Geophysical Research Abstracts, Vol. 7, 08340, 2005
SRef-ID: 1607-7962/gra/EGU05-A-08340

Permo-Triassic oxygen peak, its implications for ozone and surface UV flux.

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Atmospheric oxygen is coupled tightly to the evolution and function of life on earth, primarily through respiration but also as a prerequisite for ozone production. Here we investigate the possible consequences of changes in atmospheric oxygen content (ranging between 15% and 35% of the total atmospheric concentration), which may have occured over the period 350 - 250 Ma before present. This excursion occurred within an earth system containing an evolved biosphere, undergoing the widespread expansion of large vascular land plants. Using a 2D model we consider the effects of the changing oxygen level for ozone and subsequently upon the flux of UV radiation reaching the earth's surface. Our results confirm those of previous investigations of the pre-biological atmosphere, that the altitude of maximum ozone concentration and oxygen content are positively correlated, yet global mean column ozone as a function of oxygen varies little over the range considered here.

Various anomalies were found in the latitudinal distribution of column ozone when compared to a simulation with the present day oxygen content: a 15% oxygen atmosphere showed generally increased column ozone within the subtropics (peaking at around 5 DU), but decreased in high latitudes, reaching minima (around 10 DU) during spring time. Greater than 21% oxygen atmospheres resulted in the opposite anomalies, with reduced column ozone in the sub tropics but increased in high latitudes, peaking in spring time (around 25 DU for 30% oxygen simulation). These latitudinal distributions over time can be attributed to changes in transport of ozone in response to changes in the altitude of its formation.