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NDACC METAFILE
Observatoire de Haute-Provence Aerosols/PSC lidar

Data Set Description:

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Instrument:	Backscatter Rayleigh-Mie lidar
Site:	Alpine Station
	Observatoire de Haute-Provence (43.9°N, 5.7°E)

Measurement Quantities:
Stratospheric Aerosols profiles (8-32 km in average)

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Reference Articles:

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Keckhut P., C. David, M. Marchand, S. Bekki, J. Jumelet, A. Hauchecorne, and M. HÃ¶pfner, Observation of Polar Stratospheric Clouds down to the Mediterranean coast, Atmos. Chem. Phys., 7, 5275-5281, 2007.

Keckhut P., A. Hauchecorne, S. Bekki, A. Colette, C. David, J. Jumelet, Evidences of thin cirrus clouds in the stratosphere at mid-latitudes, Atmos. Chem. Phys., 5, 3407-3414, 2005.

Neuber R., G. Beyerle, G. Fiocco, A. di Sarra, K.H. Fricke, C. David, S. Godin, L. Stefanutti, G. Vaughan, and J.P. Wolf, Latitudinal distribution of stratospheric aerosols during the EASOE winter 1991-92, Geophys. Res. Lett., 21, 1283-1286, 1994.

Instrument Description:

The aerosol/PSC lidar in Observatory of Haute-Provence is a backscatter Rayleigh-Mie lidar designed to observe upper stratospheric temperatures at altitudes higher the 30 km (see OHP temperature lidar metafile) and particles in the lower stratosphere, roughly between 8 and 32 km.

This lidar uses the second harmonic of a Nd:YAG pulsed laser (532 nm). The laser provides 350 mJ per pulse at 50 Hz. The beam divergence is reduced to 0.04 mrad using a beam expander. The backscattered aerosols signal is received on a 50 cm Newton telescope, while the receiving area for temperature is composed by a mosaic of four 0.5 meter diameter mirrors. Light is collected by an optical fibber (300 micrometers diameter) located at the focus points leading to a field of view of 0.2 mrad. The optical fibber drive the photons up to the receiver box where signal is filtered using a 1nm interference filter. Wavelengths are separated allowing Raman detection at 608 nm. Detection is then made by cooled Hamamatsu photomultiplier tubes running on photo-counting mode. Counting gating is 0.5 microsecond, providing a 75 meters vertical resolution. Electronic gating is used on each channel, in order to reduce the effects of the large initial burst of light and the resulting induced noise. The choices for this instrumental configuration are detailed in Keckhut et al. (1993).

Algorithm Description:

A new semi-automatic processing code was developed in 2008. Stratospheric particles data processing is divided into three steps. First, atmospheric molecular optical properties are calculated, from daily PTU profiles, provided by the French Met Office (MÃ©tÃ©o-France) radiosondes. Then, total background (sky and detection) is estimated from upper levels, where signal-to-noise ratio is very low (typically above 80 km). This second step is the most sensitive part of data processing and the largest source of uncertainties on the retrieved optical properties. Finally, the inversion is made using the well-known "Fernald-Klett" method. The altitudes of the different scattering layers are first determined, in order to define a rough profile of lidar ratio (extinction to backscatter coefficients ratio) with literature values.

The optical parameters profiles (8-32 km) obtained at the end of this process are:

- lidar backscatter ratio (ratio of the aerosol backscattering coefficient to the total backscattering coefficient) at 532 nm on the parallel polarisation plane (to the emission polarisation);
- lidar backscatter ratio at 532 nm on the perpendicular polarisation plane (to the emission polarisation);
- volume total depolarisation ratio at 532 nm (defined as the ratio of the perpendicular backscattering coefficient to the total backscattering coefficient).

Expected precision / Accuracy of the instrument:

A study of error sources for aerosols lidar on Observatory of Haute-Provence and Dumont d’Urville is provided in Chazette et al., 1995. We expect an uncertainty on backscattering coefficient not exceeding 15% (for low aerosols content).

Instrument History:

From the end of the seventies, a lidar system designed for stratospheric observations of ozone, temperature and aerosols was running at OHP. This old system was separated in an ozone lidar and a Rayleigh-Mie lidar (temperature and aerosol) in 1981. Since 1991, a telescope dedicated to the specific measure of aerosols was installed. Many instrumental changes have occurred since then. A main change took place in September 1994 as receiving telescopes, electronic counting system (vertical resolution) and acquisition computers were replaced. The last upgrade in May 2008 is the implementation of a new acquisition software. Problems with this new software preclude any aerosols acquisition after April 2008 up to presumably July 2009.