Supplementary material

S1. Population density around ozonesonde stations and IAGOS airports

In order to have a first look on how IAGOS and ozonesonde profiles may be influenced by local anthropogenic sources, we investigated the population density around the IAGOS aircraft and the ozonesonde stations using the Gridded Population of the World (GPW) version 4 data (Center for International Earth Science Information Network, 2016; http://sedac.ciesin.columbia.edu/data/collection/gpw-v4) available for 2010 at a resolution of 30 arc-seconds (roughly 1 km at the equator). For each individual location, we calculated the mean population density over the area at ±0.1° in longitude and latitude from the station/airport. On average, the population density is 1,152 inhabitants km^{-2} around ozonesonde stations. It varies from density 5-24 inhabitants km^{-2} at Churchill, Yarmouth, Goose Bay and the Valentia Observatory to 3,200-3,800 inhabitants km^{-2} at Naha (Japan), Barajas (Spain), Ankara (Turkey) and Uccle (Belgium). The mean population density around IAGOS airports is 2,004 inhabitants km^{-2}, thus a factor 1.7 higher than at the ozonesonde stations. It strongly varies depending on the agglomeration size and the distance to the airport. The maximum densities are found at the airports of Istanbul (20,405 inhabitants km^{-2}), Seoul (10,692), Beirut (9,835) and Delhi (8,657). At the Frankfurt airport, the population density is 1,437 inhabitants km^{-2}. The minimum densities are found at some minor Canadian airports like Goose Bay (14 inhabitants km^{-2}) or Gander (35). One exception is the Denver airport that is very isolated from the city, as illustrated by its population density of only 69 inhabitants km^{-2} (the airport is surrounded by agricultural lands, a secondary airport and separated from the city by the large Rocky Mountain Arsenal National Wildlife Refuge).

S2. Supplementary figures

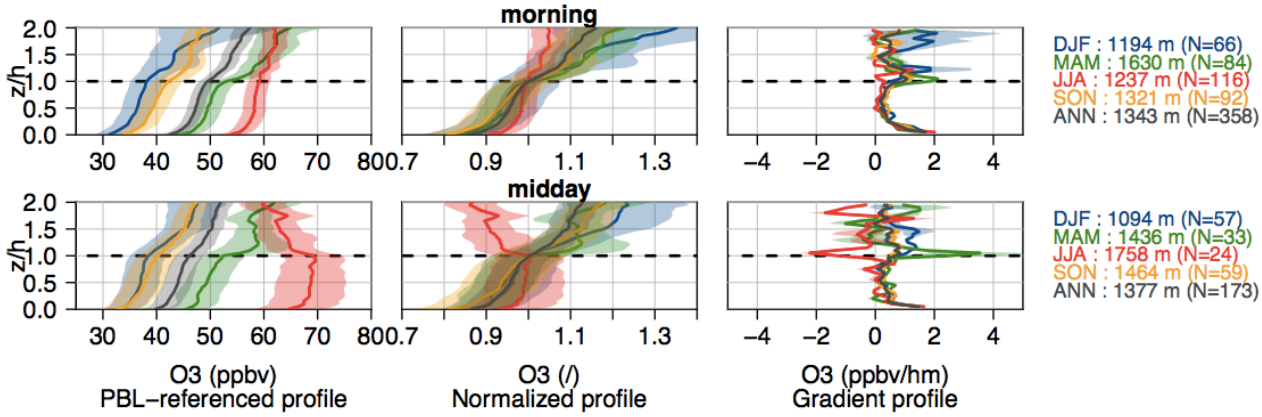

Figure S-1: Vertical profiles of O_3 mixing ratios (in ppbv; left panels), same profiles normalized by the O_3 mixing ratio at z/h=1 (middle panels), and vertical gradient profiles (in ppbv hm^{-1}; right panels), at the Boulder, Colorado, ozonesonde station. Plots are shown only during morning (late morning since most profiles are available after 10:00 LT) and at midday. The shaded area represents the uncertainties (at a 95% confidence level) on the mean. For each season and time slots, we indicate the number of profiles (N) used for calculating the PBL-referenced profile (i.e. profiles without any missing data) and the mean PBL height calculated based on this subset of profiles.

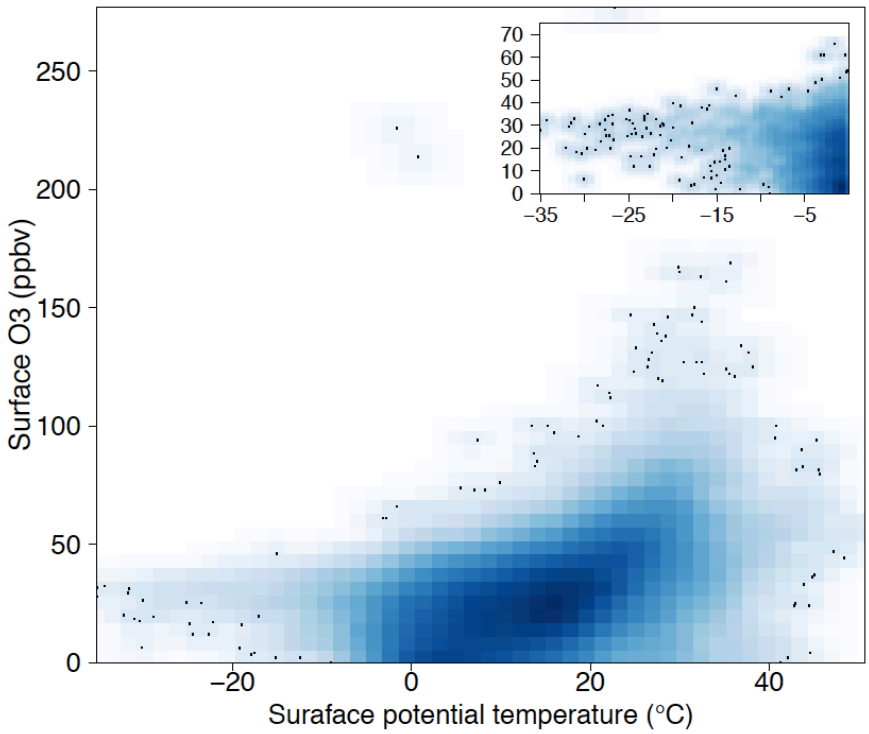

Figure S-2: Density scatter plot of surface O_3 mixing ratios against surface potential temperature considering all profiles; a zoom on the negative temperatures is shown in the top-right corner. In each of the two panels, the 100 points corresponding to the lowest densities are shown explicitly.