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Supplement of

Influences of downward transport and photochemistry on surface ozone over East Antarctica during austral summer: in situ observations and model simulations

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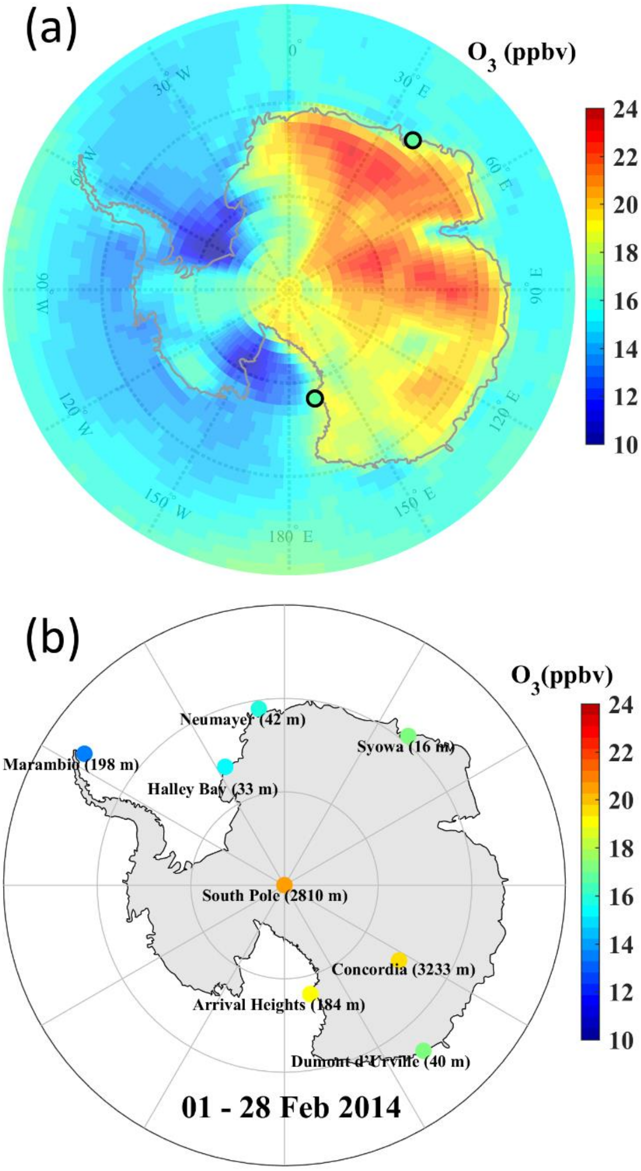


Figure S1: (a) Spatial distribution of EMAC simulated surface O_3 averaged over the study period. Colour inside the black circle represent the average value from in situ measurements over Syowa and Arrival Heights. (b) Spatial distribution of in situ measured surface O_3 averaged over 01–28 February 2014. Spatial heterogeneity is in line with the distribution simulated with EMAC. Surface ozone observations at Antarctic stations (South Pole, United States; Arrival Heights, New Zealand; Marambio, Argentina; Syowa station, Japan) were obtained from the World Data Centre for Reactive Gases (WDCRG), WMO's GAW (Global Atmosphere Watch; World Meteorological Organization) programme (https://ebas.nilu.no/, last access: 1 January 2024 and https://ebas-data.nilu.no/Default.aspx, last access: 1 January 2024), and Legrand et al., 2016.

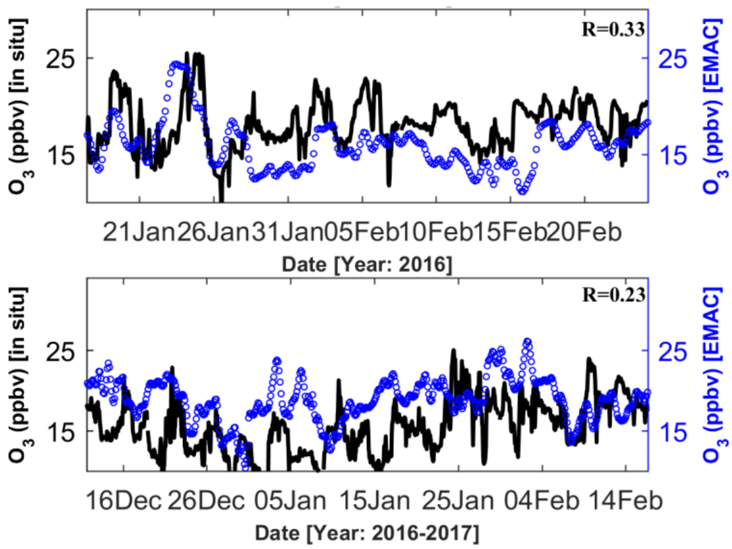


Figure S2: In situ (black) and EMAC simulated (blue) surface O_3 at Arrival Height during austral summer of 2016–2017.

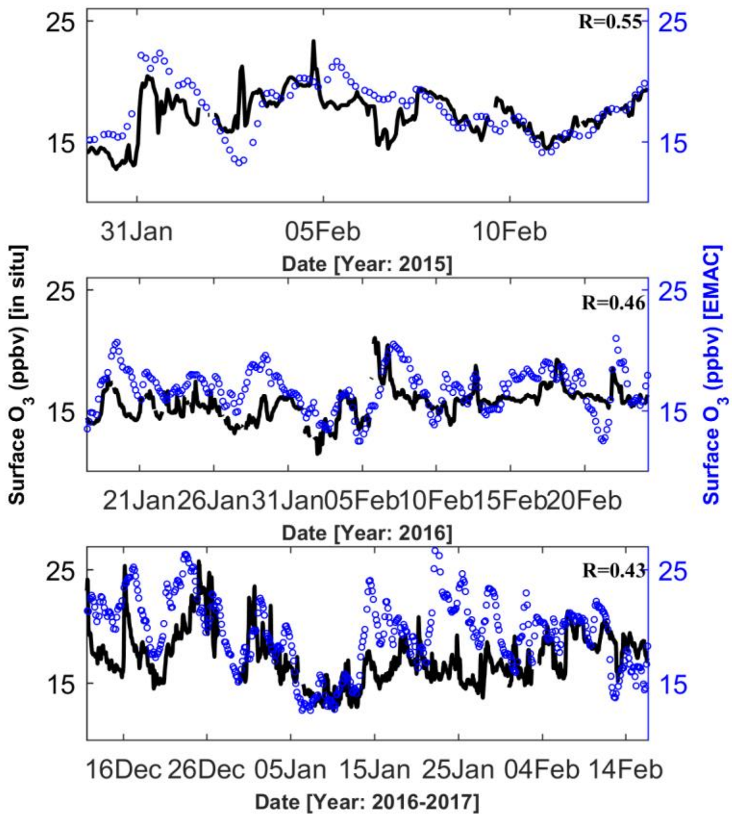
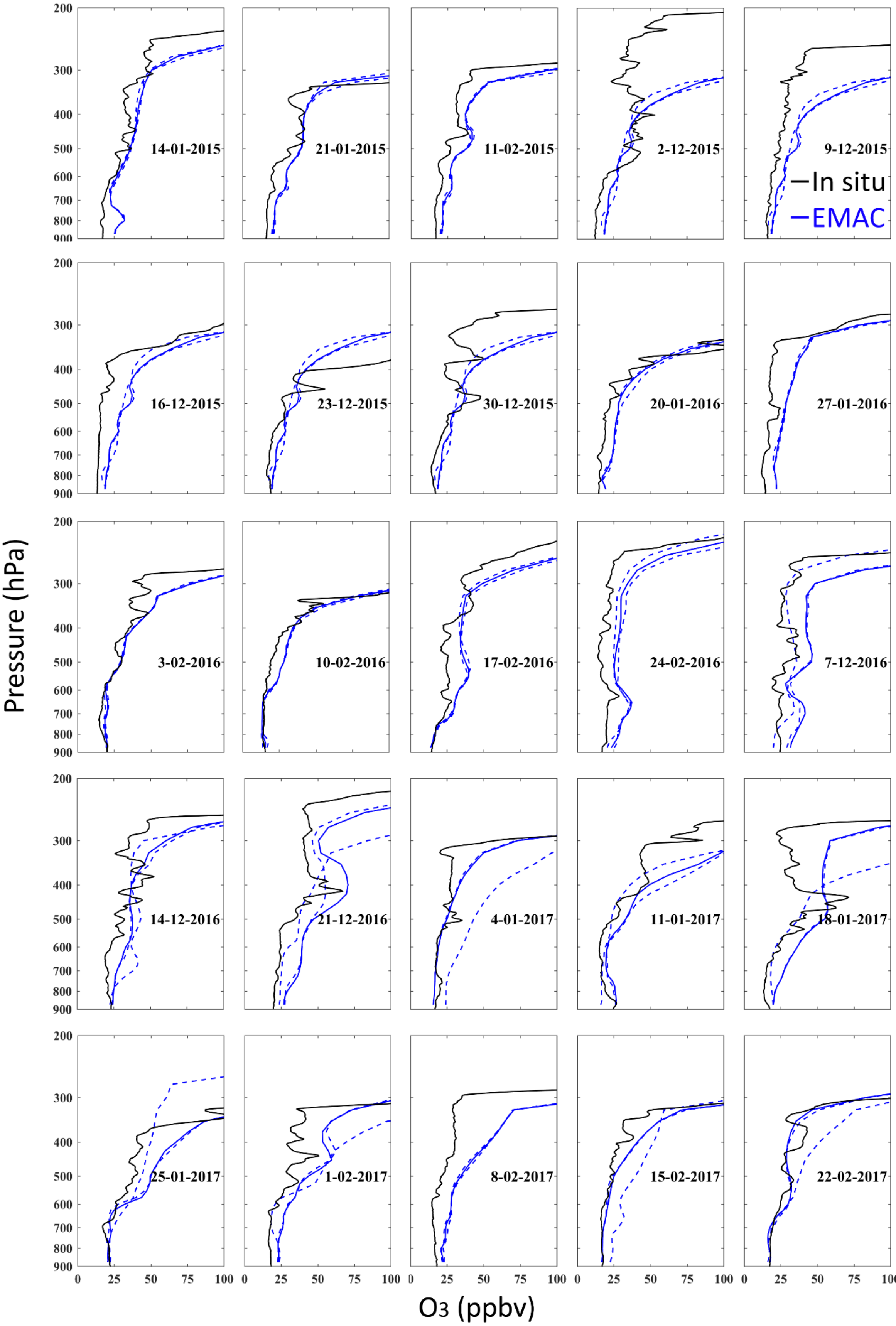


Figure S3: In situ (black) and EMAC simulated (blue) surface O_3 at Syowa during austral summer of 2016–2017.



14-01-2015
21-01-2015
11-02-2015
2-12-2015
9-12-2015
In situ
EMAC
16-12-2015
23-12-2015
30-12-2015
20-01-2016
27-01-2016
3-02-2016
10-02-2016
17-02-2016
24-02-2016
7-12-2016
14-12-2016
21-12-2016
4-01-2017
11-01-2017
18-01-2017
25-01-2017
1-02-2017
8-02-2017
15-02-2017
22-02-2017
Pressure (hPa)
200
300
400
500
600
700
800
900
0
25
50
75
100
O3 (ppbv)

Figure S4: In situ (black) and EMAC simulated (blue) vertical profile of O_3 at Davis station. Dashed blue curves represent O_3 profiles 3 h prior and after the time of ozonesonde launch.

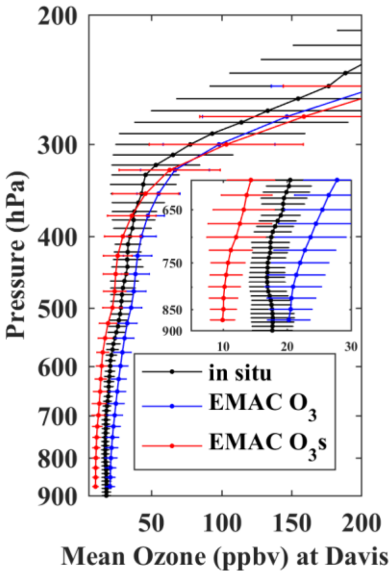


Figure S5: Vertical distribution of O_3 (black: in situ and blue: EMAC) and O_3s (red: EMAC) averaged over profiles shown in figure S4 at Davis station.

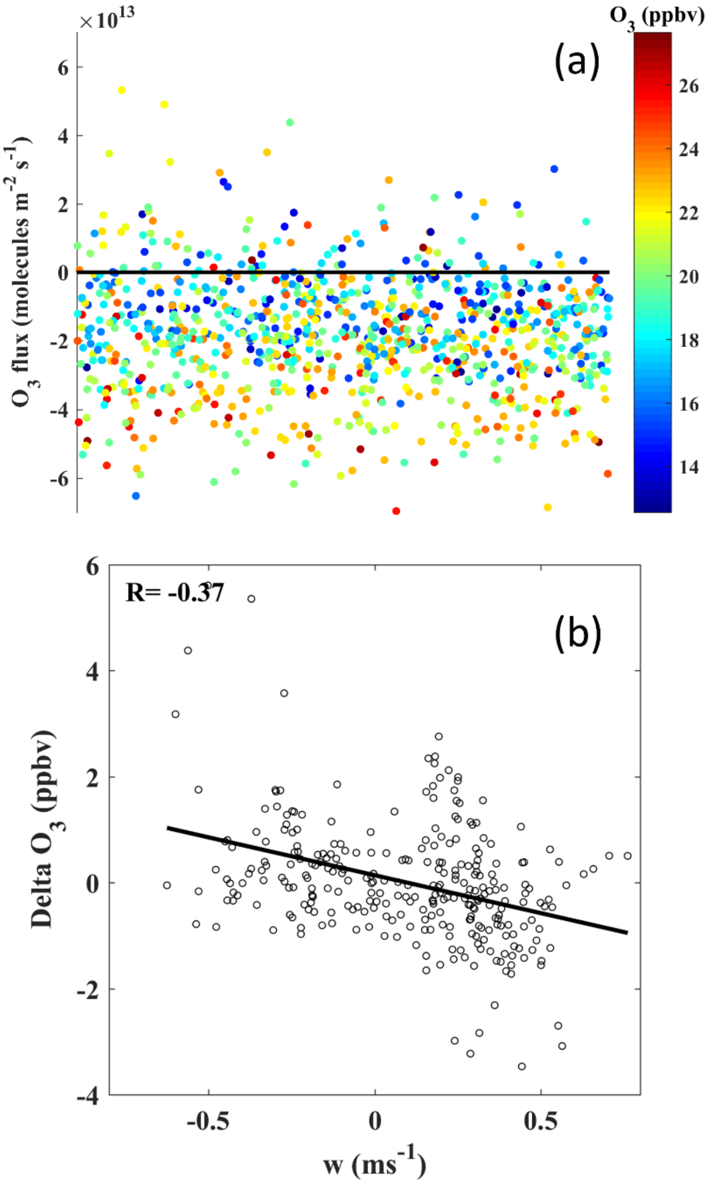


Figure S6: (a) Distribution of measured O_3 mixing ratio with respect to EMAC simulated O_3 fluxes during the study period. Larger downward fluxes are corresponding to frequent higher O_3 mixing ratio. (b) Scatter plot between in situ measured vertical wind and ΔO_3 during 18–29 January 2016.

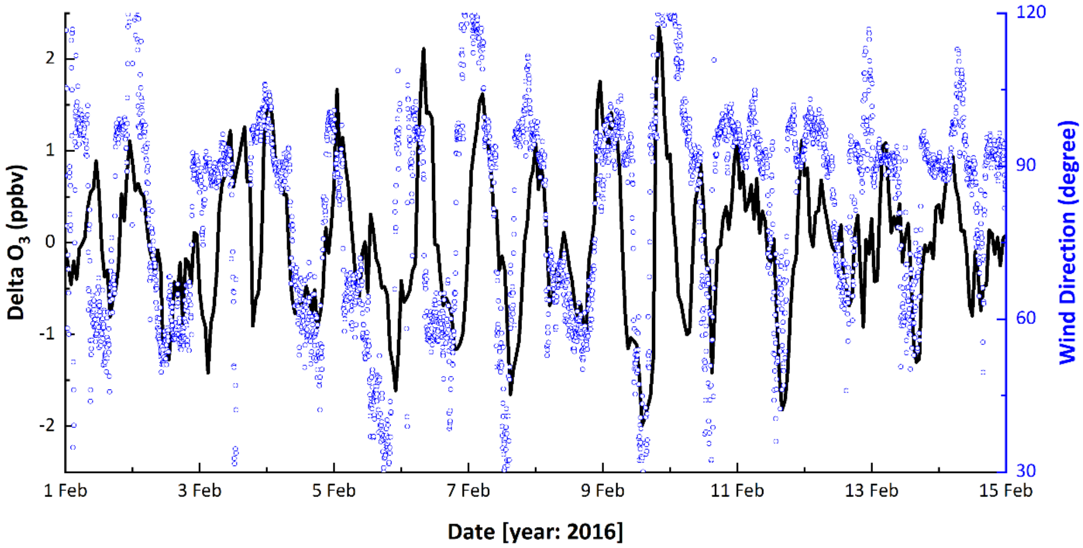


Figure S7: Variations in ΔO_3 and wind direction at Bharati during summer 2016.

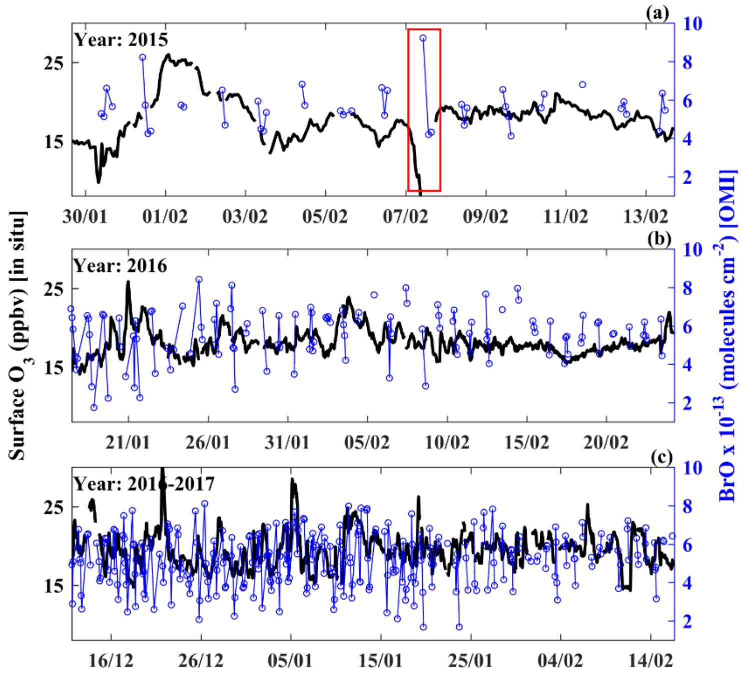


Figure S8: Variations in surface O_3 at Bharati and OMI-derived BrO column around Bharati (±0.5° latitude/longitude) during austral summer. Red rectangle mark the O_3 depletion event coinciding with enhanced BrO.

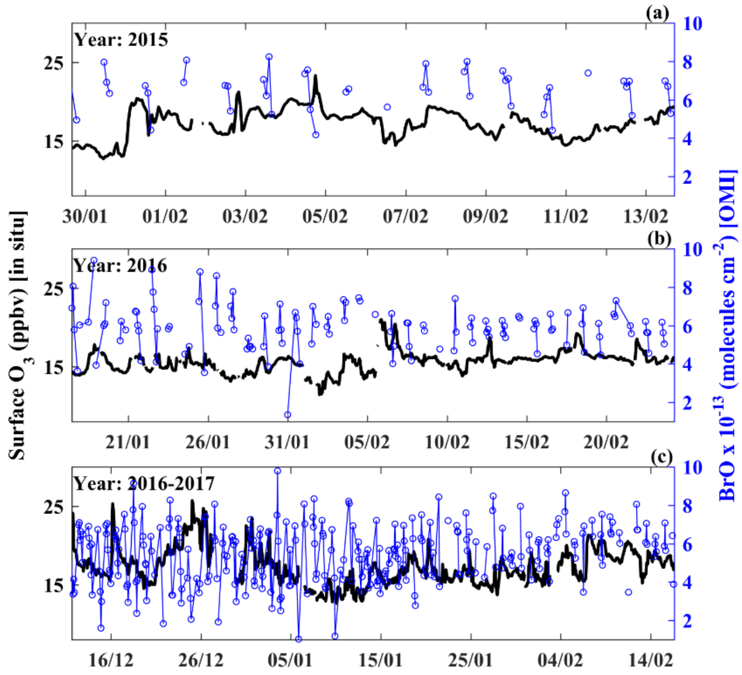


Figure S9: Same as S8 but for Syowa station.

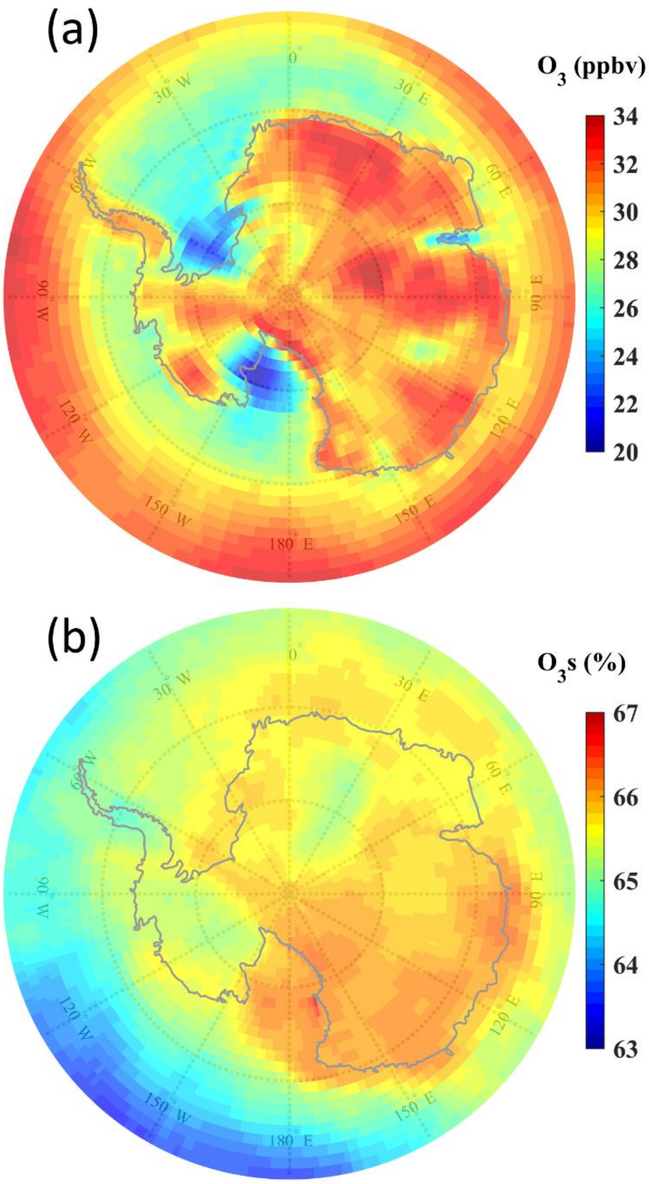


Figure S10: EMAC simulated wintertime distribution of surface O_3 and O_3s over the Antarctic region (July of 2015–2017).

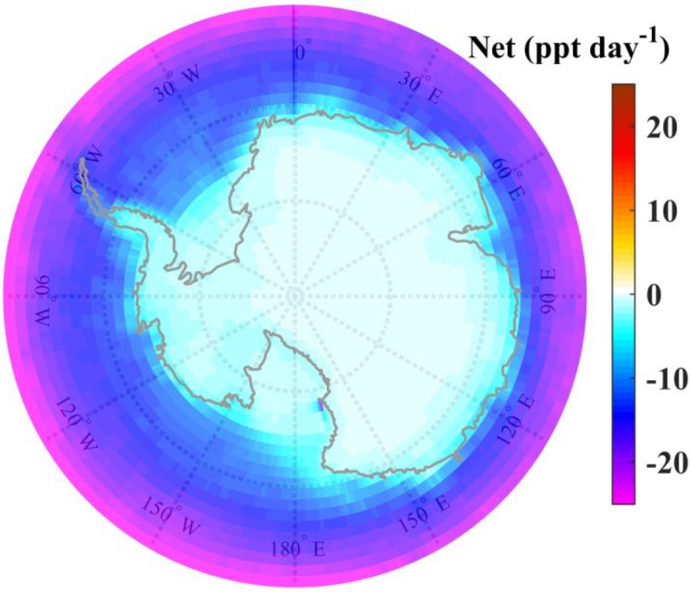


Figure S11: Spatial distribution of net rate of change (production minus loss) of surface O_3 due to photochemistry during winter (July of 2015–2017).

Reference

Legrand, M., Preunkert, S., Savarino, J., Frey, M. M., Kukui, A., Helmig, D., Jourdain, B., Jones, A. E., Weller, R., Brough, N., and Gallée, H.: Inter-annual variability of surface ozone at coastal (Dumont d'Urville, 2004–2014) and inland (Concordia, 2007–2014) sites in East Antarctica, Atmos. Chem. Phys., 16, 8053-8069, doi: 10.5194/acp-16-8053-2016, 2016.