Dust Particle Distribution in Free Troposphere in East Asia and West Pacific Ocean

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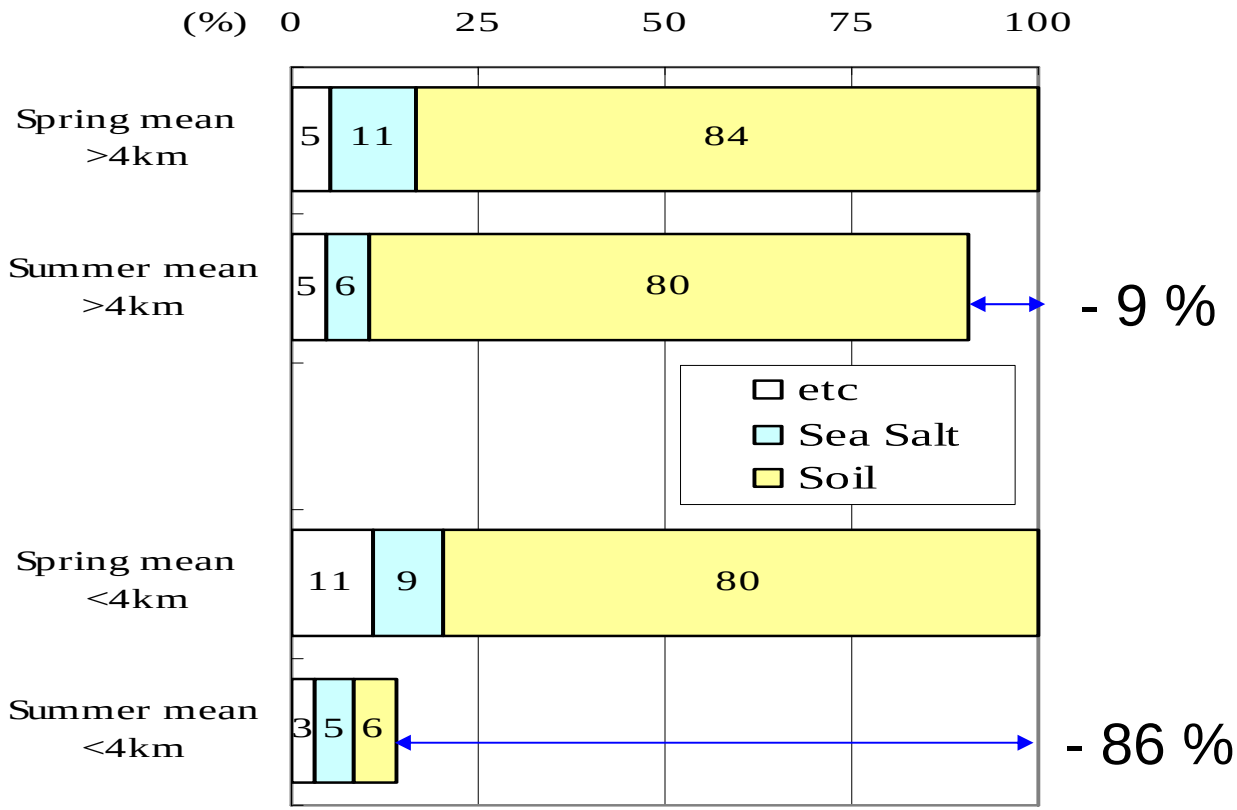
Aircraft borne measurements in Japan



Observed seasonal change in the vertical structure of coarse (D＞1μm) aerosols over Japan. Relative seasonal change in the total number of coarse particles is shown as 100% being the mean value for spring. Fractions by different particle types are superimposed. (Matsuki et al., JGR 2003)

Observations of Aerosols over Taklamakan Desert

- Observational Periods: 2001-2003
- Aerosol concentration, size, morphology and chemistry

- Lidar
- Balloon-borne Optical Particle Counter
- Electron-microscopic experiments of particles collected directly in free troposphere over Taklamakan desert

Lidar Measurements

Aerosol Concentration

Scatt. Ratio = [B1 + B2]/B1

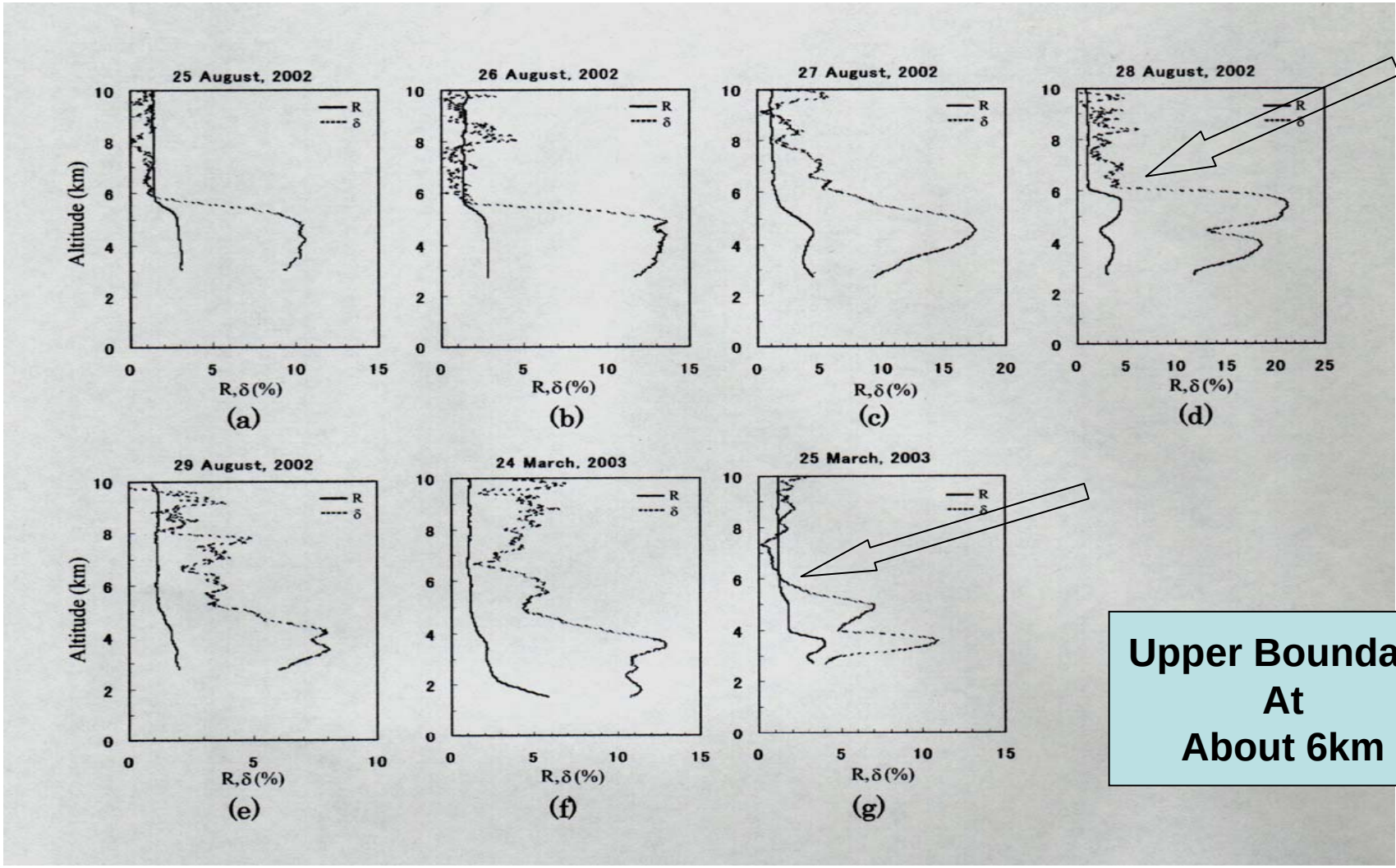
Where B1 and B2 are backscattering coefficient of air molecules and aerosols, respectively.

Nonspherisity

Depolar. Ratio = P cross/P parallel

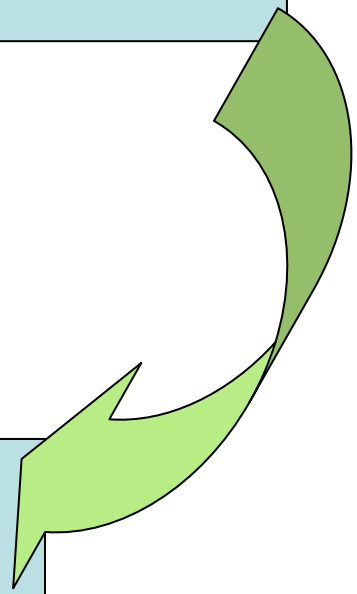
where P cross and P parallel are cross and parallel component of backscattering power

Vertical Profiles of Aerosols Measured by Lidar at Dunhuang



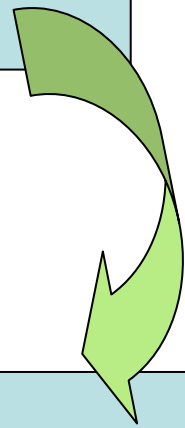
Upper Boundary At About 6km

Large Depolarization Ratio
From near the boundary to about 6km



Existence
of
Nonspherical Shape Particles

Clear Boundary at about 6km
In
Spring and Summer



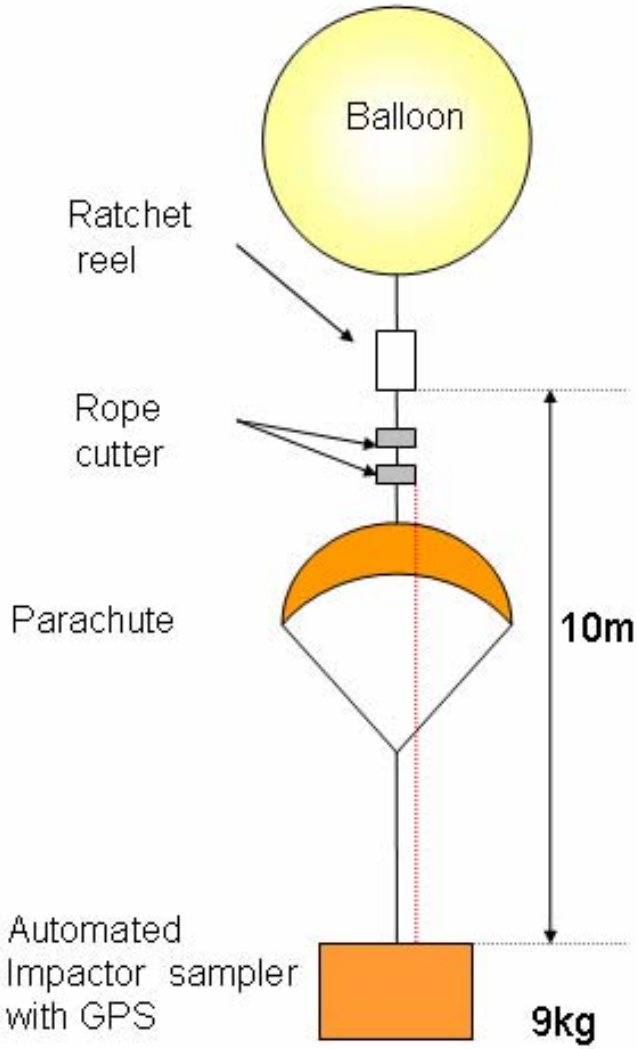
Characterizing Vertical Distribution of Aerosols
over
Dunhuang (possibly Taklamakan Desert)

Existence of Mineral Particles deduced from electron-microscopic experiments of particles collected over Dunhuang

- summer of 2002 and spring of 2003
- Collection of particulate matter with a Balloon-borne impactor

(JGR 2003 Iwasaka et al.)

(this symposium M. Yamada et al.)

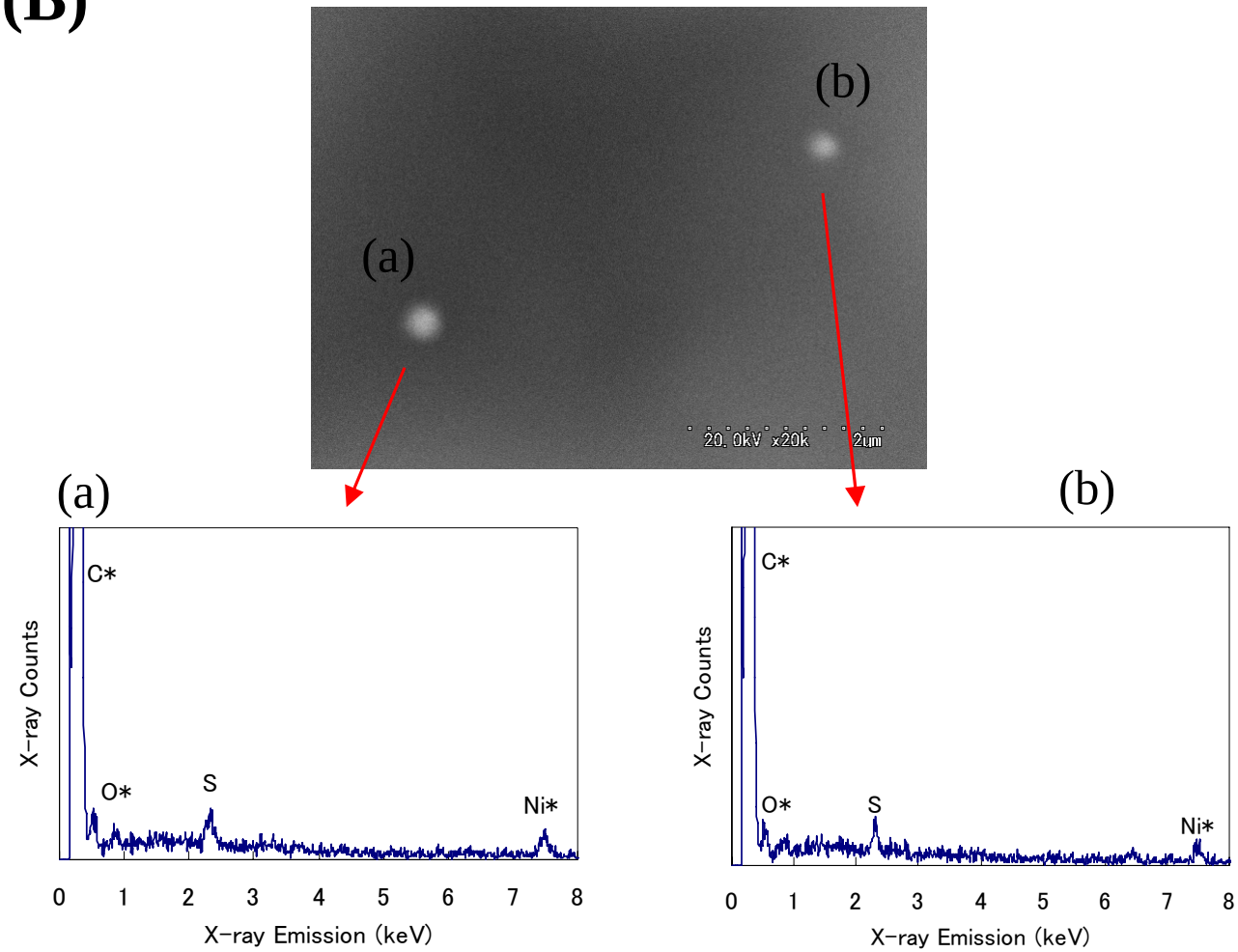


Balloon-train

Positioning of sampler is made by GPS

Fine particles also were collected

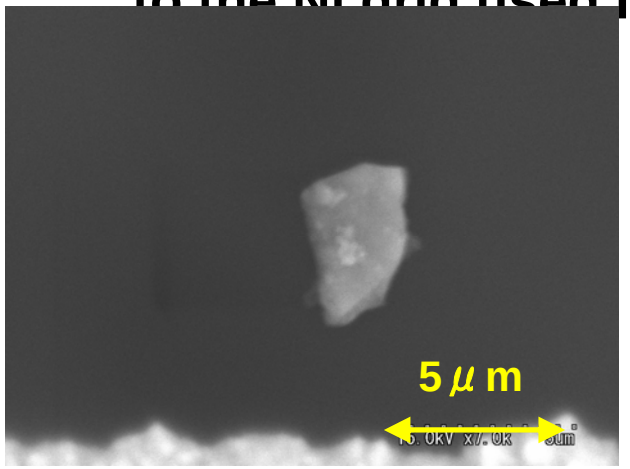
(B)

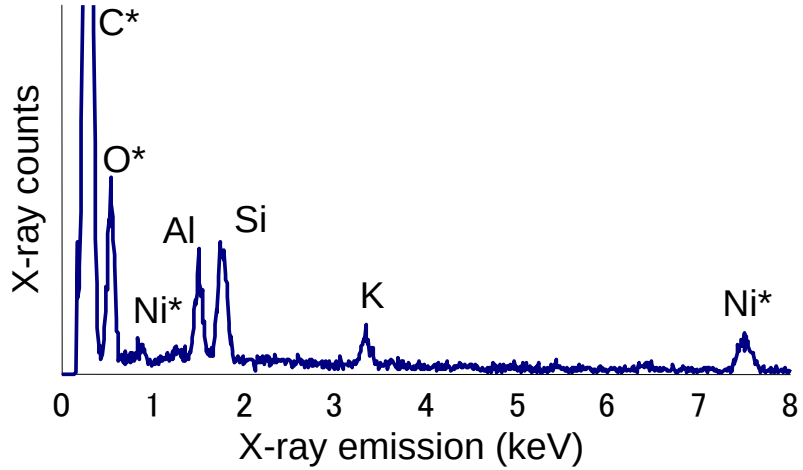


Electron micrograph of individual particles collected in the free troposphere between about 3km and 5km over Dunhuang, China. Both fine particles (a) and (b) are ammonium sulfate.

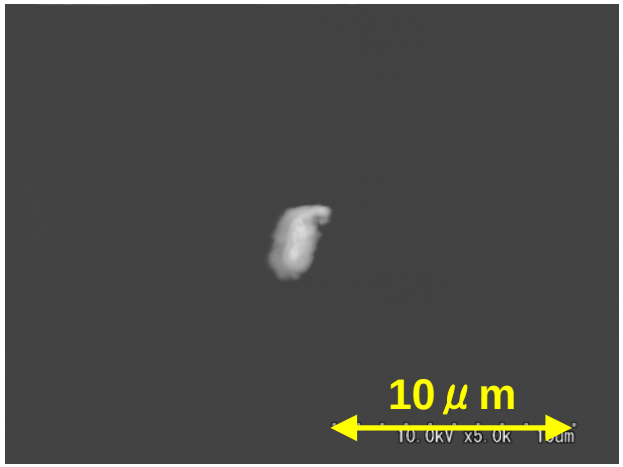
Typical electron micrograph of collected particles in spring in the range of 3-7km.
(a) Si-rich particle, (b) Ca-rich particle. The Ni* peak is due to the Ni grid used inside the collection surface

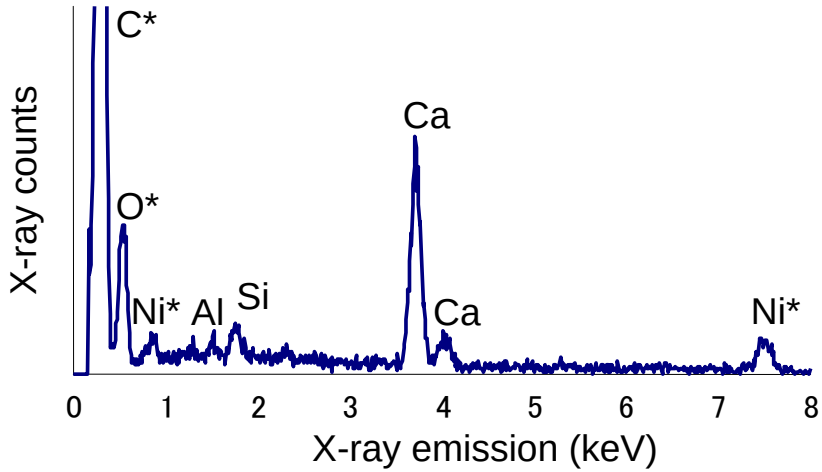
(a)





(b)



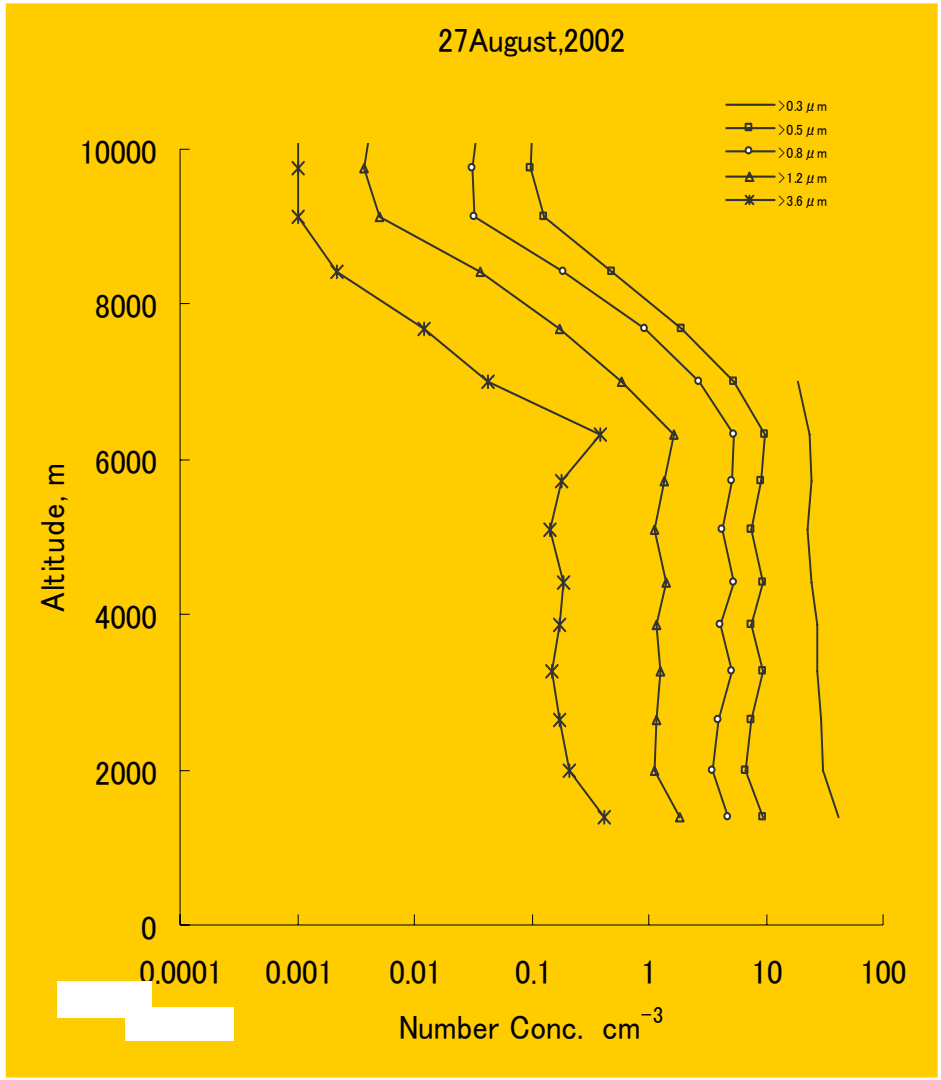


Measurements
of
aerosol size and concentration
with an Optical Particle counter
show
large decrease in concentration
of
particles with all size ranges
near 5km

Particle concentration measured with a balloon borne OPC at Dunhuang

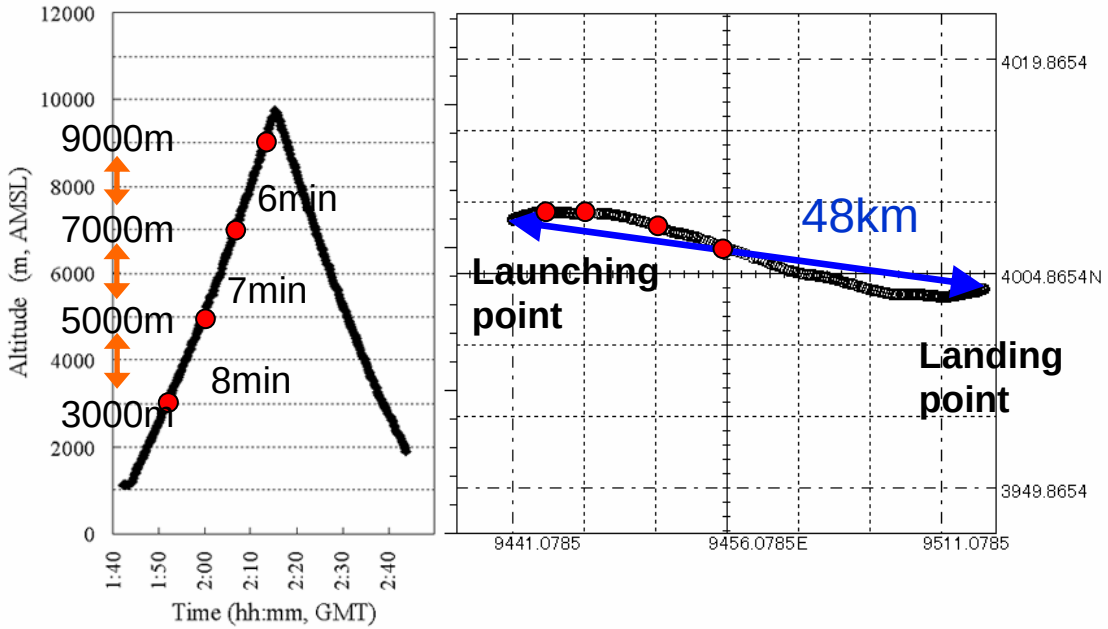
Coarse mode particles well mixed in near surface ~ 6km

(Y.S.Kim et al., JGR,2004)

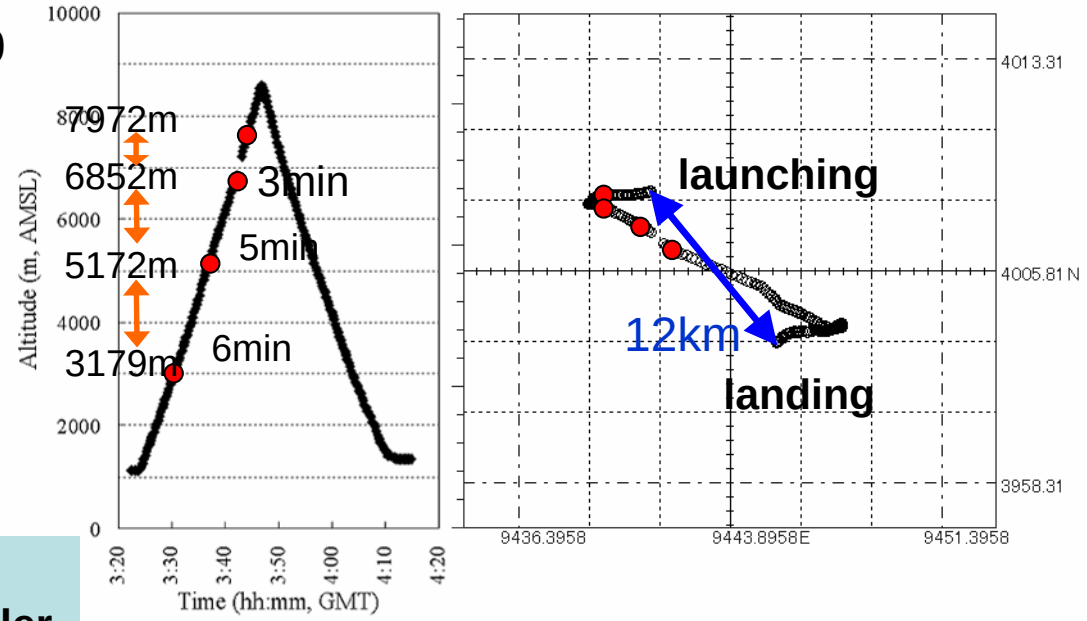


The trajectories of balloons
suggest noticeable westerly above about 5km
and
sometimes north-easterly below about 5km

2003/3/24



2002/8/29



Trajectories of Balloon-borne sampler

Westerly becomes clear above about 5km

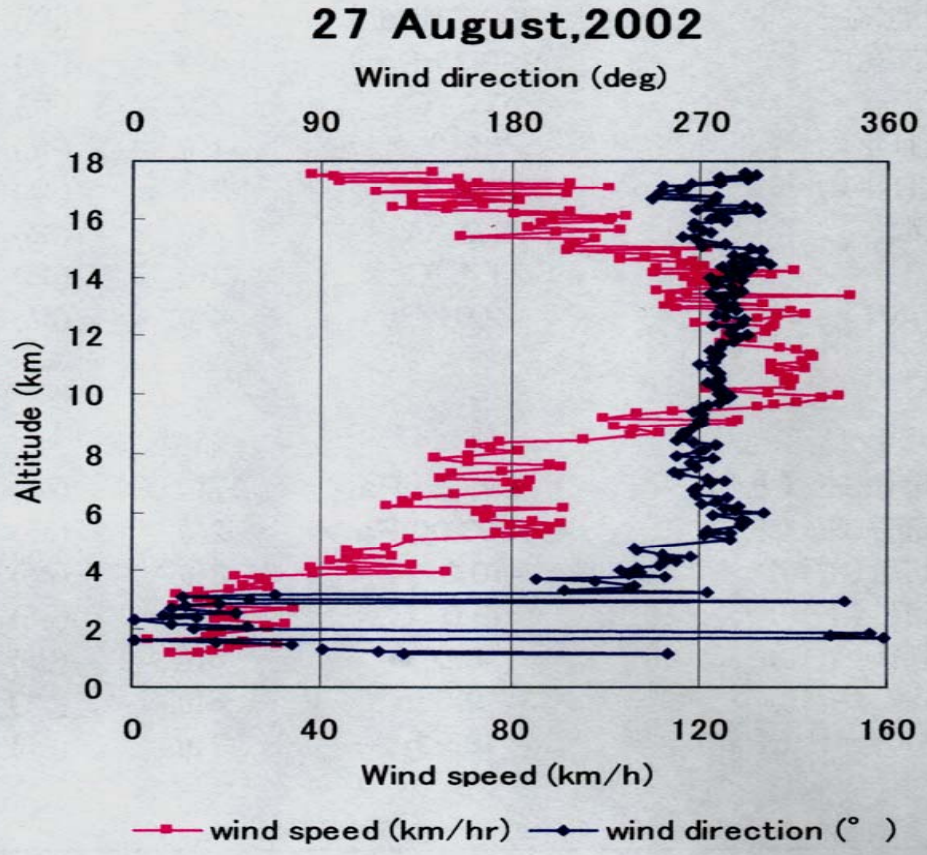
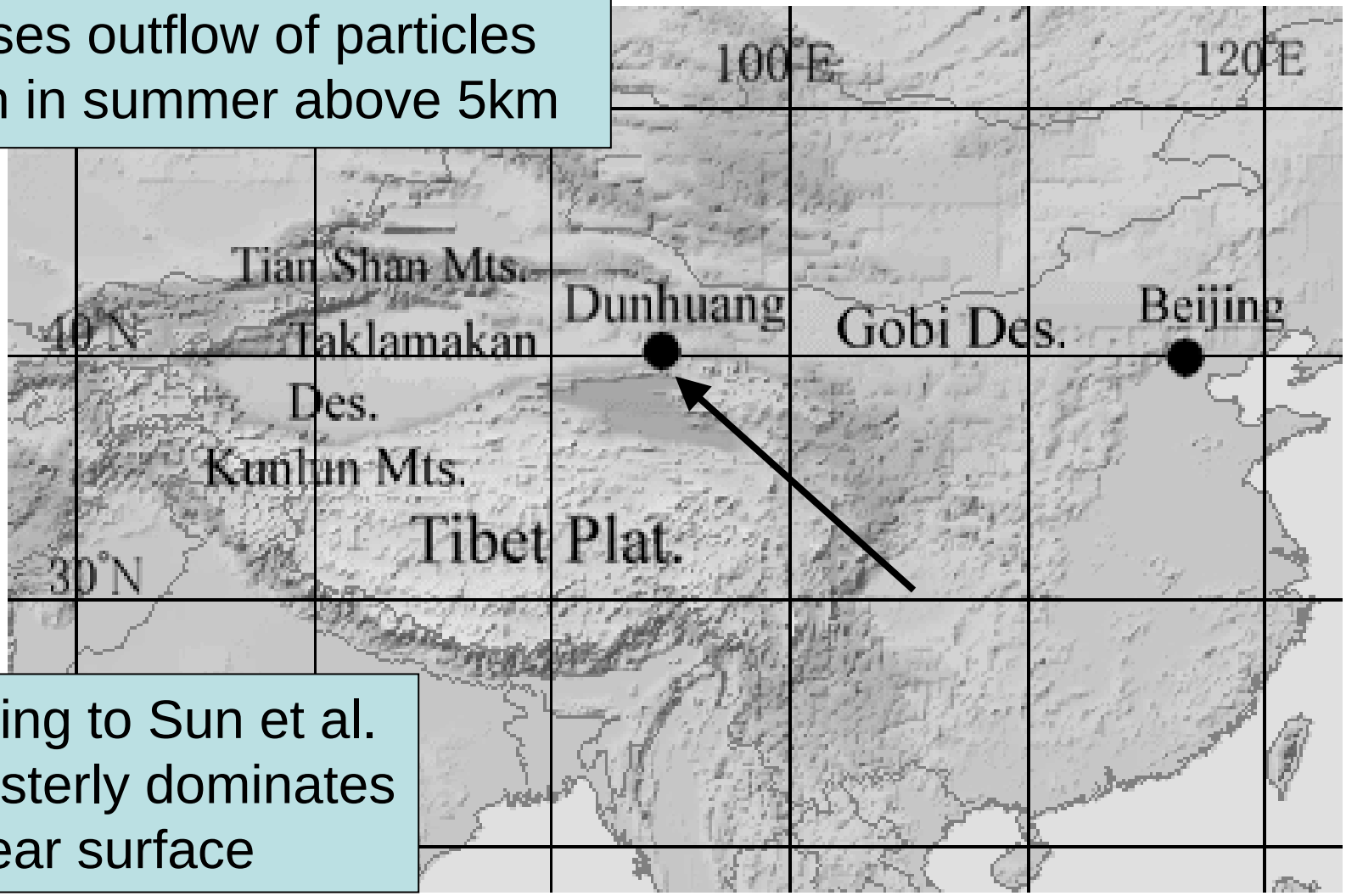


Fig.6 Wind speed and direction deduced from analysis of the balloon trajectory.

Combination of wind system
and
geographical situation
causes outflow of particles
even in summer above 5km



According to Sun et al.
north-easterly dominates
near surface

Summary

- Coarse dust particles were frequently observed in summer in the free troposphere
- Above about 5-6km westerly dominates even in summer
- Taklamakan desert can play as dust pool and source in summer
- Long range transport of dust particles in summer is important from view point of radiative contribution of particles and chemistry on surface of dust
- In future systematic field studies of dust particles (weak KOSA) impact in summer season

Thank You