SPARC Workshop SHARP2016

Stratospheric circulation signal of the volcanoes for the 1989 to 2010 period

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The "background" stratospheric aerosol layer is shown to be persistently variable rather than constant, even in the absence of major volcanic eruptions by the recent observations (Solomon et al.,2010). Despite their potential to slow global warming, the radiative forcing associated with small volcanic aerosols reaching the lowermost stratosphere had not been considered until recently in the climate models (Andersson et al.,2015).

Here we investigate the stratospheric circulation signal due to the volcanoes for the 1979-2010 period and their impact on the AoA calculated from backward trajectories guided by ERA-Interim reanalysis. We collect 4 aerosol optical depth (AOD) data sets from GISS (Sato et al.,1993), Vernier et al.,(2011), Bourassa et al.,(2012) and CCMI AOD. We use the 4 AOD data sets in a multi-linear regression method to estimate the stratospheric circulation signal associated with these volcanic eruptions over the last 22-yr.

The 4 data sets show a very interesting feature in how the stratosphere is affected by each considered eruptions. The older AoA is correlated with each eruption intensity. Pinatubo impact is about 2.5 yr.dec-1 in the lowermost stratosphere but the wide of the pattern depend on the considered data sets. The vernier AOD data set exhibits no impact on the AoA in southern hemisphere while the other data show an positive amplitude of the AOD variation on AoA when we consider Pinatubo and all eruptions. Chaiten-Okmok-Kasatochi-Sarychev-Merapi (2008-2010) eruptions exhibit an impact of order of 1.8 yr.dec-1 with a similar pattern for all AOD data sets. This impact is due to a combination of successive eruptions that overlap. Even weaker than Pinatubo, the fact that these eruptions occurring with a small delay between each others, makes their impact strong. Manam-Soufriere-Tavurvur eruptions (2005-2006) reveal a very localized and small impact of these volcanoes on the AoA in the extra-tropical stratosphere with a maximum of 0.8 yr.dec-1.