Particles in the tropical UTLS from CALIPSO lidar measurements

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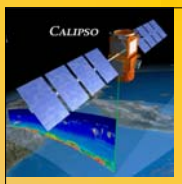


Data processing

✓Data : Total and Perpendicular attenuated backscatter at 532nm from CALIOP lidar + meteo data from GEOS-5 model, level 1 product, nighttime only.

✓ Processing : - Averaging 1°lat (300 profiles) along track

- Correction for attenuation due to molecular diffusion and ozone absorption

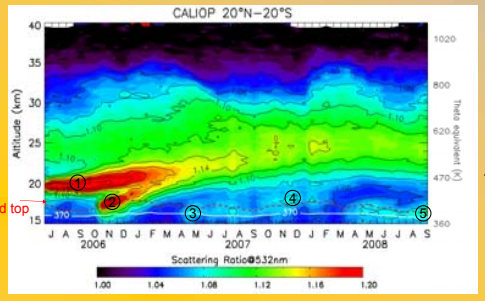
- Calculation of the scattering ratio (SR)

- Cloud mask when volume depolarization ratio >5%

- Adjustment of calibration at 36-39 km : assumed aerosol free

- More details on calibration see poster (CALIOP calibration for studying stratospheric aerosols)

① Transport of aerosols in the tropical stratosphere



Volcanoes :

1. Soufrière Hills (16°N-62°W), 20 May 2006, Montserrat Island, West Indies
2. Tavurvur (4°S,152°E) , 7 October 2006, Papua New Guinea
3. Piton de la Fournaise (21°S,55°E), 2 April 2007, Reunion Island
4. Jebel-Al-Tair (15°N-42°E) , 30 September 2007, Yemen
5. Okmok (53°N, 168°W) , 12 July 2008, Umnak Island, Alaska

- Vertical transport :

✓ B-D circulation : Minimum vertical velocity (near zero) at 20 km, slow ascent to 25 km at 0.3 km/month

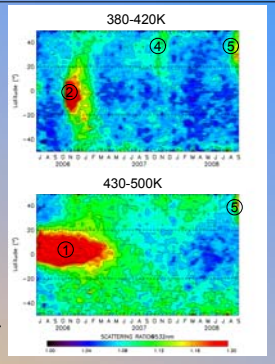
✓ Fast Clean air injection from the tropopause to 19 km in Feb-Mar followed by a stagnation for several months

- Meridional transport :

✓ 380K-420K : Fast exchange within 3-4 months

✓ 430K-500K : Containment of aerosols from Soufrière Hills in the tropical belt for more than 10 months

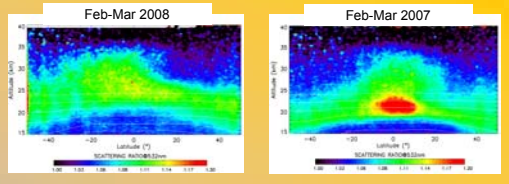
-Additional particles near the tropopause in Apr-May and Jul-Aug



② Clean air in the lower stratosphere

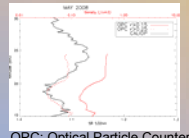
Injection

- Uplift in the lower stratosphere until 19-20km
- Faster than radiative heating calculation
- Coïncident with beginning of the overshooting season as seen by TRMM (Tropical Rainfall Measuring Mission)



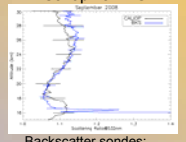
Stagnation

Caliop vs OPC



OPC: Optical Particle Counter, Teresina Brazil, U. Wyoming

Caliop vs BKS



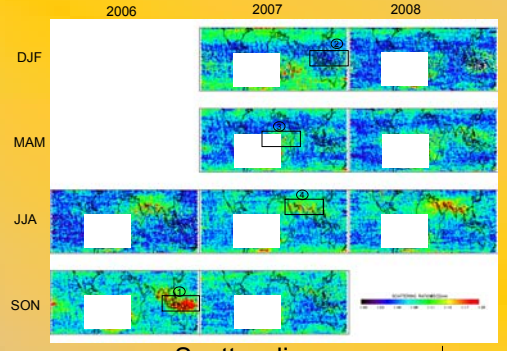
Backscatter sondes: Niamey, Niger, DMI

- Stagnation between 18-20km
- Confirmed by balloon flights In situ aerosols measurments

③ Particles near the tropopause

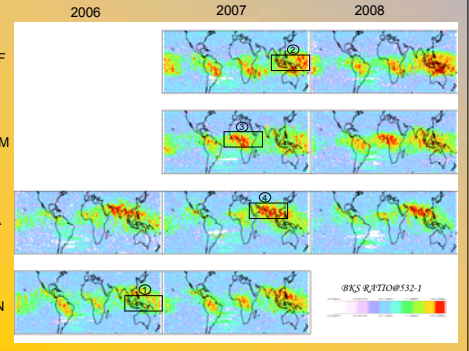
Aerosols 16-17 km

Mean Scattering Ratio (SR) with volume depolarization ratio(δ) <5%

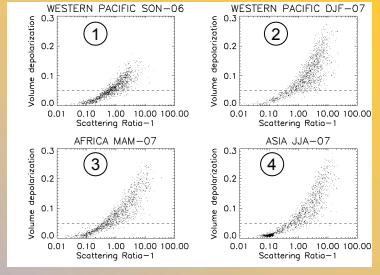


Clouds 16 km

Mean scattering intensity at 16km within 3 months (2°Lon x 1°Lat)



Scatter diagram



- CALIOP Volume depolarization ratio (δ) vs Scattering Ratio -1 (SR-1) (at 532nm)
- Mean δ and SR-1 between 16-17km

- Signature of aerosols from Tavuvur volcano in SON-06 over the Western Pacific (Low δ)
- DJF-07 over Western Pacific, MAM-07 over Africa and JJA-07 over Asia : convective season with high δ and SR-1 but :
  - ➢ Still thin cirrus clouds with δ<0.05 and SR<2 over Africa
  - ➢ Very low depolarizing particles (δ<0.02) with SR=1-1.2 over Asia, nature?

④ Conclusion

- Brewer-Dobson uplift at 300 m/month in the stratosphere with a minimum vertical velocity at 20 km
- Fast injection of clean air from the tropopause up to 19 km in Feb-March in the equatorial belt and stagnation.
- Additional particles at 16-17 km : Jul-Aug over Asia, Apr-May over Africa (less prononced)
- Very low depolarizing particles over Asia during convective period, nature ?

Acknowledgments

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