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ENSO对平流层气溶胶分布的影响

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The impact of the ENSO cycle on the stratospheric aerosol distribution

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摘要

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摘要 本文采用ONI(Oceanic Nino Index)和HALOE(Halogen Occultation Experiment)气溶胶面积密度资料,从其滞后相关性入手分析了ENSO循环对平流层气溶胶的影响,通过对滞后于El Nino和La Nina时气溶胶含量的比较探讨了ENSO强迫的影响程度,并用剩余环流及其输送量解释了平流层气溶胶变化的动力机制.结果表明:ENSO对平流层气溶胶的分布有明显影响,在赤道和低纬度上空尤为显著,El Nino发生后半年内热带平流层低层的气溶胶面积密度较平均值偏大,平流层中层的面积密度则偏小,而La Nina反之.El Nino和La Nina影响的差异显著,在分别滞后于El Nino和La Nina事件2~8个月间的60 hPa气溶胶含量差异甚至高达45%,海表温度变化1 K则在滞后半年内气溶胶面积密度的变化可达到16%.ENSO的强烈影响能够维持大约半年,两年后基本消退.热带的变化幅度明显强于中高纬度,南北半球的变化特征也有所不同.ENSO通过影响剩余环流导致气溶胶输送量发生变化,进而引起气溶胶分布出现上述差异.

关键词: 平流层气溶胶 ENSO 滞后相关 剩余环流

Abstract: In this paper the Oceanic Nino Index and the HALOE dataset were used to study the impact of the ENSO cycle on the stratospheric aerosols by analyzing the lag correlation. The comparison of aerosol surface area after El Nino and the La Nina images the impact clearly and the change can be explained according to the transporting velocity and stream situation. The result displays that ENSO significantly affects the distribution of stratospheric aerosols, especially above the equator and low latitude. Within six months after El Nino, the aerosol surface density in the tropical lower-stratosphere layer is larger than the average while it's smaller in the middle stratosphere; however, the situation was contrary after La Nina. El Nino and La Nina had significantly different effects, which made the differences in aerosol content in 60 hPa as high as 45%. The change of aerosol surface density in the six months lag could be up to 16% as the temperature changed 1 K. The strong influence of ENSO could last for about six months and faded out in 2 years. Changes in the tropics were stronger than in the middle and high latitudes, while the characteristics of northern and southern hemispheres are different. ENSO lead to a change in the aerosol delivery by affecting the residual circulation, and in turn lead to these differences of the aerosol distribution mentioned above.

Keywords: Stratospheric aerosols ENSO Lag correlation Residual circulation

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