Geophysical Research Abstracts
Vol. 12, EGU2010-5151-1, 2010
EGU General Assembly 2010

Atmospheric blocking signatures in total ozone and ozone mini-holes

David Barriopedro (1), Manuel Antón (2,3), José Agustín García (2), Guadalupe Saénz (2), and Moisés G. Chamorro (2)

(1) CGUL-IDL, Faculdade de Ciências, Lisbon, Portugal (dbarriopedro@fc.ul.pt), (2) Departamento de Física, Universidad de Extremadura, Badajoz, Spain, (3) Centro de Geofísica de Évora, Universidade de Evora, Évora, Portugal

In this study, the statistical and dynamical relationship between total ozone column (TOC) and Northern Hemisphere blocking is explored by employing data from the ERA-40 reanalysis for the 1978-1998 period. Blocking signals in different statistics of TOC including its mean and extreme distribution and an objective definition of ozone miniholes are described, with special emphasis on the winter-extended season and the European and eastern Pacific sectors.

Blocking occurrence is accompanied by the decrease of TOC within the anticyclonic circulation region and a distinctive ozone increase upstream/downstream (upstream/south) of its center in the Pacific (European) sector. Regional differences mirror the preference for different types of blocking patterns to dominate over each basin. Blocking also enhances the likelihood of low TOC extremes, especially over the Scandinavian and the Alaska Peninsulas, where more than 50% of winter blocking days cause TOC values below its lower tercile. Conversely, blocking is not significantly responsible for the occurrence of TOC minima in western Mediterranean and central North America.

Blocking-related ozone miniholes (BMs, hereafter) exhibit a clear spatial dependent pattern confined to high-latitudes of both basins, where more than half of ozone miniholes can be concurrent with blocking. Oppositely, ozone miniholes unrelated with blocking (NBMs) are characteristic of mid-latitudes and they are more probably caused by synoptic transient wave breaking near the jet stream. BMs are also among the most intense and persistent.

BMs are consistent with an almost purely dynamic origin caused by the superposition of ozone-poor transport and vertical motions. Although the contribution of the former is dominant in BMs and NBMs, accounting for about two thirds of ozone reduction in the 330-850 K column, the enhancement of the vertical term becomes a distinctive feature of BMs. Photochemical effects may also account for the stronger ozone reductions observed in BMs, particularly over Europe, where meridional displacements of the polar vortex are a common feature of BMs.