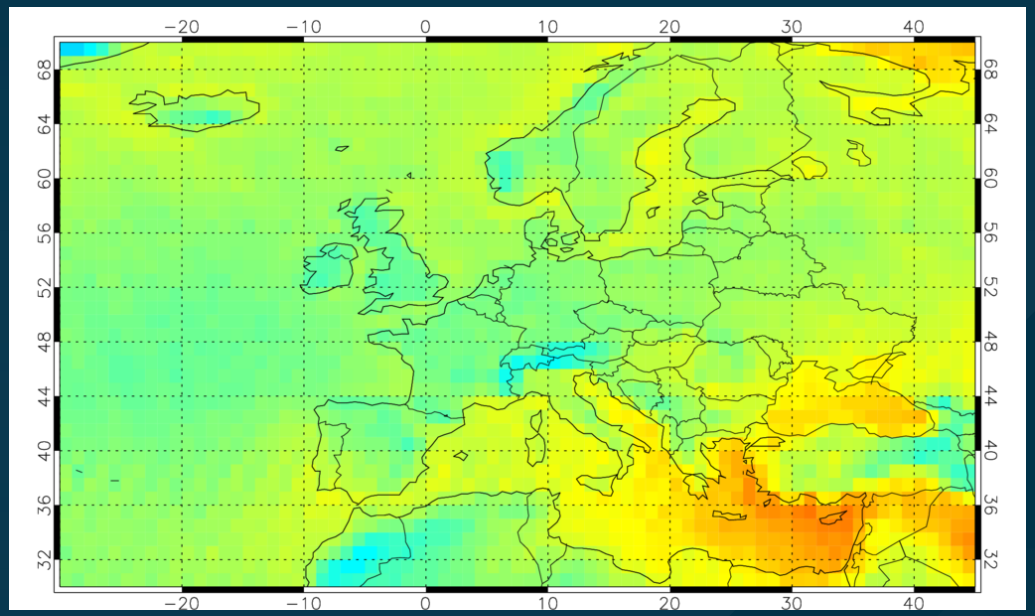
WP2: *Use an Earth System Model to interpret satellite-observed TO_3 temporal changes (2005-present, most densely sampled period) and quantify the impacts on climate (e.g. atmospheric radiative properties).*

Table 1. Annual Global Mean Tropospheric Ozone Column, Radiative Effects (REs) and Normalized Radiative Effects by Column Ozone (NREs) for the Radiative Transfer Model Simulations[a]

	Tropospheric O_3 Column (DU)	Tropospheric O_3 RE (W m^{-2})			NRE (mW m^{-2} DU^{-1})
		LW	SW	Net	
TOMCAT PI	19.7	0.70	0.15	0.85 (0.82)	43
TOMCAT PI (BB_PD)	21.6	0.77	0.17	0.94 (0.92)	43
TOMCAT PD	28.5	0.96	0.21	1.17 (1.16)	41
TOMCAT-AK 05/06	28.7	0.93	0.21	1.14 (1.15)	40
TOMCAT-AK 06/07	29.0	0.94	0.21	1.15 (1.15)	40
TOMCAT-AK 07/08	29.3	0.96	0.21	1.17 (1.17)	40
TES 05/06	29.9	0.97	0.21	1.18 (1.18)	39
TES 06/07	29.9	0.96	0.21	1.18 (1.17)	39
TES 07/08	30.4	0.98	0.22	1.20 (1.20)	39

[a]RE and NRE values are calculated using the radiation model by comparison against the NO OZONE simulation. Values in brackets are cal ds with the RK.

Rap et al., (2015), DOI: 10.1002/2015GL064037



Example of Ozone Monitoring Instrument (OMI) sub-column (0-6 km) ozone (Dobson Units, DU), 2005 - 2017, provide by the **Rutherford Appleton Laboratory**.

WP3: *Identify dominant Earth system processes driving satellite-observed TO_3 temporal variability.*