

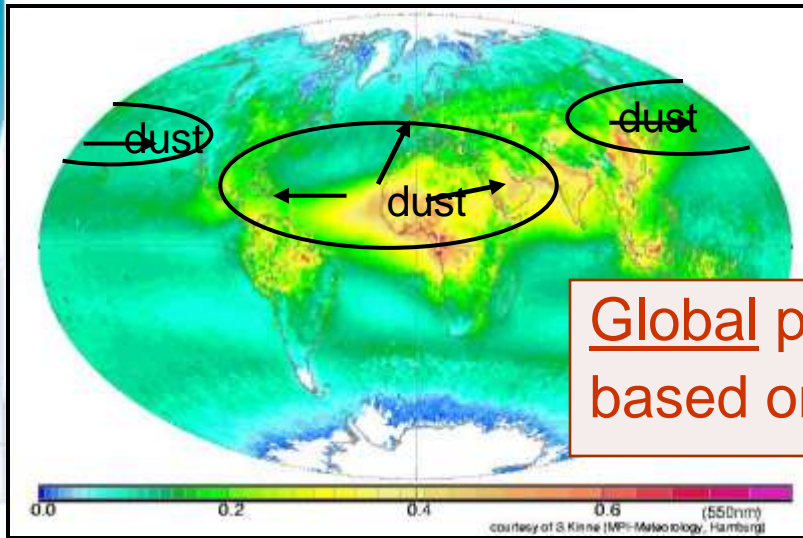
The World Meteorological Organization (WMO) Sand and Dust Storm Warning System (SDSWS): An Effective Aid in Reducing Adverse Effects on Health

*Slobodan Nickovic
Leonard Barrie
World Meteorological Organization, Geneva*

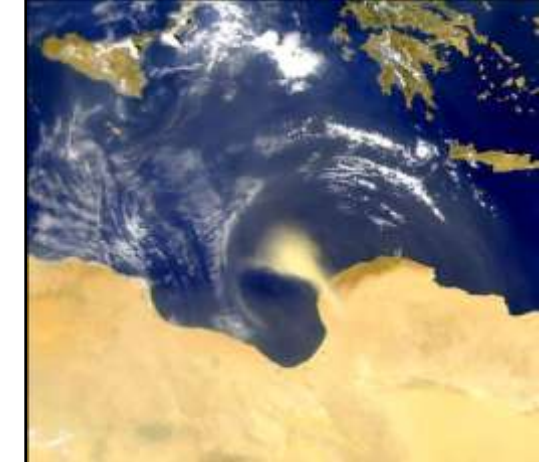
*William Sprigg
University of Arizona, Tucson*

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Lbarrie@wmo.int
wsprigg@email.arizona.edu*

SDS PROCESS



Global process based on local origins

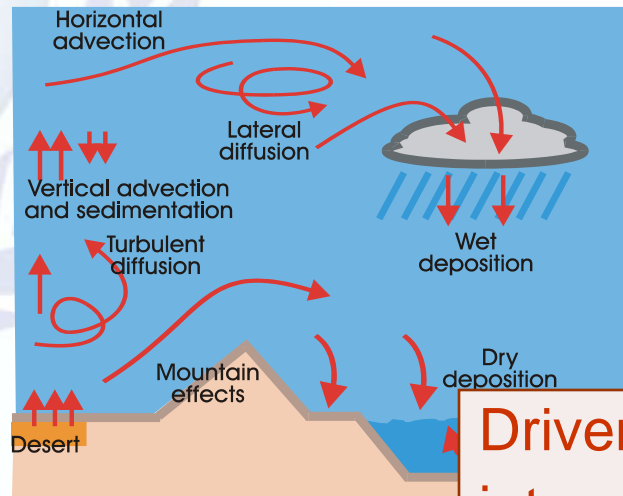


Dust from Libyan sources; SeaWiFS

Source: S. Kinne MPI, Hamburg, Germany



Afghanistan dry lake dust sources MODIS 2, June 2001



Driven by and interacting with the atmosphere

RATIONALE FOR BUILDING UP THE WMO SDSWS

A) To reduce risks from SDS;

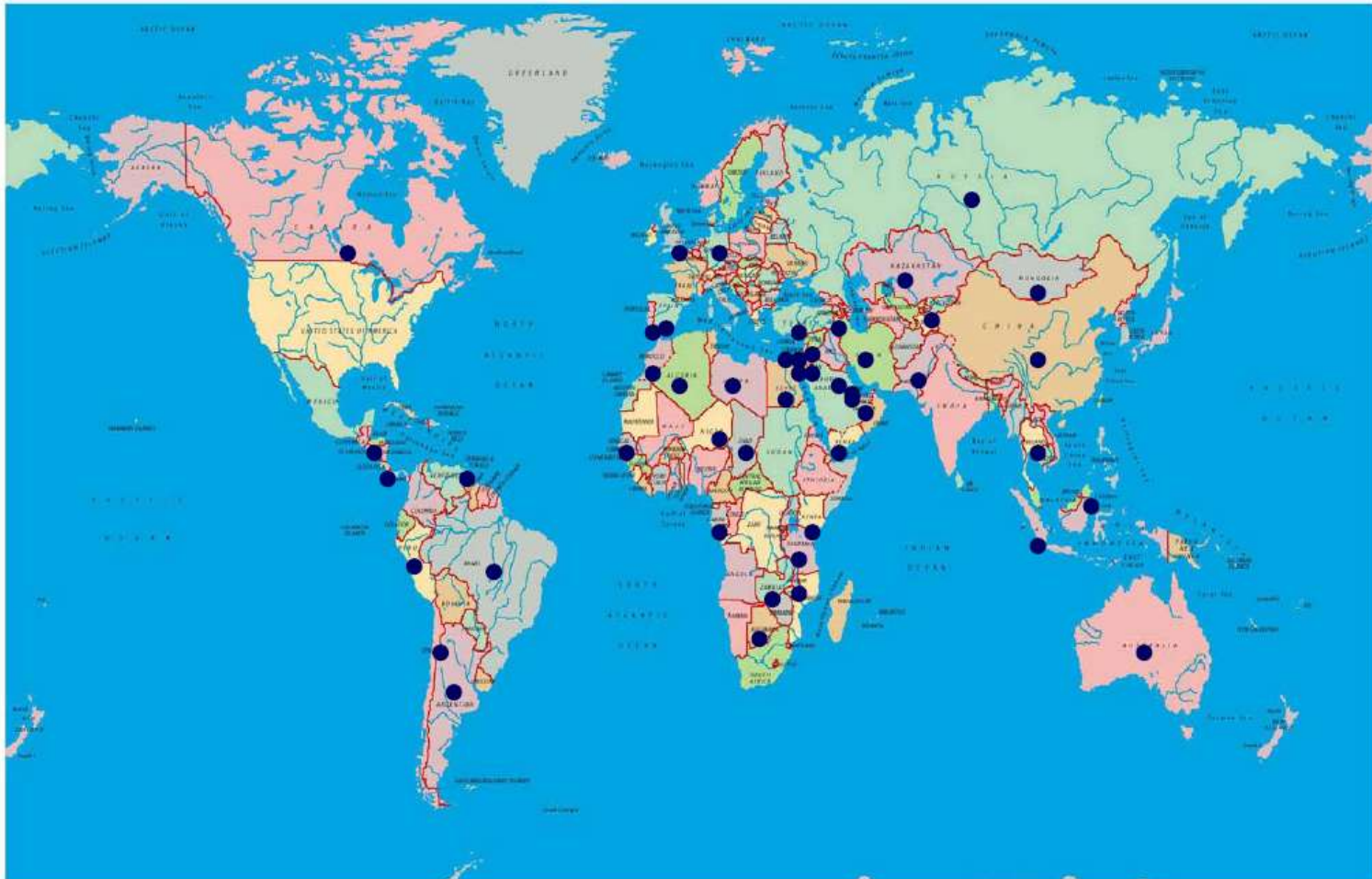
SDS considered as **environmental hazards** with numerous adverse impacts

B) To exploit the **accumulated experience** in SDS forecasting over last 10 years

Mid 90ties: only two research operational models;
today: several times more

D) To satisfy increased interest for SDSWS

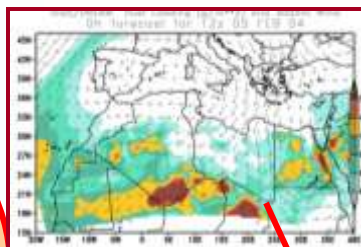
A WMO questionnaire showed that more than 40 WMO Members wished to participate in SDSWS



E) To coordinate established operational research dust forecasting
11 institutions providing products on the web



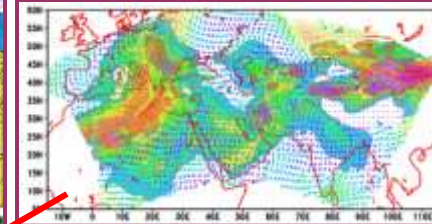
ECMWF-based GEMS Project will deliver global SDS products – to be used for boundary conditions for regional SDS models



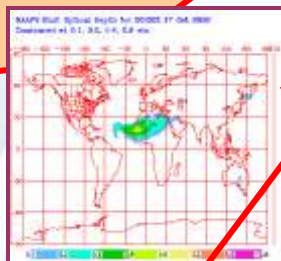
BSC, Spain



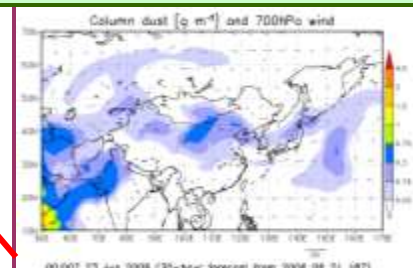
Univ Athens, Greece



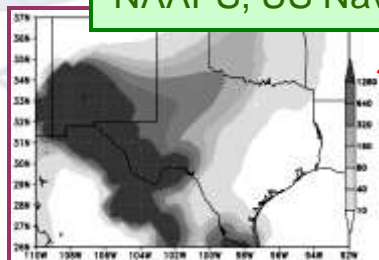
Middle East Tech Univ, Turkey



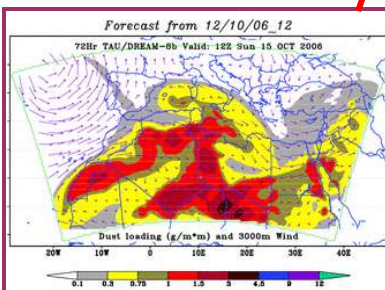
NAAPS, US Navy, USA



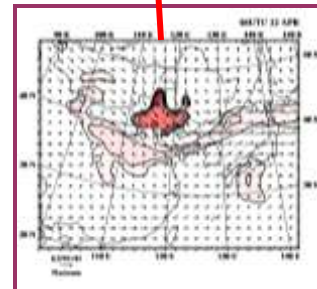
MAISINGAR, MRI, Japan



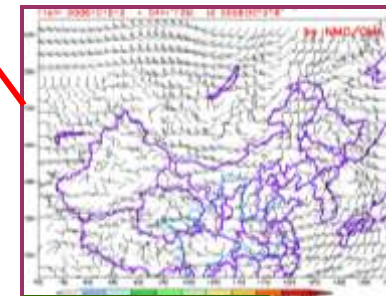
DREAM, Arizona Univ, USA



Tel Aviv Univ, Israel



ADAM, S. Korea



CMA, China

WMO SDS WS: PROPOSED OBJECTIVE

To establish a WMO-coordinated global network of SDS forecasting centers delivering products useful to a wide range of users in understanding and reducing the impacts of SDS

Framework for SDSWS is the WMO SDS Project. One of its major goals is

“...to enhance the participating countries’ ability to establish and improve systems for warning and forecasting services and to suppress the impact of SDS...”

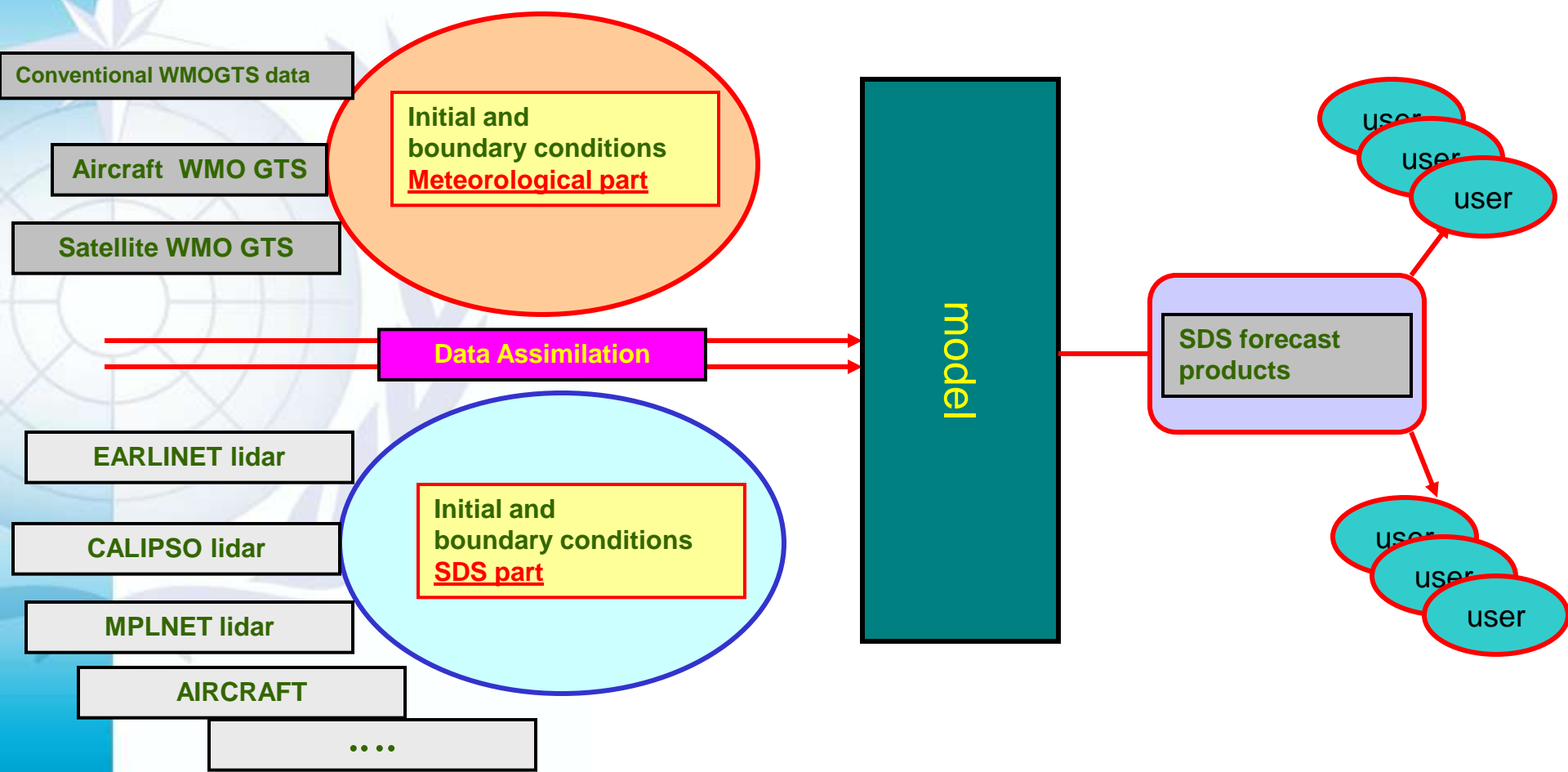
IMPLEMENTATION STEPS

Developing Research Strategy & Implementation Plan (IP)

Review the RSIP (Barcelona Meeting, 2007)

SDSWS Implementation

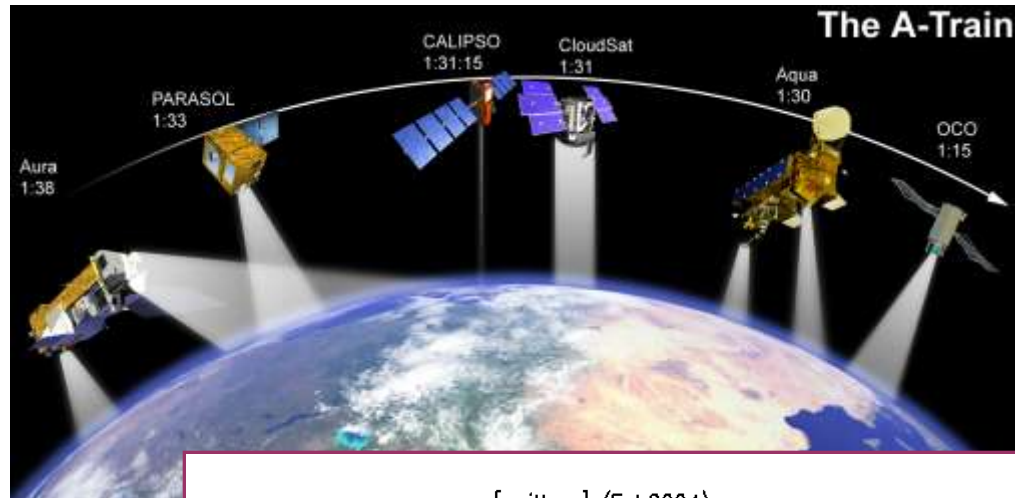
SDSWS: STRUCTURE



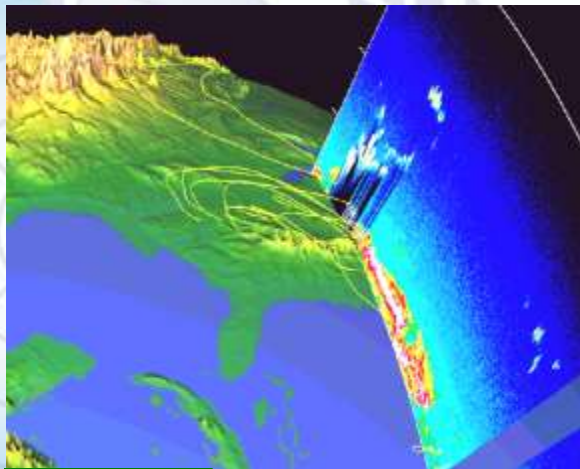
OBSERVATIONS

Two-fold use

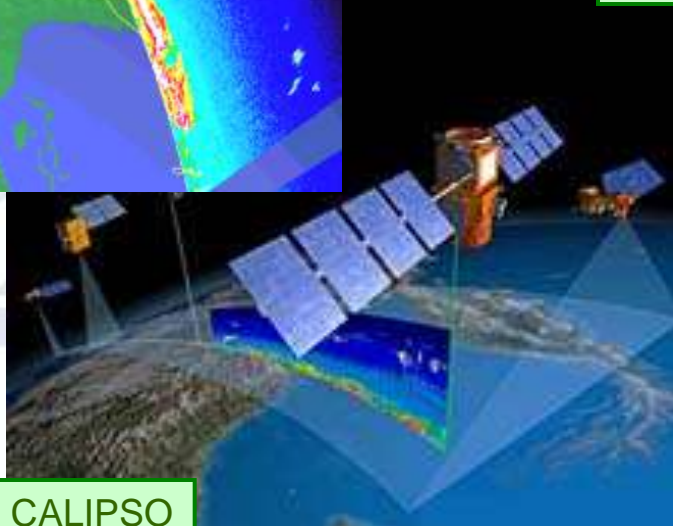
- data assimilation
- model validation



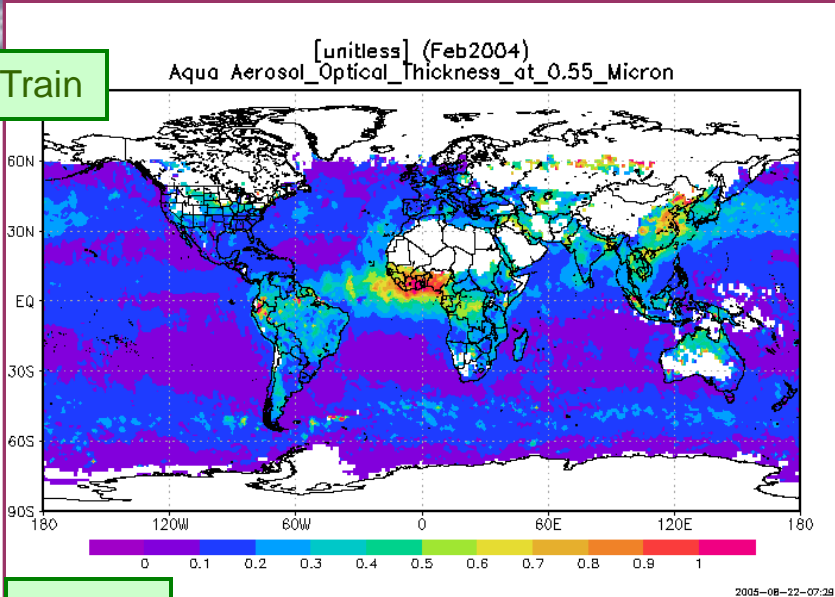
NASA A-Train



CALIPSO Lidar

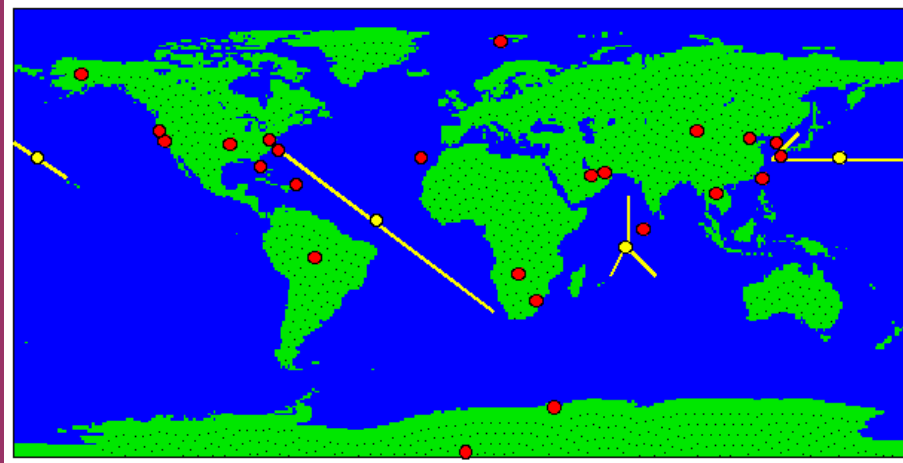


CALIPSO Lidar

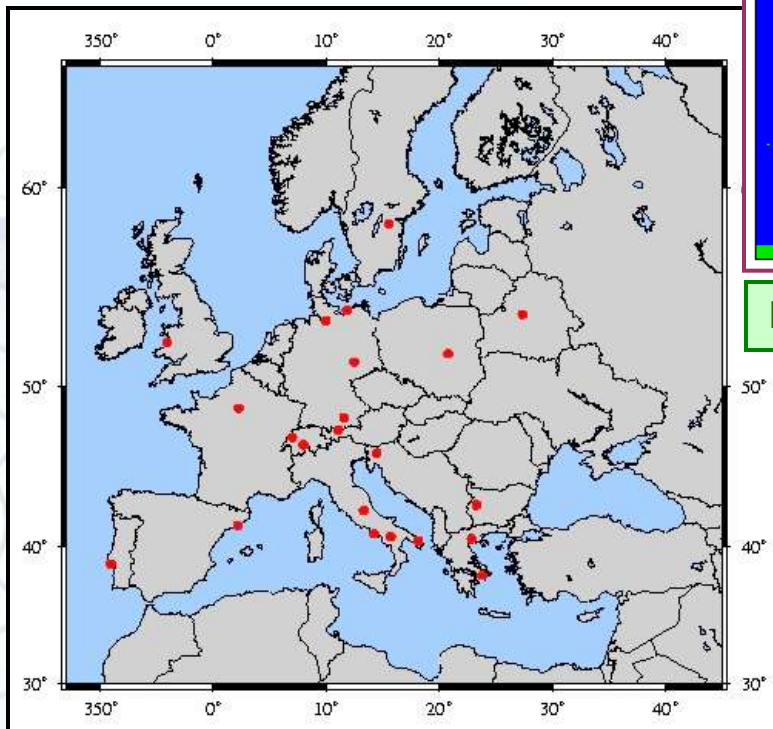


MODIS AOD

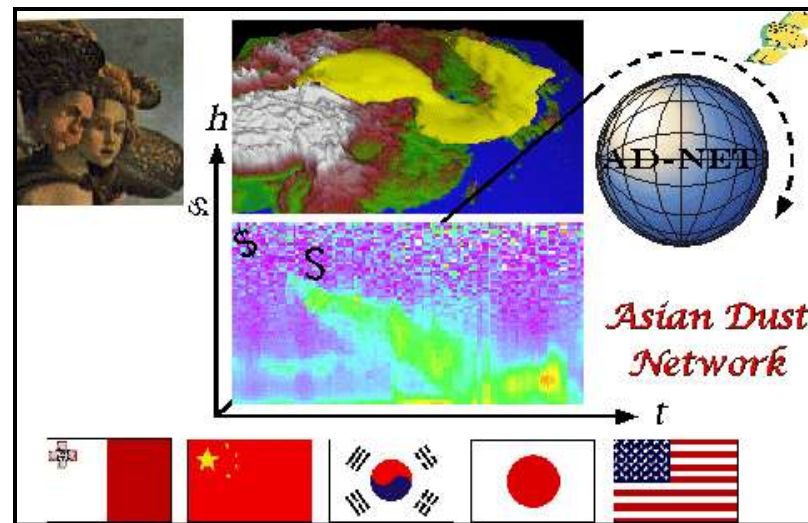
Lidar networks



NASA Micro-pulse Lidar Network MPLNET



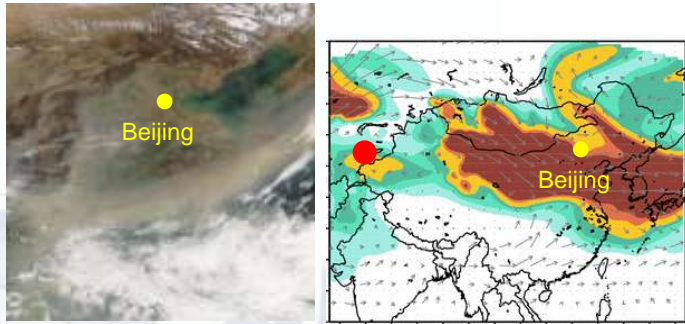
European EARLINET



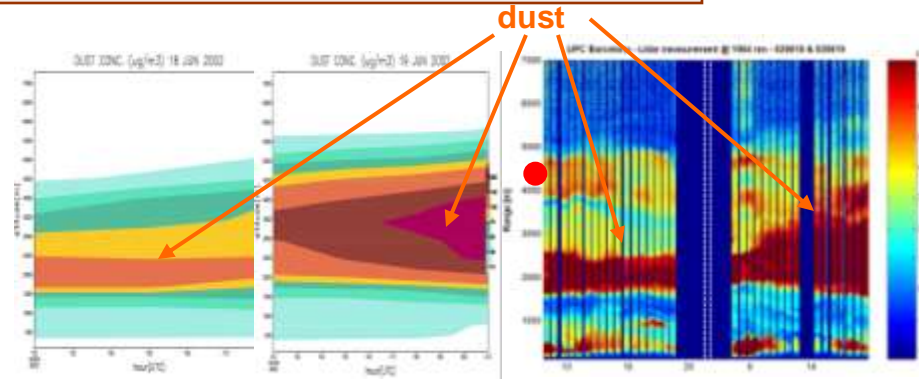
Asian AdNet

MODEL VALIDATION

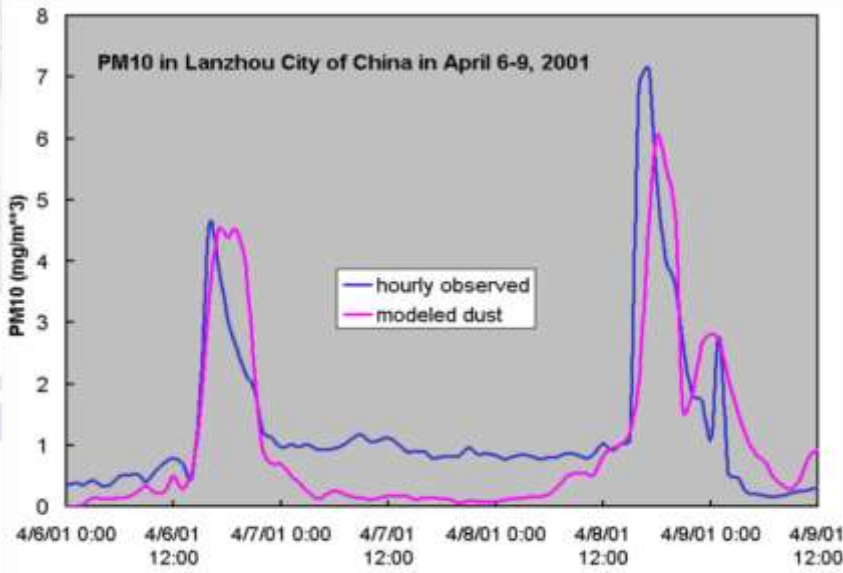
- Model tuning
- Models inter-comparisons



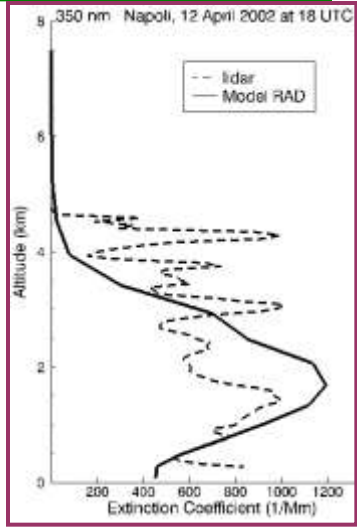
Dust storm in China: Beijing, 17 April 2006



Model vs. lidar
Source: Carlos et al., 2006



Model vs. PM10 observations
Source: Westphal et al., 2005



Model vs. Napoli lidar
Source: Carlos et al., 2006

SDS IMPACTS

HEALTH:

Bronchial tubes, eye infections, asthma, heart stress

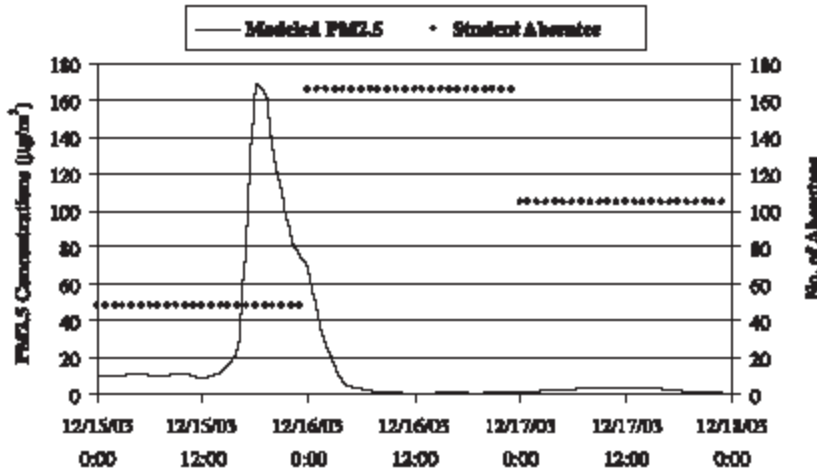


Fig. 18. PM2.5 hourly concentrations and daily number of student absentees at Lubbock, Texas.



Dust PM2.5 predicted at Univ. Arizona and student absentees, Lubbock, Texas;
Yin et al, 2005

SDS IMPACTS

HEALTH: Valley Fever

Valley Fever – endemic regions
– located in western hemisphere
Source: Hector and Laniado-Laborin, 2002

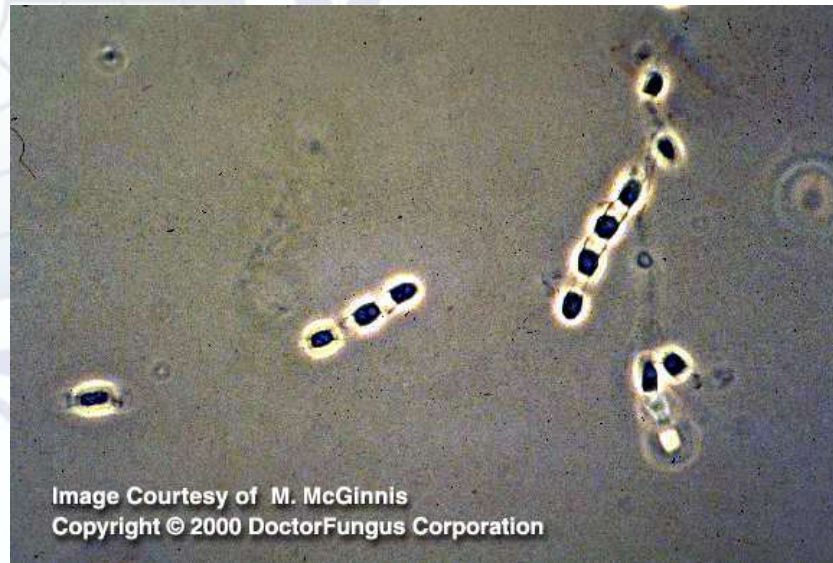
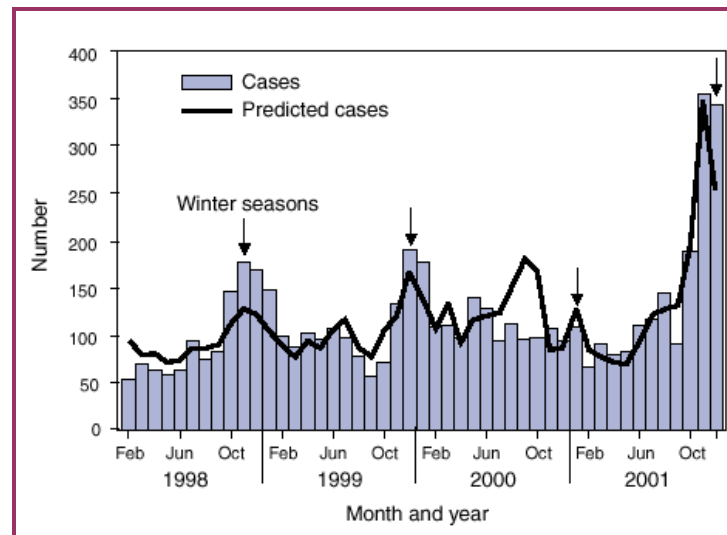


Image Courtesy of M. McGinnis
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Valley Fever spores transported by SDS storms



Number of Valley Fever cases in Arizona

Meningitis in Africa



Meningococcal meningitis occurs worldwide but especially so in dry Sub-Saharan Africa: the "African meningitis belt", including Nigeria, Burkina Faso, Mali, Niger, Chad, Cameroon....

Transcontinental transport of microorganisms

- Evidence: Saharan dust carries bacteria and fungi across the Atlantic
- 10,000 microbes/(gr of soil)
- 30 percent of the bacteria isolated from airborne soil dust are known pathogens, able to affect plants, animals, or humans (Griffin et al., 2003)

Prospero et al, 2005)

“...Endospores of *Bacillaceae* bacteria isolated from non-saline Japanese soil may be transported by dust events...”

Akinobu Echigo et al., 2003



Figure 4. Microbial growth on a sample filter collected during an African dust event in the US Virgin Islands, after 96 hours of incubation. Sample collected from Deck Point, St. Thomas, US Virgin Islands on 8 August, 2001 at 1145 am.

Sample filter collected during African dust event in the US Virgin Islands

Griffin et al., 2003

Transcontinental transport of microorganisms

Kellogg, Griffin, 2005:

Fungal diseases, affecting crops like sugarcane and bananas, have appeared in the Caribbean within a few days after an outbreak in Africa.

Bacterial pathogens of rice and beans in the Caribbean air samples, as well as those that cause disease in fruit and a variety of trees, from African air samples.

Foot and Mouth Disease virus (endemic to sub-Saharan Africa) may be carried by African dust; links between dust storms that passed over Great Britain and outbreaks of the disease.