Measurement based estimates of long range pollution transport

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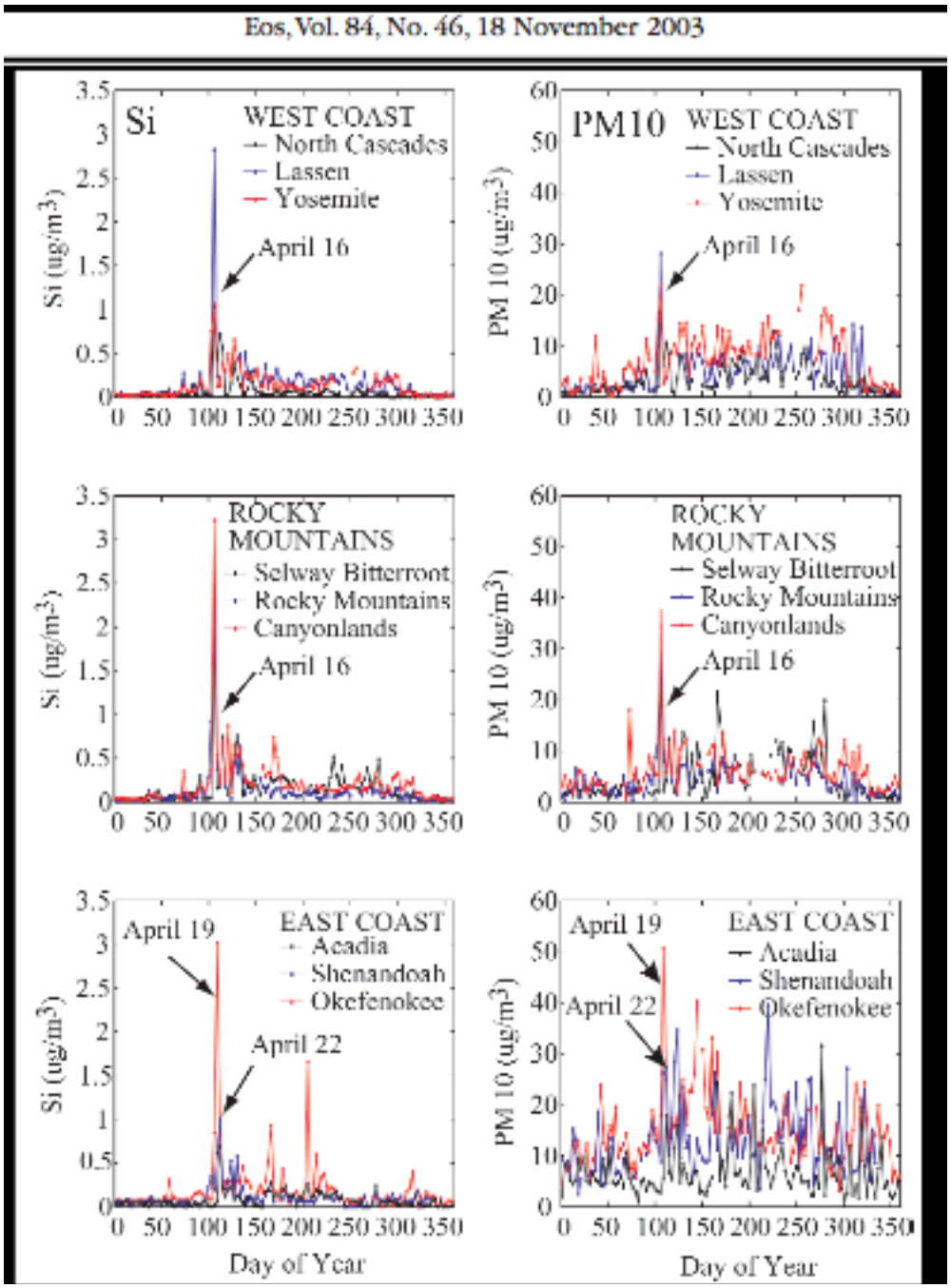
From the files of L.A. Remer, aerosol detective

"I don't want to hear about the model," I interrupt. "All models are wrong. Chin says so herself. We're a *detective agency* not an *ad agency*. We don't need a model. Besides, we couldn't even afford a model's cosmetics budget after full cost accounting.

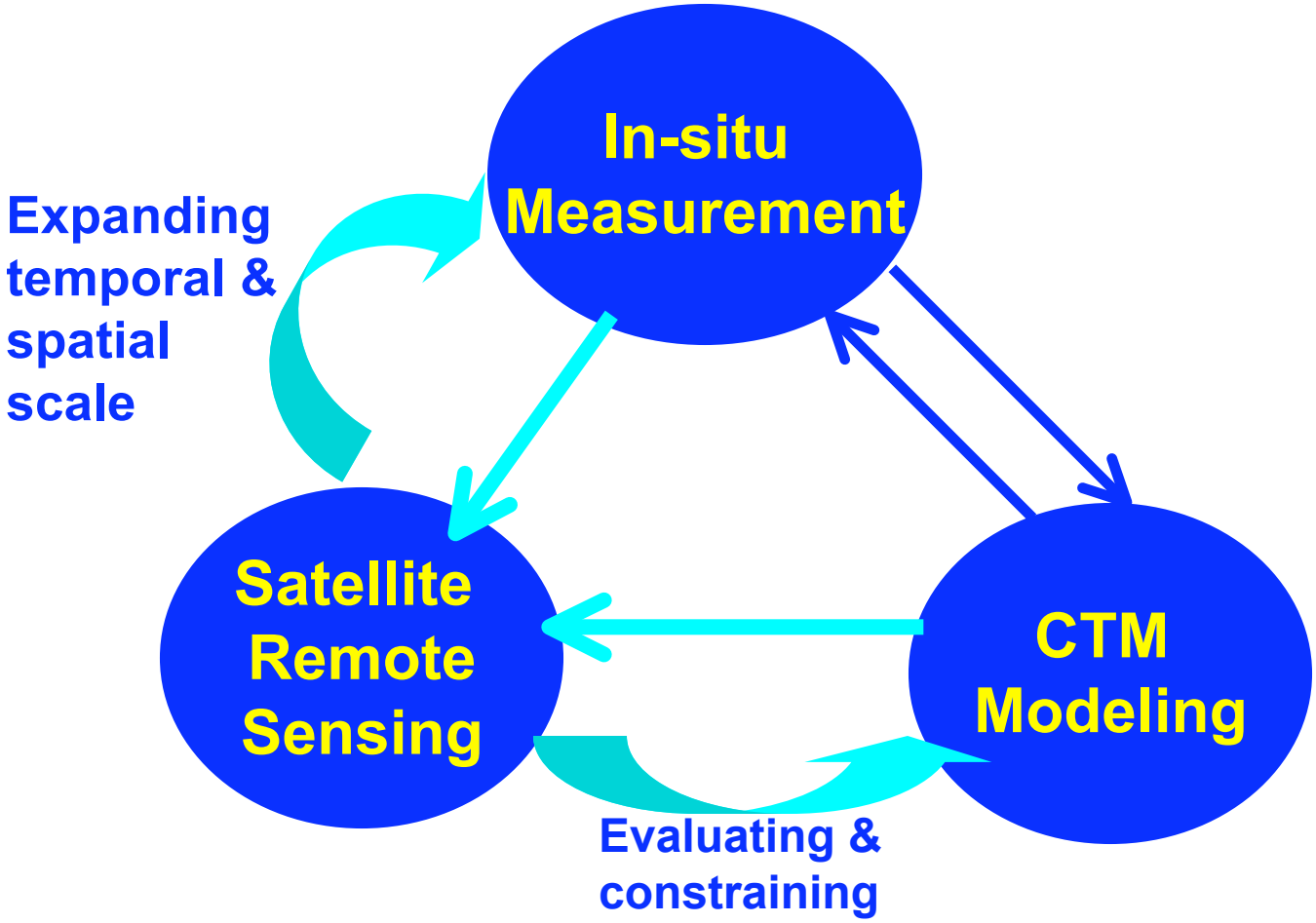
I want the facts, plain and simple. Go OBSERVE."



Jaffe et al.
EOS (2003)

Shows elevated dust aerosol in April
from ground sites in North America and traces it to transported Asian dust

Approaches to Understanding ICT



An integrated study is necessary for a better understanding of the issue!

$$\tau_{po} = (f\tau - f_{ma}\tau_{ma} - f_{du}\tau + f_{du}\tau_{ma})/(f_{po} - f_{du})$$

τ_{po} = pollution AOD

f = total fine mode fraction

τ = total AOD

f_{ma} = fine mode fraction of marine aerosol

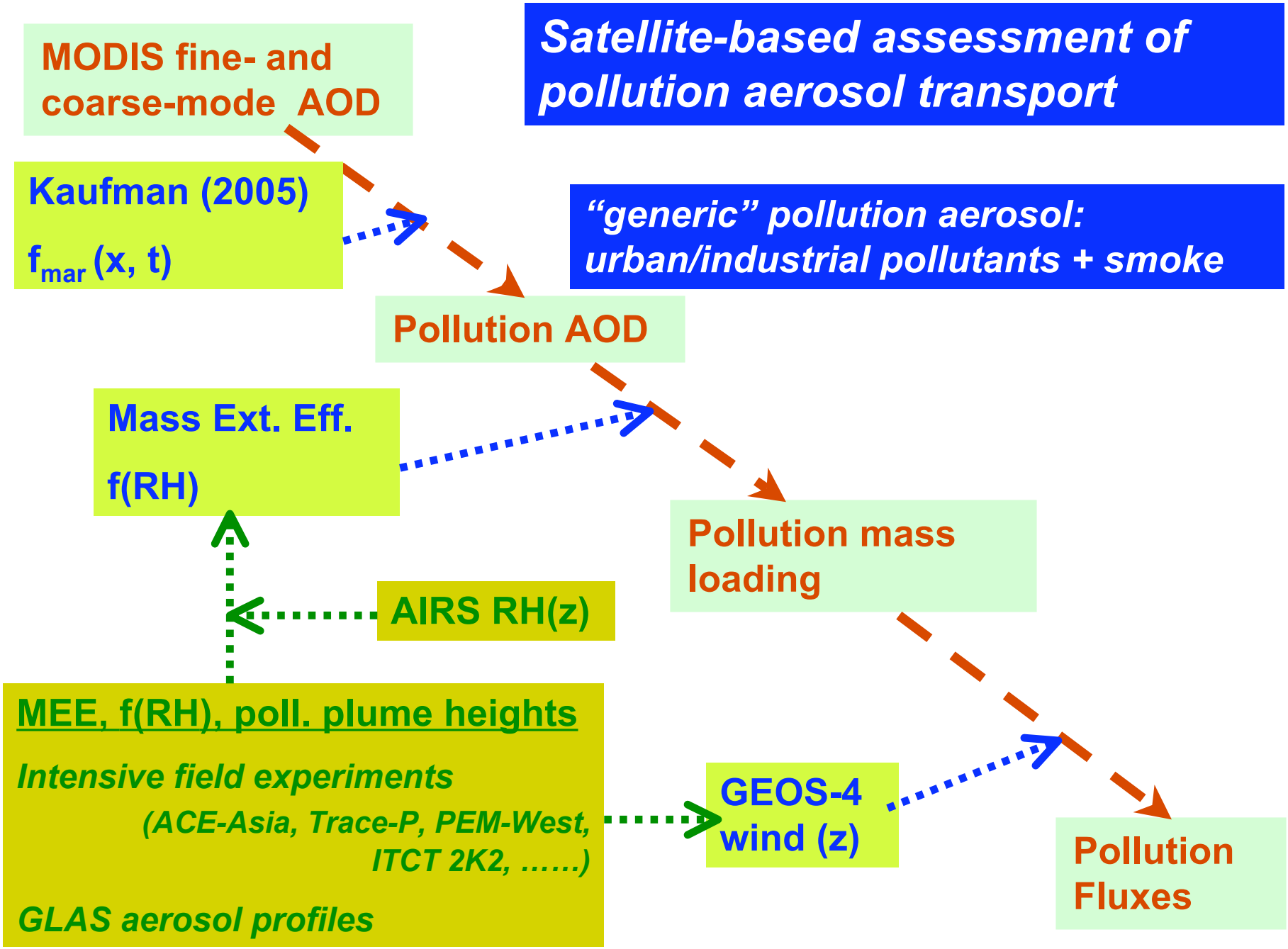
f_{du} = fine mode fraction of dust aerosol

f_{po} = fine mode fraction of pollution aerosol

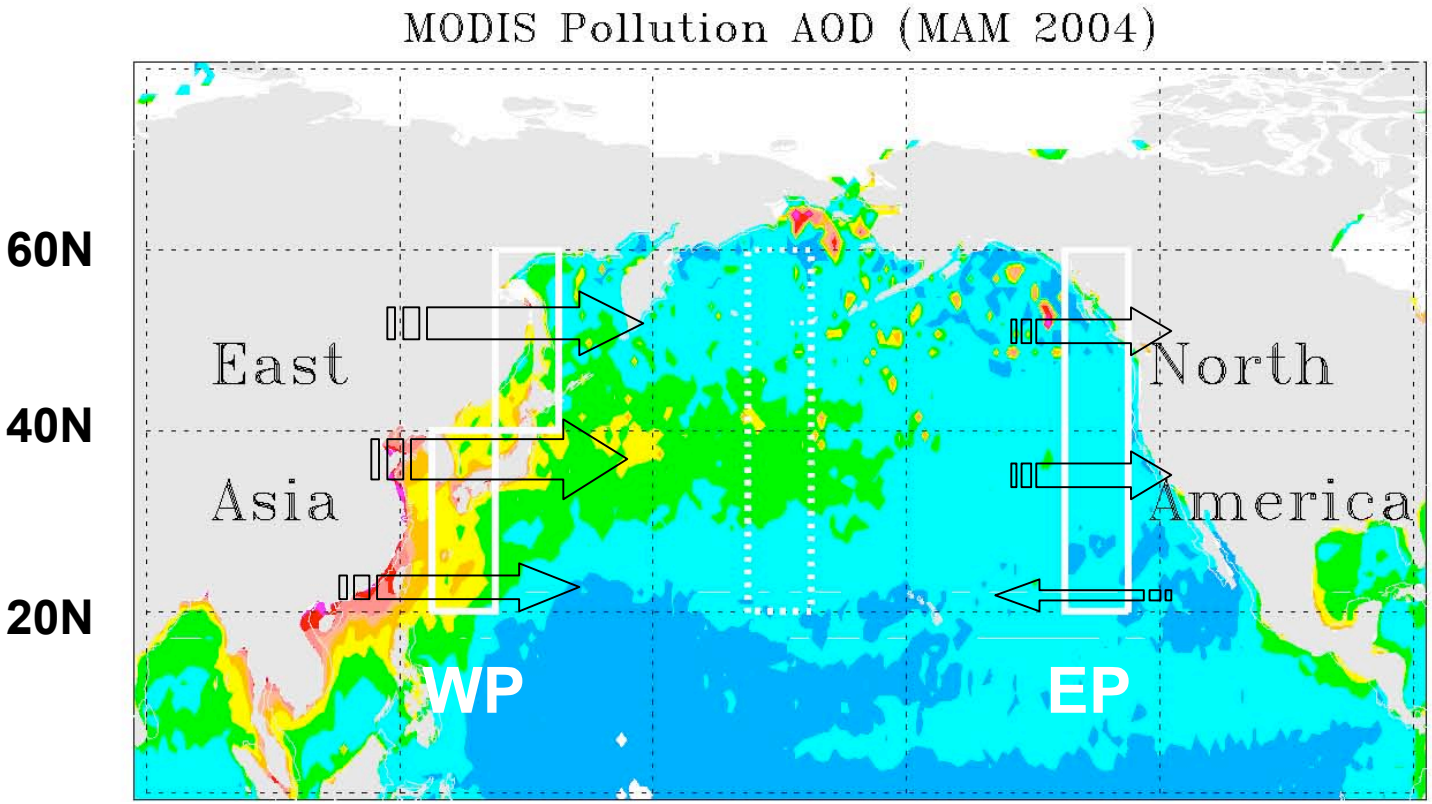
$\tau_{po} \neq f\tau$

Anthropogenic part is not the same as fine mode aerosol

Kaufman et al. (2005)


Satellite-based assessment of pollution aerosol transport
MODIS fine- and coarse-mode AOD
Kaufman (2005)
f_{mar} (x, t)
"generic" pollution aerosol: urban/industrial pollutants + smoke
Pollution AOD
Mass Ext. Eff.
f(RH)
Pollution mass loading
AIRS RH(z)
MEE, f(RH), poll. plume heights
Intensive field experiments
(ACE-Asia, Trace-P, PEM-West, ITCT 2K2, ……)
GLAS aerosol profiles
GEOS-4 wind (z)
Pollution Fluxes

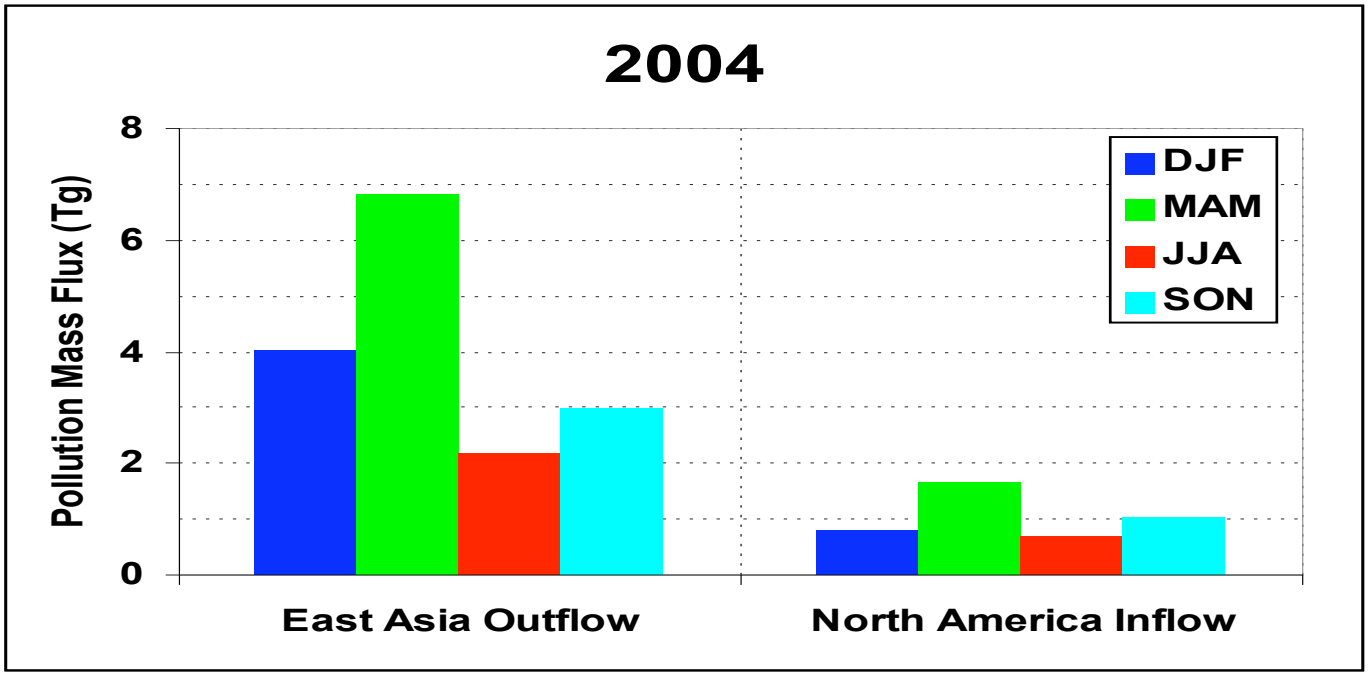
Estimate pollution mass flux across boxes by zonal wind (July 2001 to May 2006)



East Asia Outflow (20-60°N)

North America Inflow (30-60°N)

MODIS



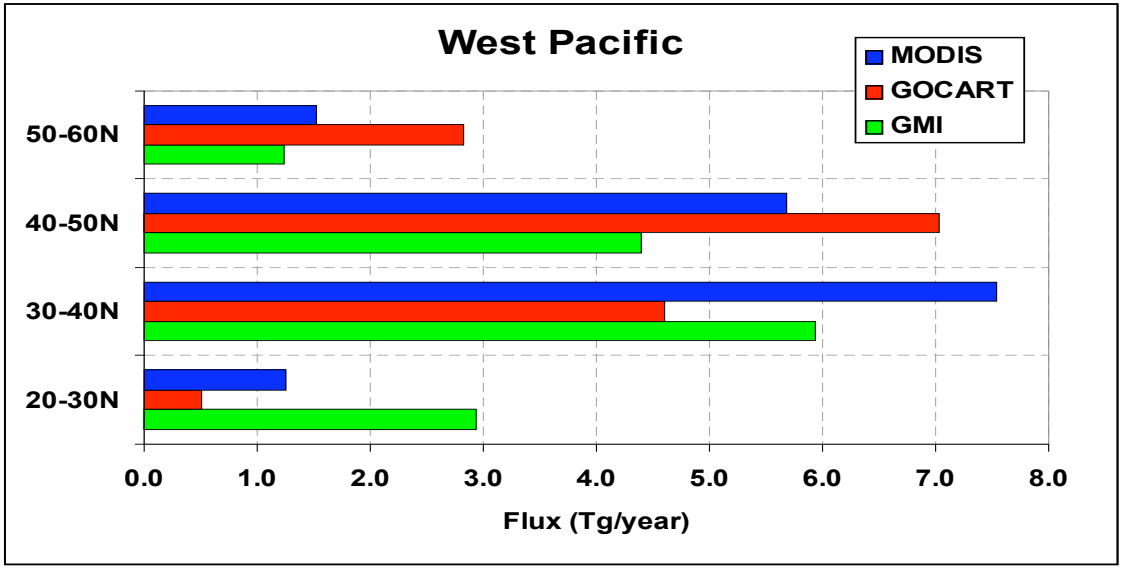
Tg/yr	OUTFLOW	INFLOW	IN/OUT
MODIS	16.0	4.2	26%
GOCART	15.0	4.8	32%
GMI	14.4	4.8	34%

Inflow for April 2004: MODIS: pollution flux = 0.7Tg

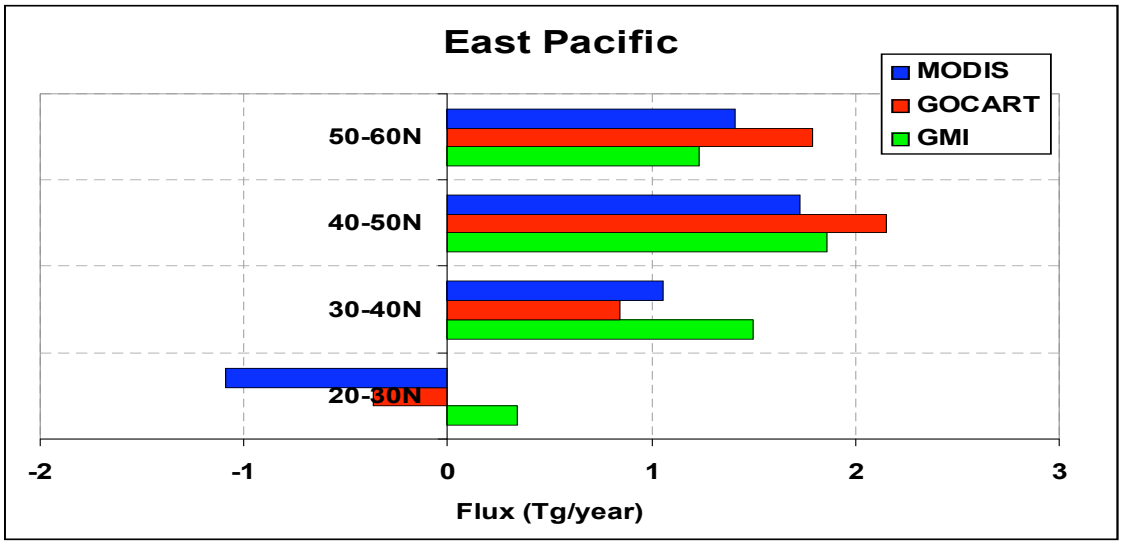
Hadley et al. (2007): fine particle flux = 1.1Tg

Satellite-Model Comparison: Meridional Variations

East Asia Outflow



North America Inflow



Inter-annual Variability of Pollution Fluxes

	East Asia Outflow (Tg/yr)	North America Inflow (Tg/yr)	Inflow / Outflow
2002	15.8	3.7	0.23
2003	20.3	5.7	0.28
2004	16.0	4.2	0.26
2005	18.6	4.1	0.22

Topics of discussion:

1. Don't forget satellite data can play an important role in estimates of pollutant transport.

2. This is more than "validating models".

3. Of course, there are limitations and models are essential.

4. NASA's AQ program should encompass long range pollutant transport, and that should include both modeling AND measurement-based studies.