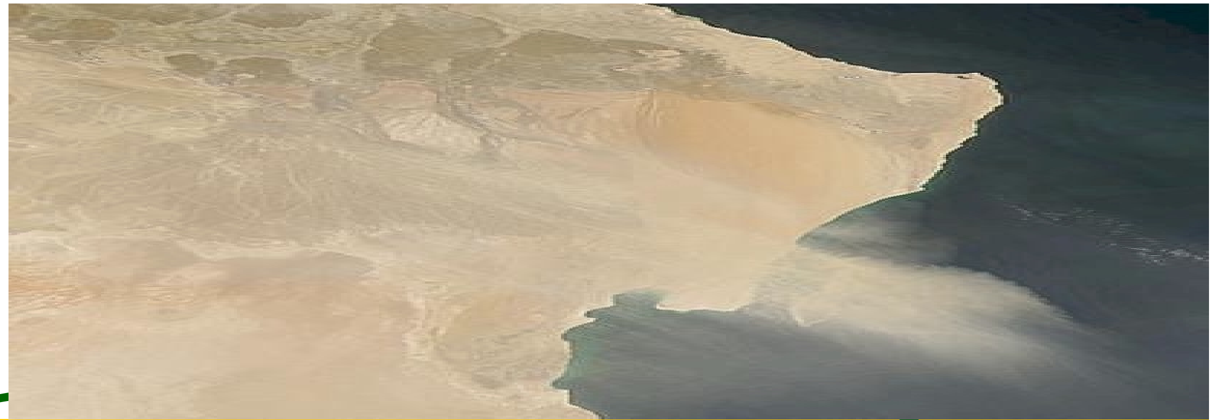
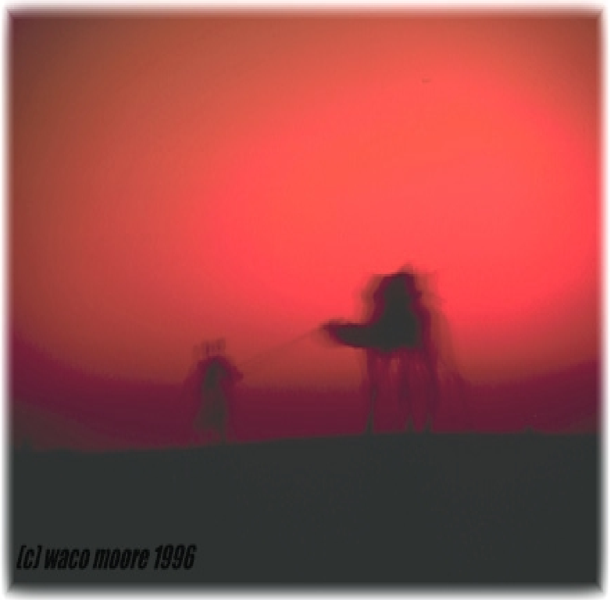


Aerosols, Dust and Hyperspectral Remote Sensing



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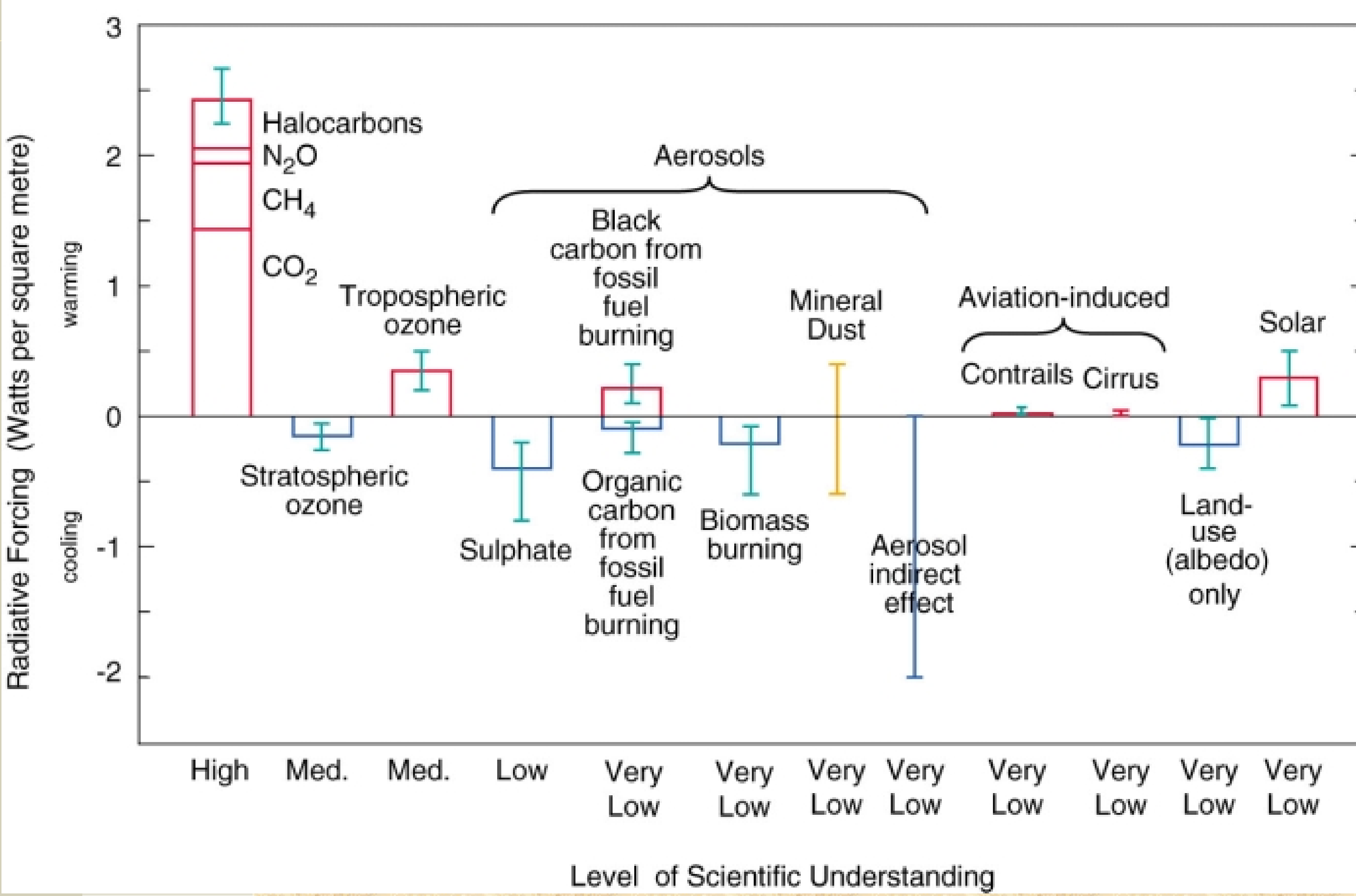
Direct Radiative Impacts of Mineral Aerosols

(Sokolik et al., *2001, JGR, Dust Special Issue*)

IMPACT	IMPORTANCE
Top of the atmosphere radiative forcing (solar plus IR)	affects energy balance of the Earth's climate system
Radiative forcing at the surface (solar plus IR)	affects surface temperature and surface-air exchange processes
Radiative heating/cooling (solar plus IR)	affects temperature profile and atmospheric dynamics
Actinic flux (UV)	affects photolysis rates and photochemistry

The global mean radiative forcing of the climate system for the year 2000, relative to 1750



Goals and Objectives

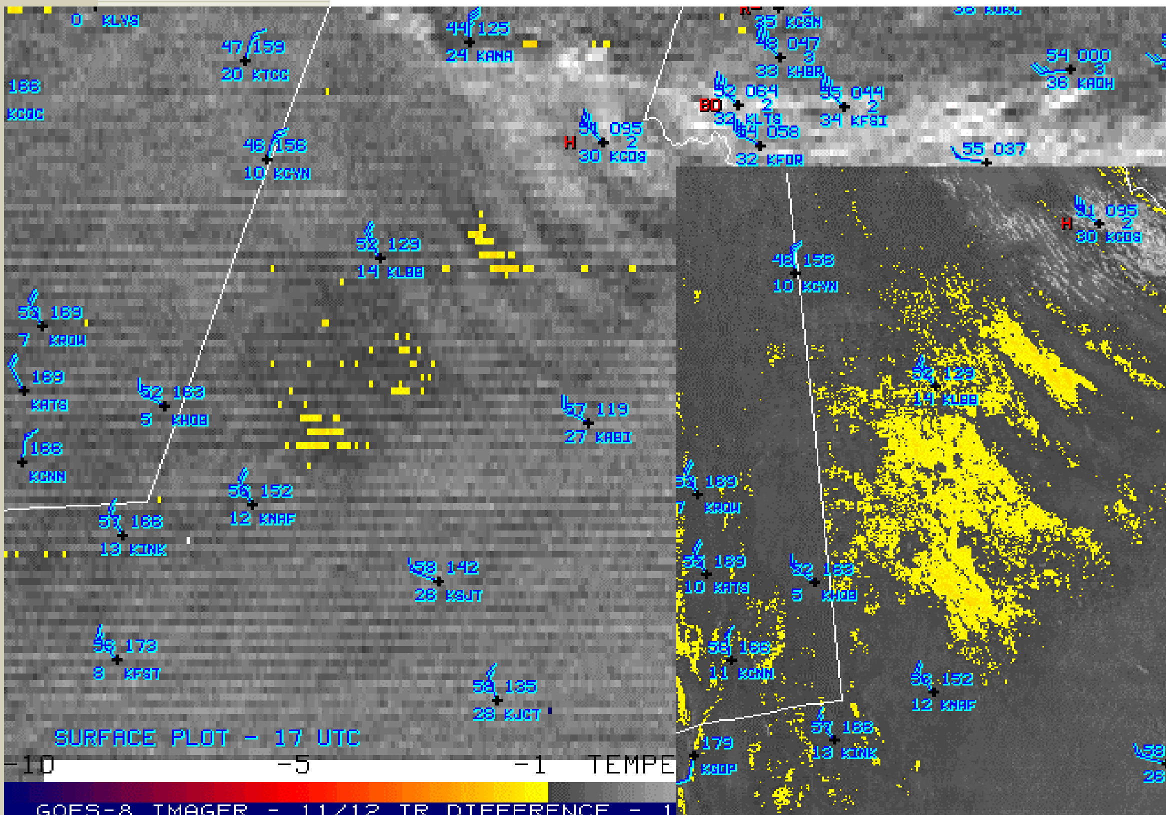
MAIN GOAL: **establish a framework for the development of a new physically-based treatment of mineral dust for IR hyperspectral remote sensing**

OBJECTIVES:

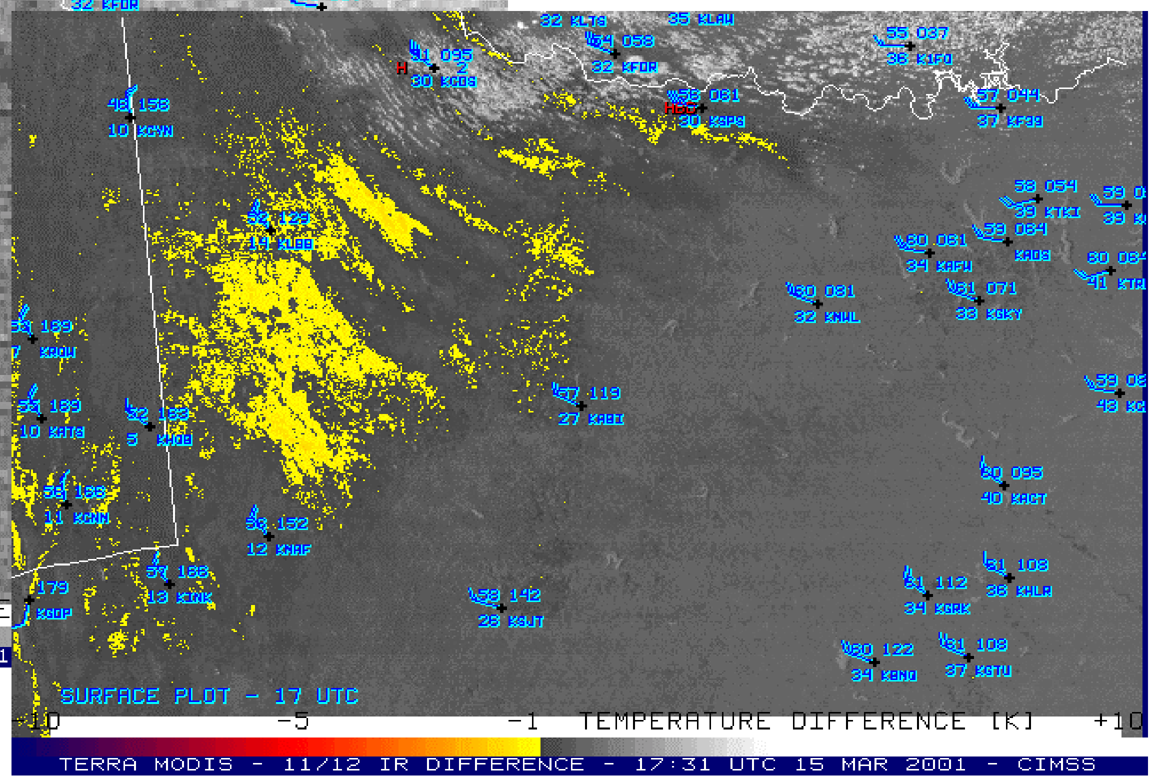
- **analyze NAST-I spectra along with other observations performed in the East China Sea region during Spring of 2001 to identify an Asian dust spectral radiative signature**
- **perform detailed forward modeling to determine the sensitivity of GIFTS observations to regional dust properties and develop an atmospheric correction algorithm in the dust laden conditions**
- **develop and test a new algorithm to retrieve dust from GIFTS observations**

Dust storm over Texas, 15 March 2001

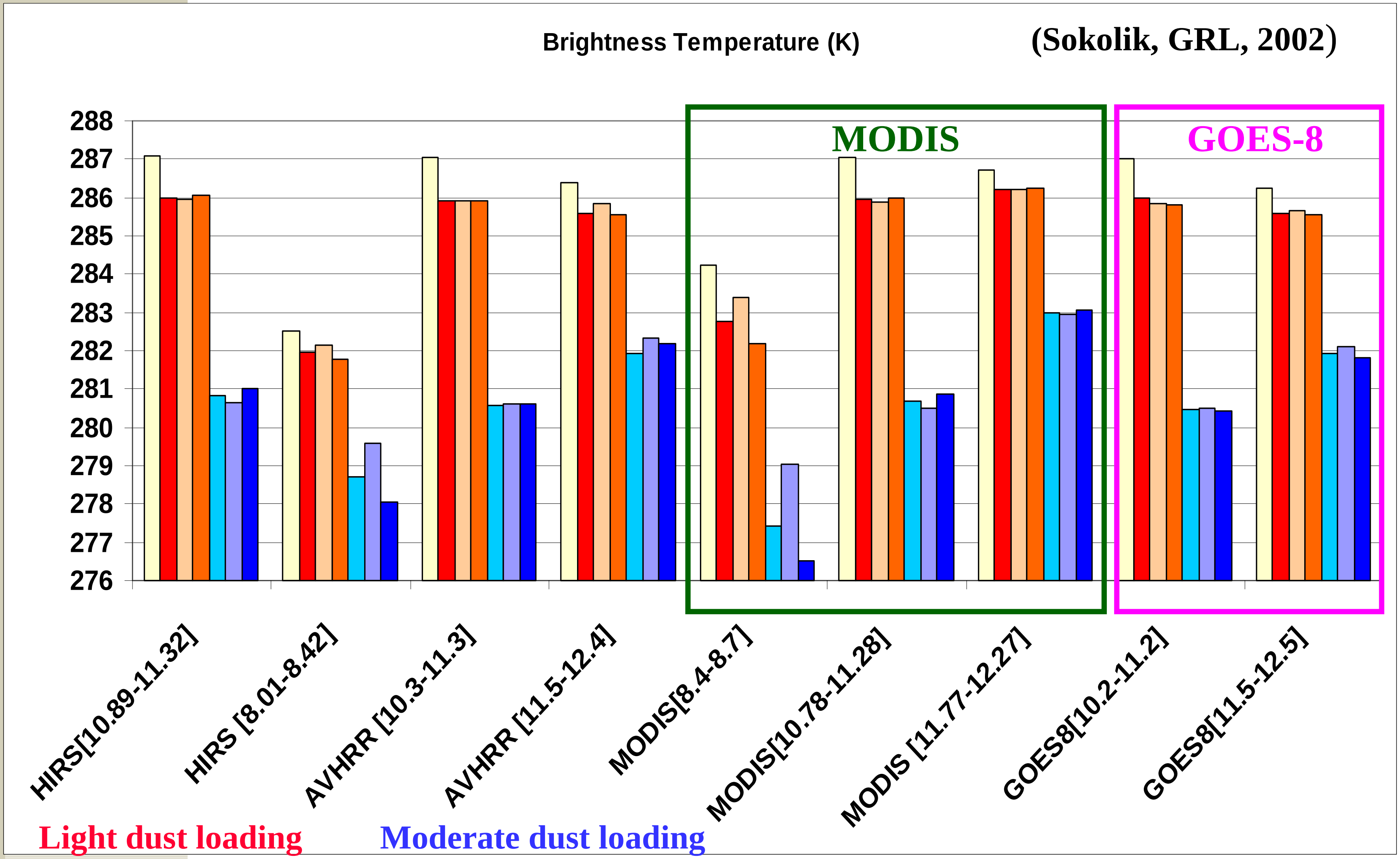
GOES-8, BT11-BT12



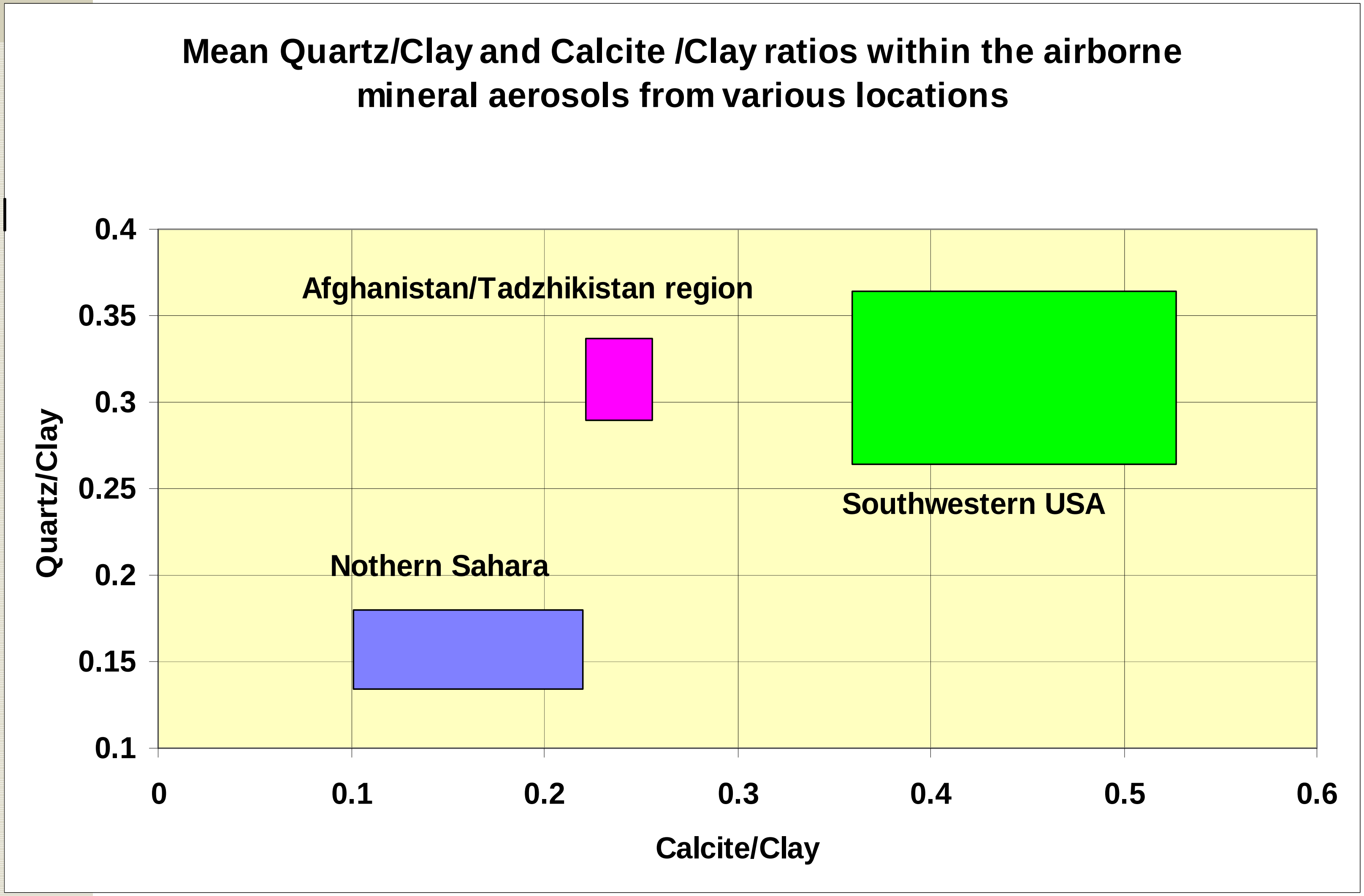
MODIS, BT11-BT12



Effect of dust composition on remote sensing in the thermal IR region

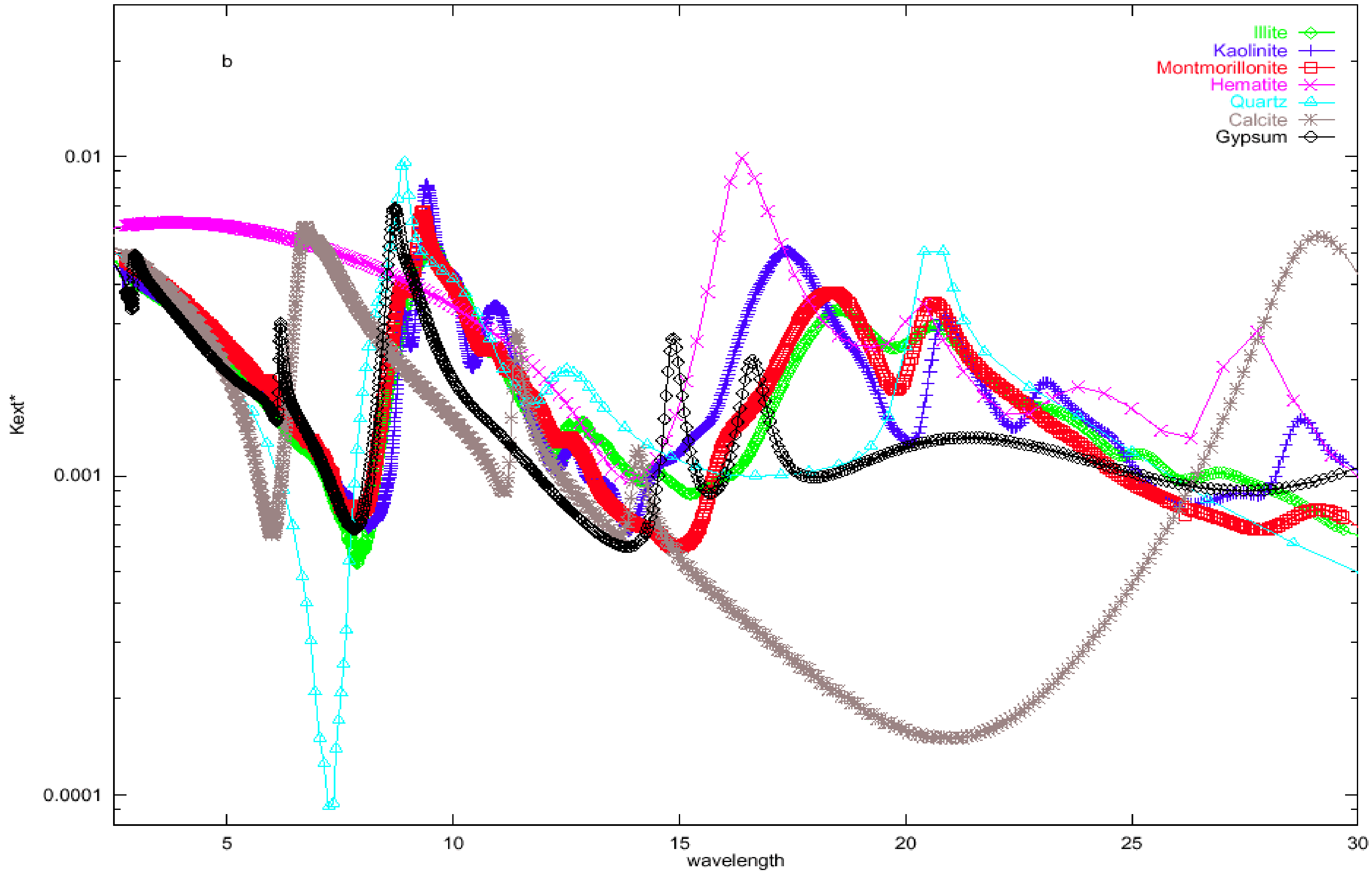


Dust mineralogical composition depends on the source of origin



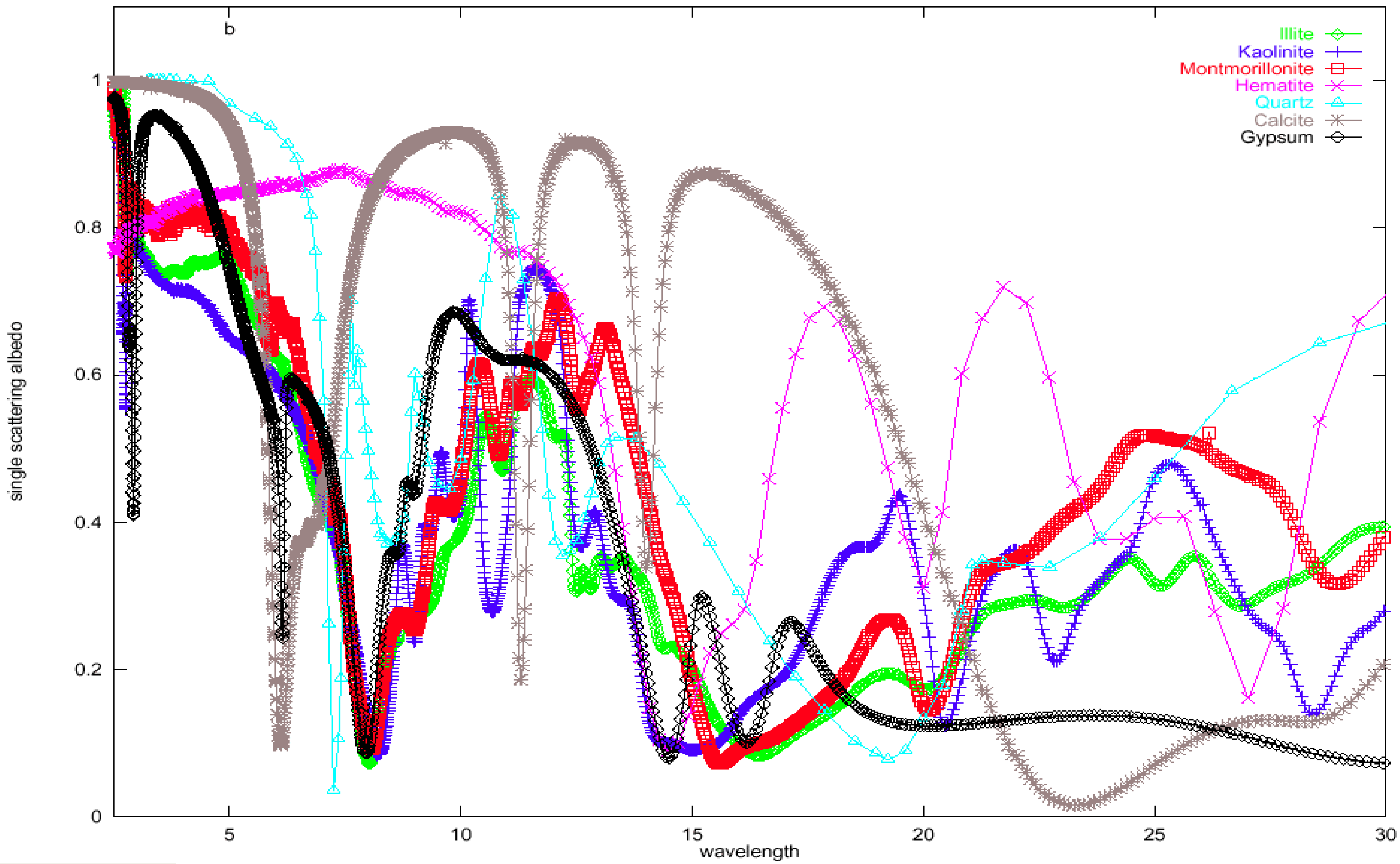
Spectral normalized extinction coefficient of selected minerals

(Sokolik and Toon, 1999)



Single scattering albedo of selected minerals

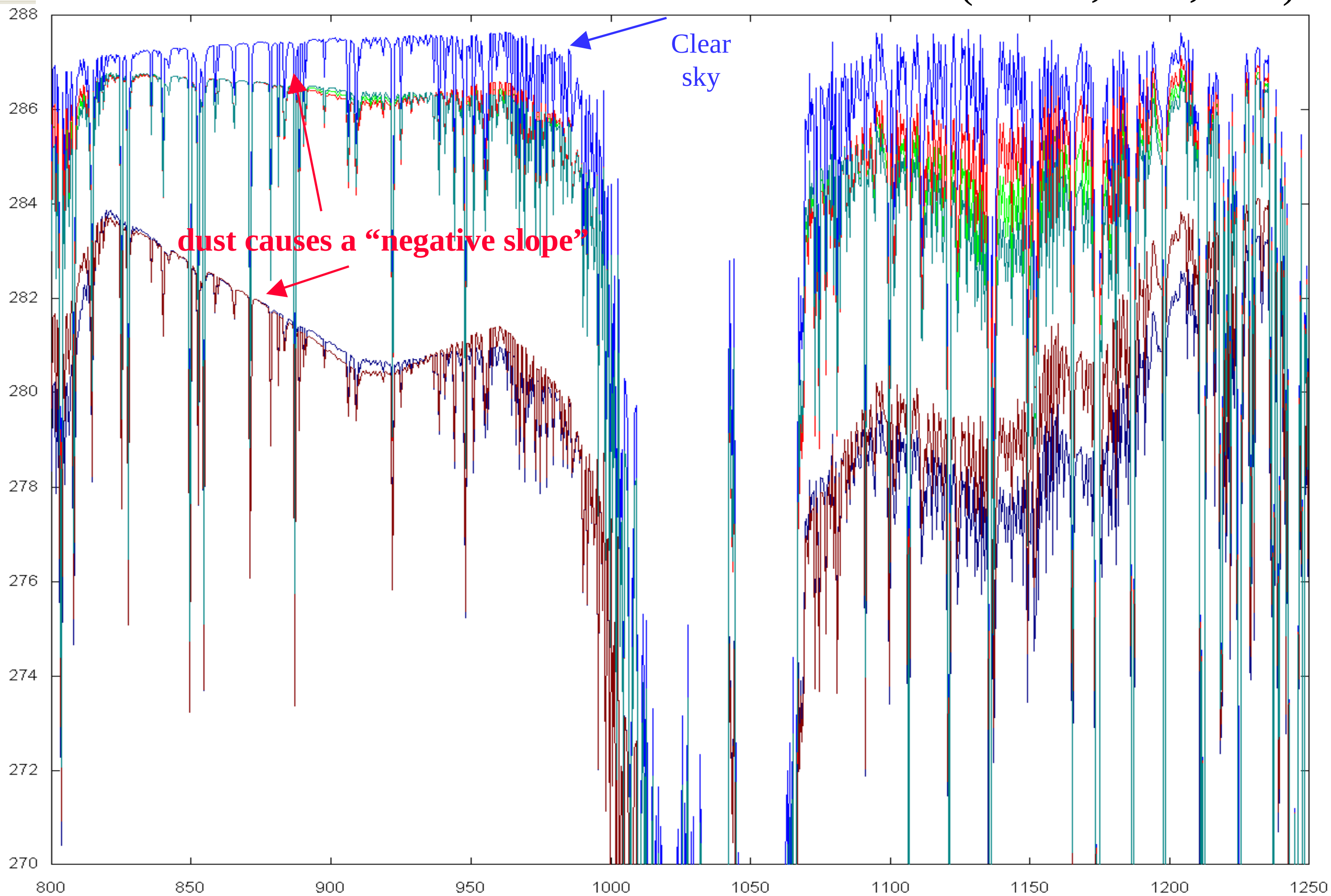
(Sokolik and Toon, 1999)



Effect of the dust mixture and loading on brightness temperature

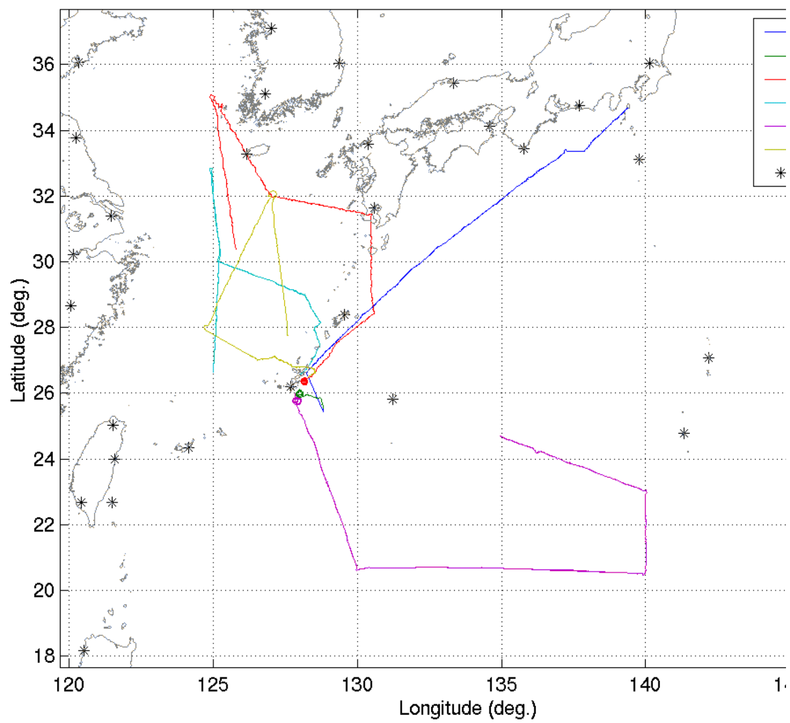
(US 1976 Standard Atmosphere, observation at 100 km, averaging $\Delta\nu = 0.5\ cm^{-1}$, dust in the lowest 2.5 km)

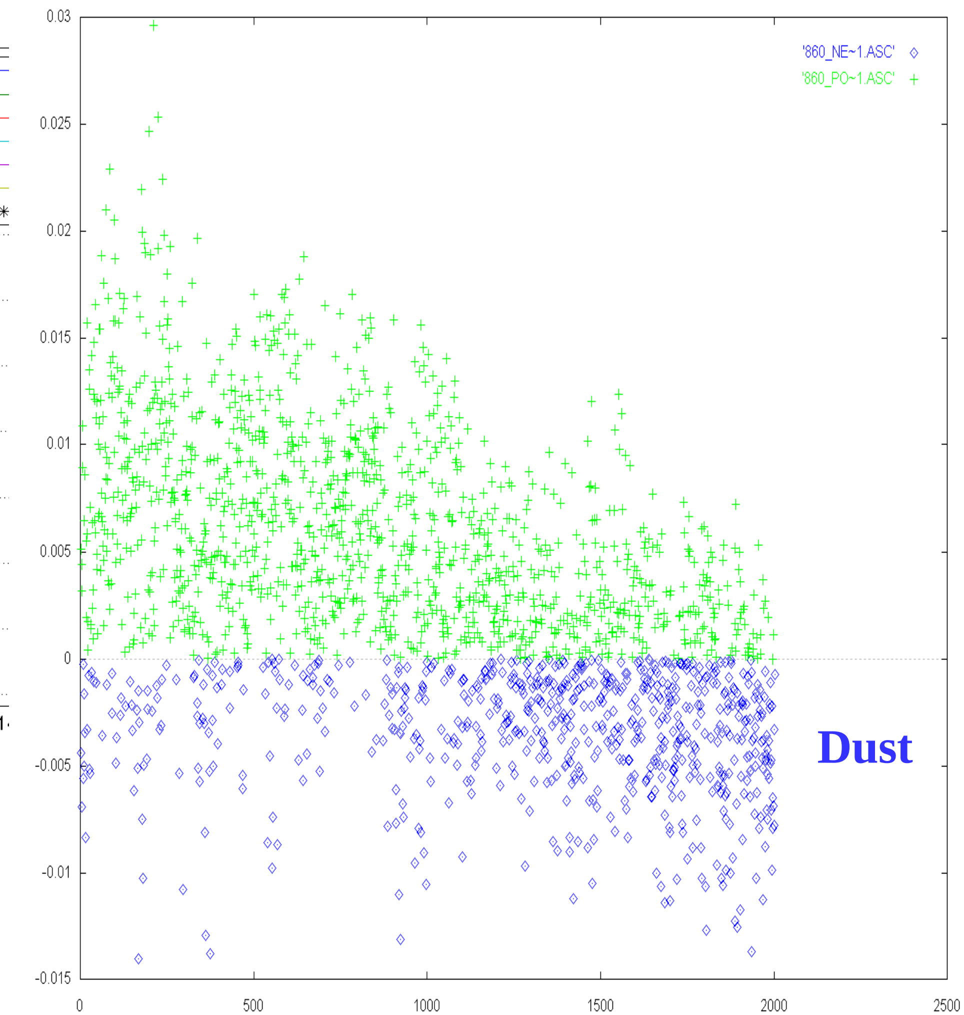
(Sokolik, GRL, 2002)



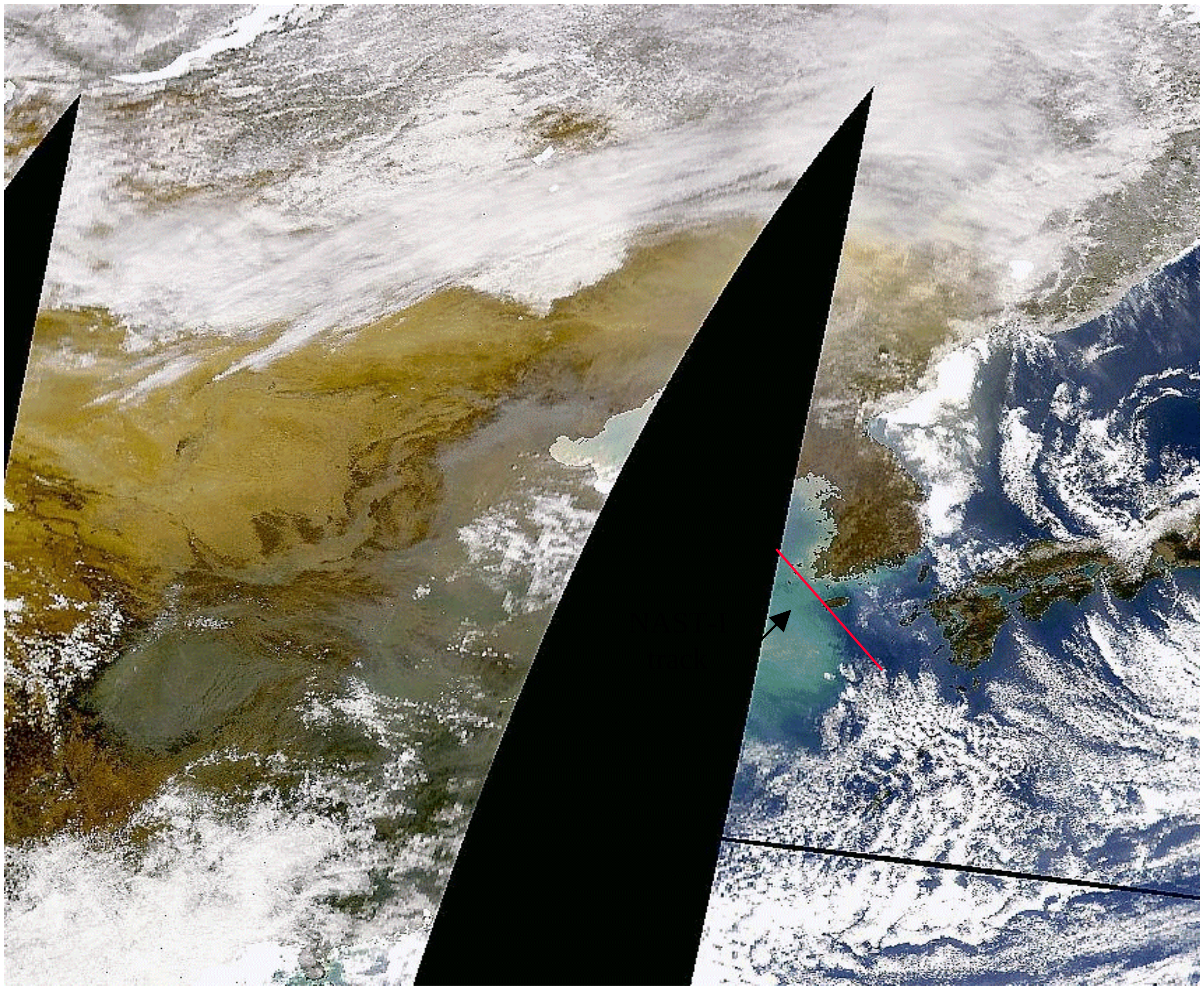
Analysis of NAST-I spectra for Spring 2001

PROTEUS flight tracks

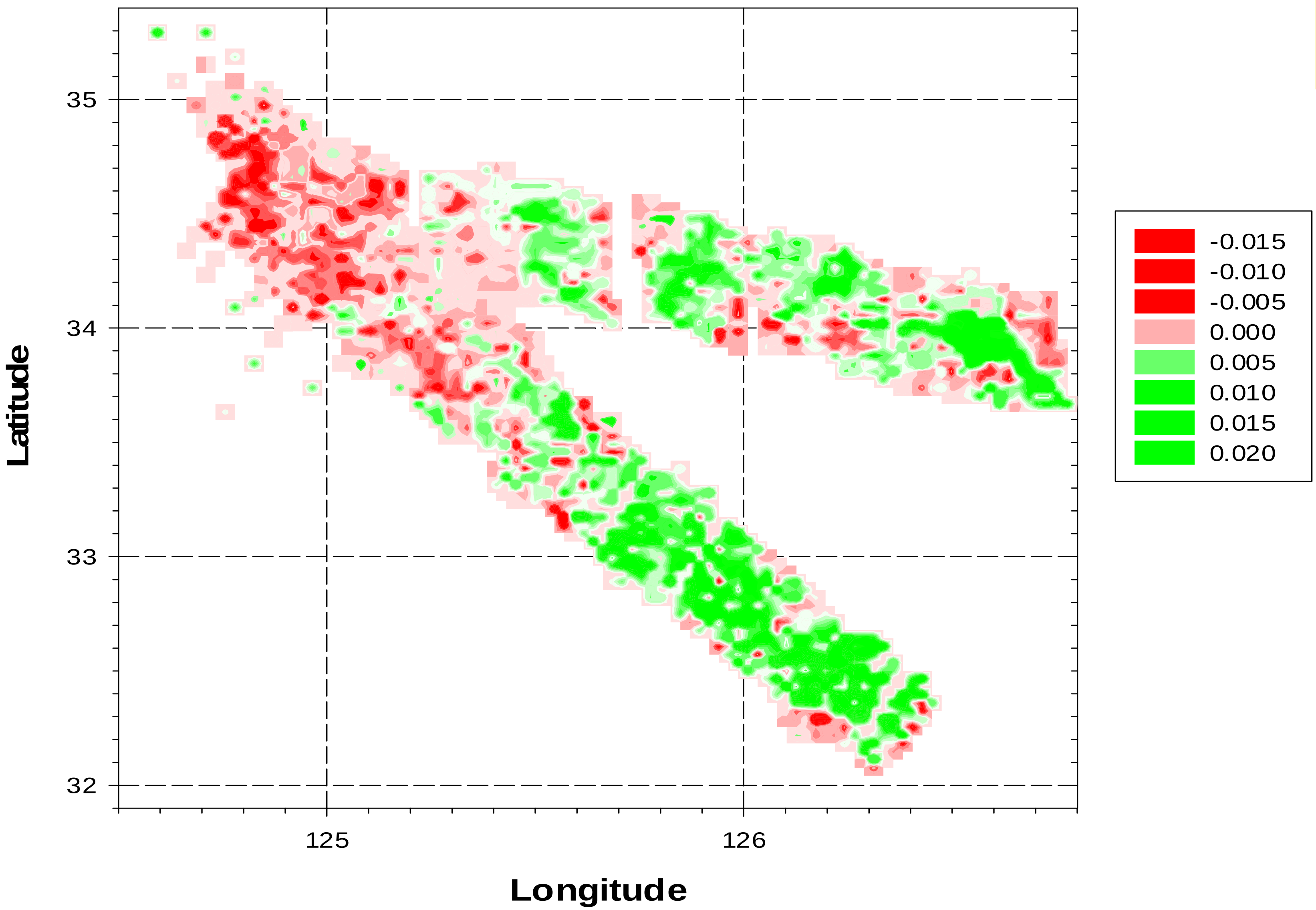




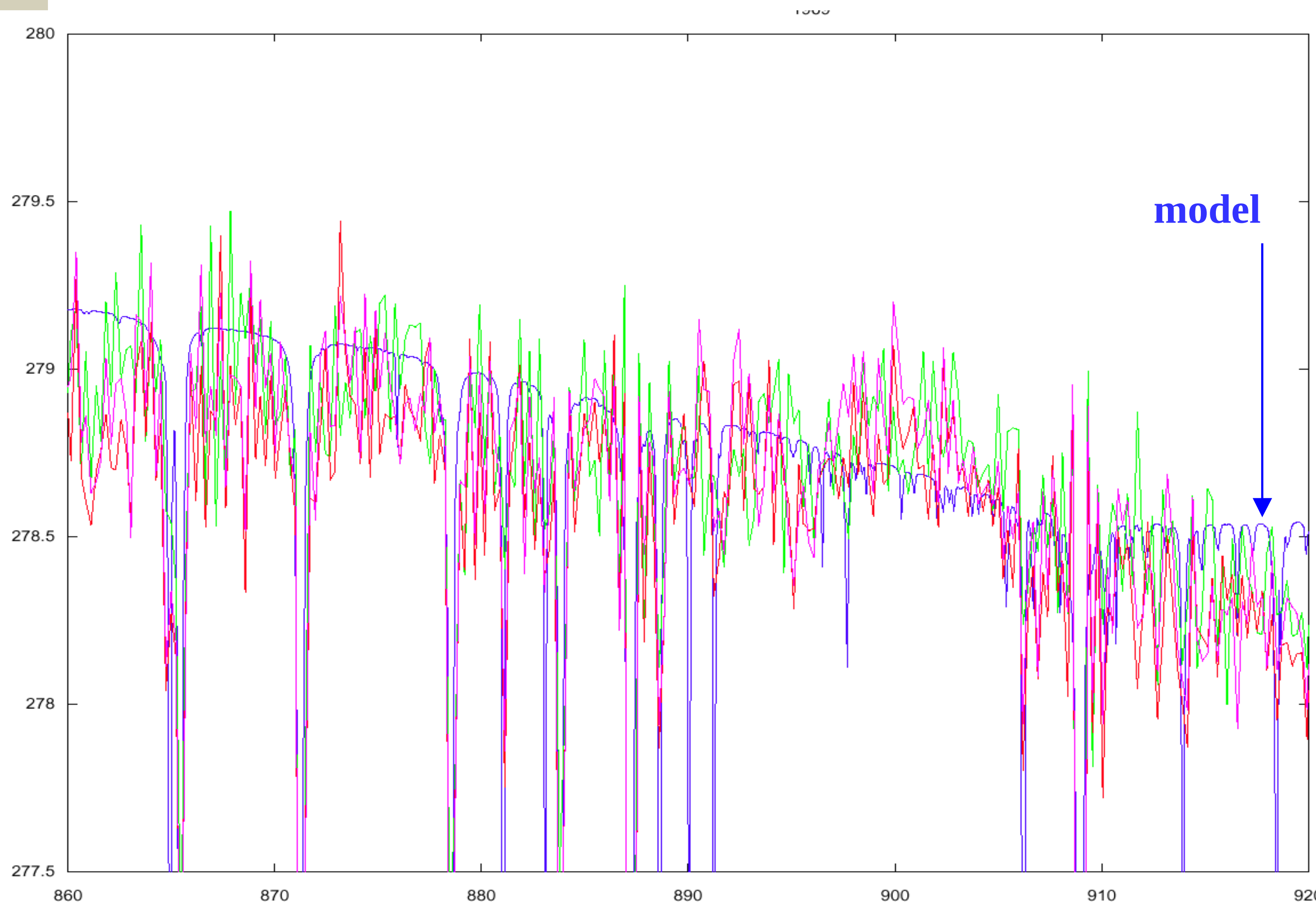
SeaWiFs image showing Asian dust event on 3/12/2001



Slope of 4004 apodized NAST-I spectra in range 860-920 cm^{-1}

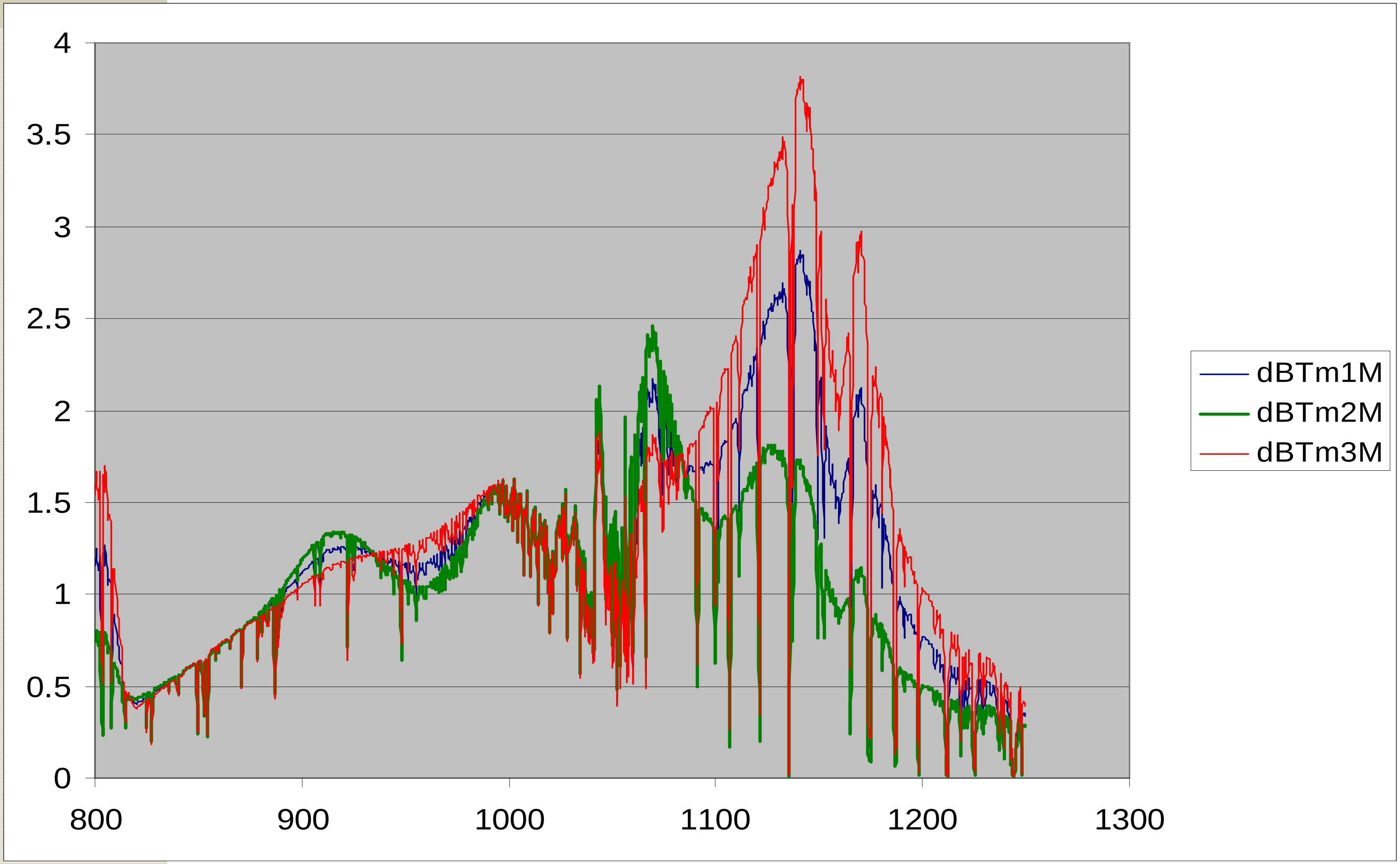


Fit to NAST-I brightness temperature spectra #1673, 1686, 1969

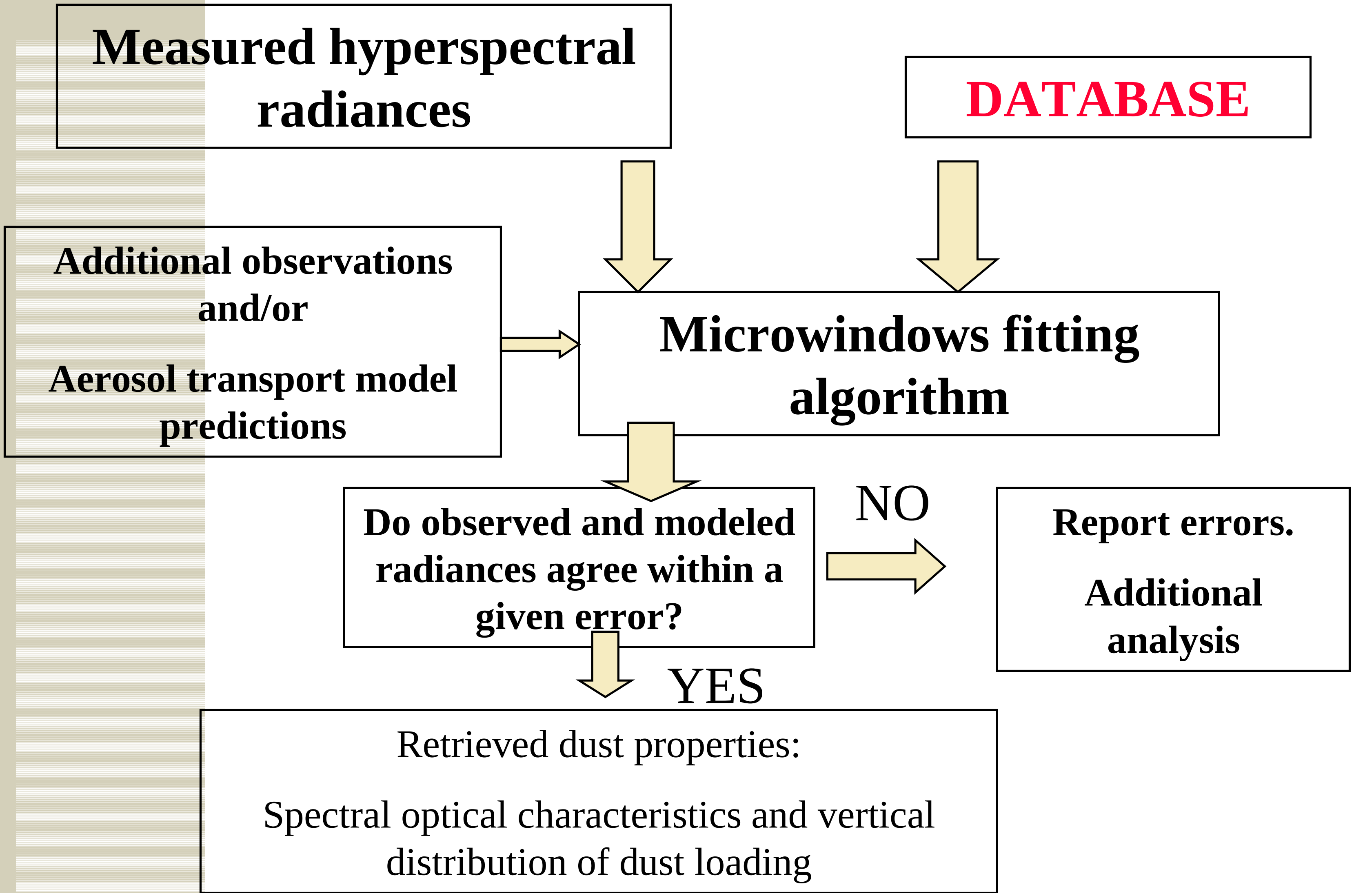


Differences in brightness temperatures: BT_{clear}-BT_{dust}

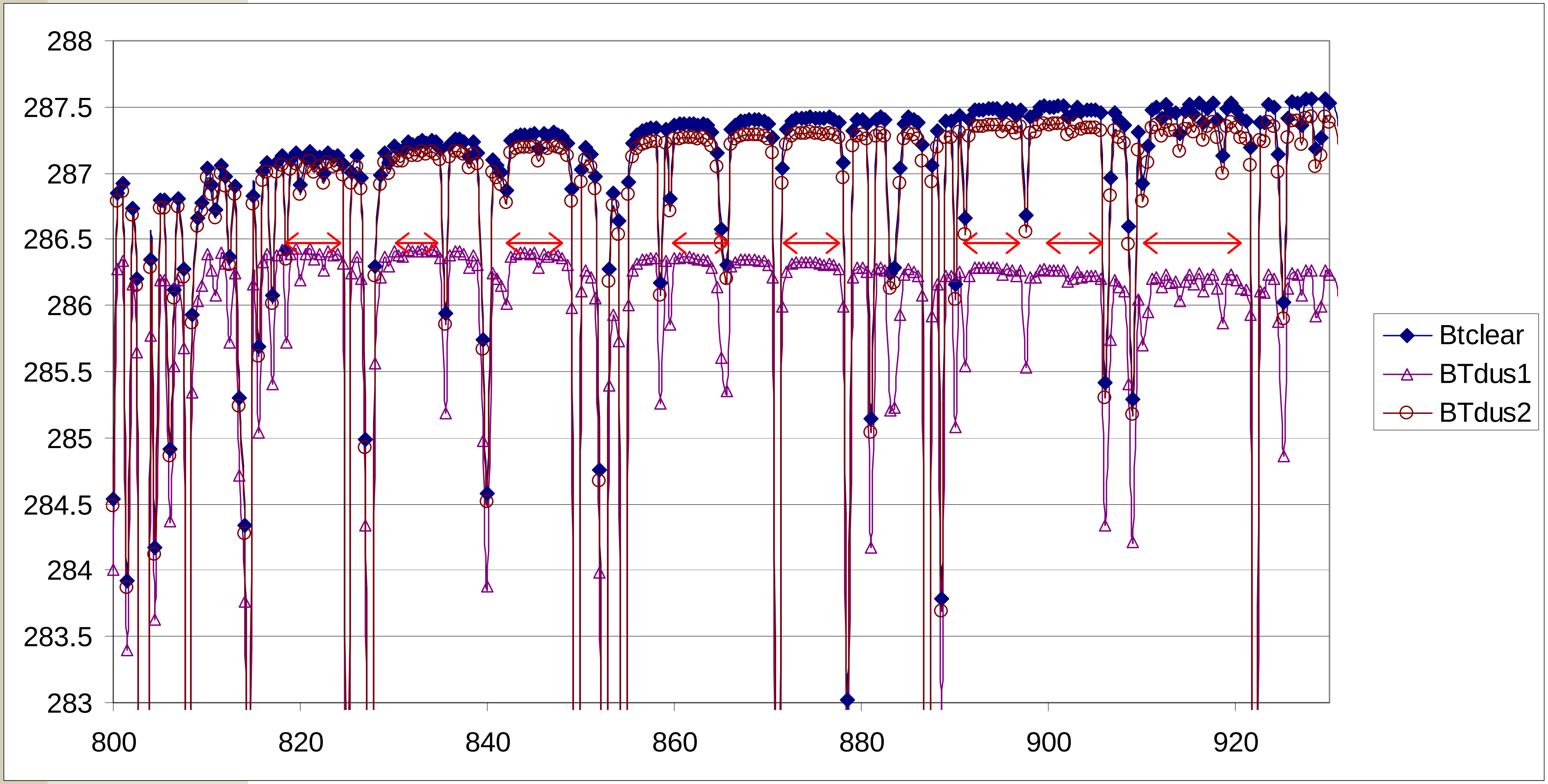
(US 1976 Standard Atmosphere)



Schematic diagram of the dust retrieval scheme



Selection of microwindows



Database

- **Regional soil and wind-blown dust samples**

Asian Dust Databank: China, Kazakhstan, Tadzikistan, Afghanistan and Mongolia

Saharan Dust (in collaboration with Paris Univ.12, France, and Univ. of Mainz, Germany)

Arabian dust: dust samples from Saudi Arabia

- **Library of atmospheric aerosol refractive indices (LAARI)**

- **Climatology of transport routes and vertical distributions of dust outbreaks**

Lidar network (China-Korea-Japan)

LIBRARY OF ATMOSPHERIC AEROSOL REFRACTIVE INDICES (LAARI)

- **LAARI includes spectral optical constants of individual aerosol species and their aggregates over the range of wavelengths from about 0.2 μm (UV) to 50 μm (IR).**

MINERAL DUST

SULFATES

NITRATES

SEA-SALT

CARBONACEOUS

MIXTURES

Imaginary part of the refractive index of selected minerals

(Sokolik and Toon, 1999)