The Abdus Salam
International Centre for Theoretical Physics

United Nations
Educational, Scientific and
Cultural Organization

IAEA
International Atomic Energy Agency

2066-27

Workshop and Conference on Biogeochemical Impacts of Climate and Land-Use Changes on Marine Ecosystems

2 - 10 November 2009

From the last gauge to the plume: Acqua Incognita

Richey J.
University of Washington
U.S.A

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From the last gauge to the plume: *AcqualIncognita*

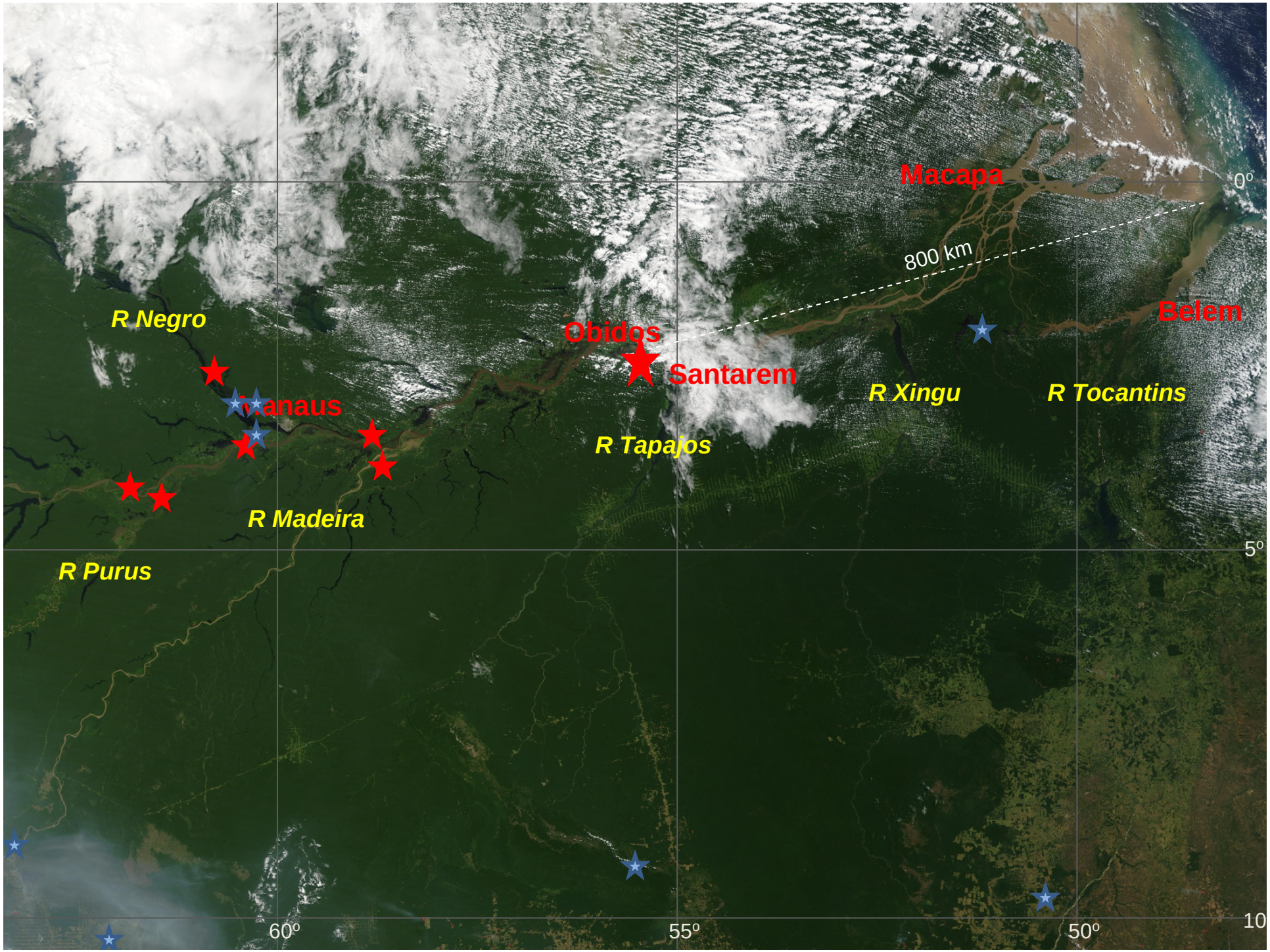
Is the *last* gauge an ”adequate” proxy for river inputs to the sea? (If not, what are you going to do about it…)

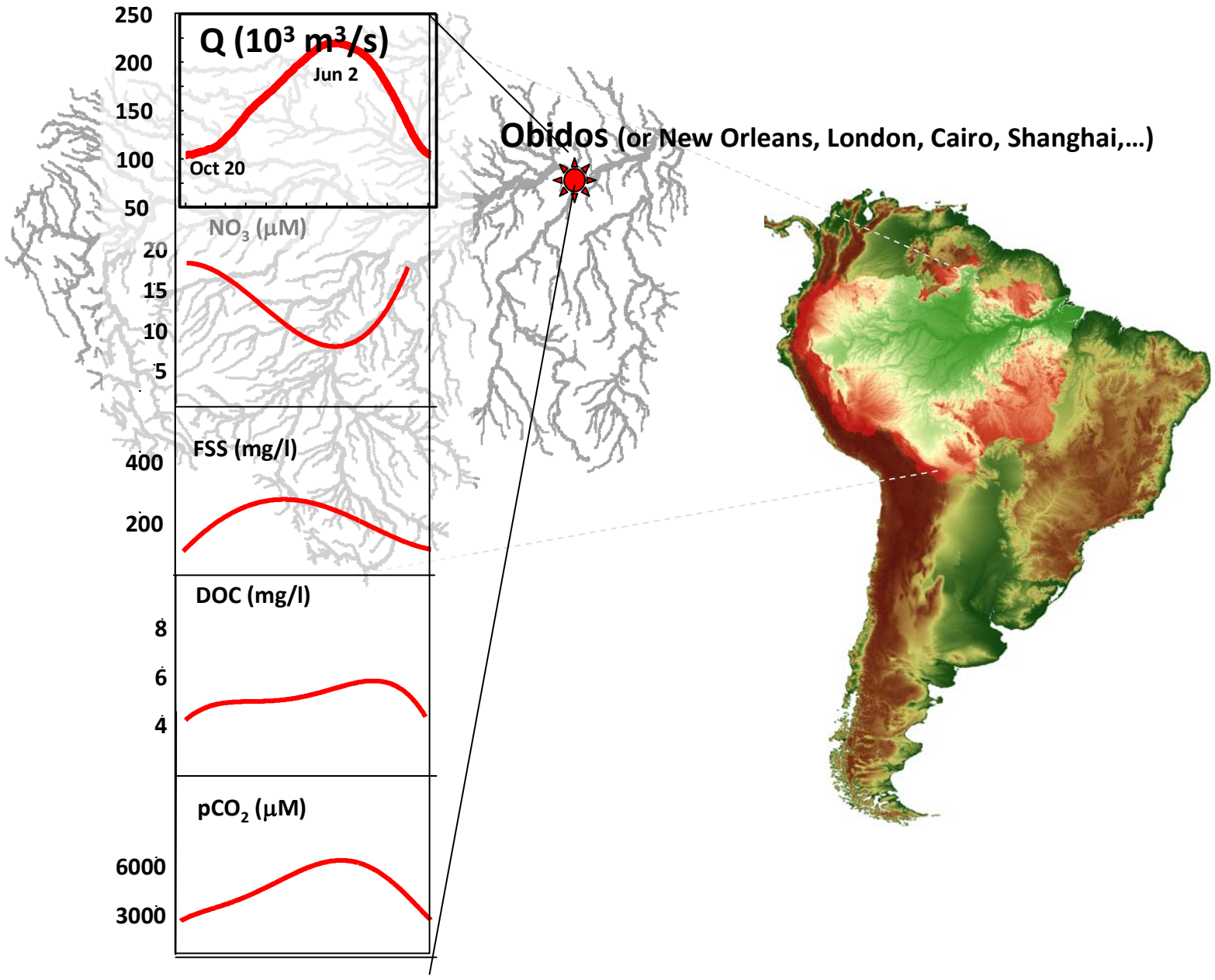
What are the implications of upriver change for the lower river/delta and then coastal seas?

What is the “balance” between river inputs and marine fates?

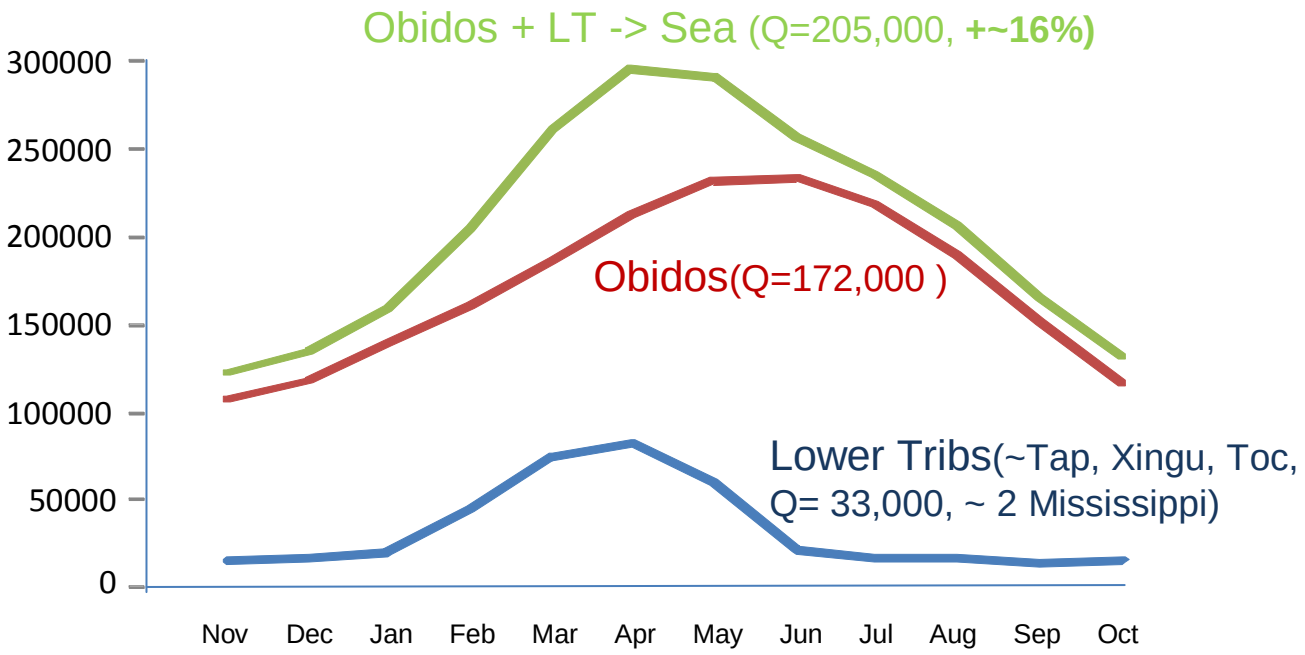
Jeffrey E. Richey
University of Washington
jrichey@u.washington.edu

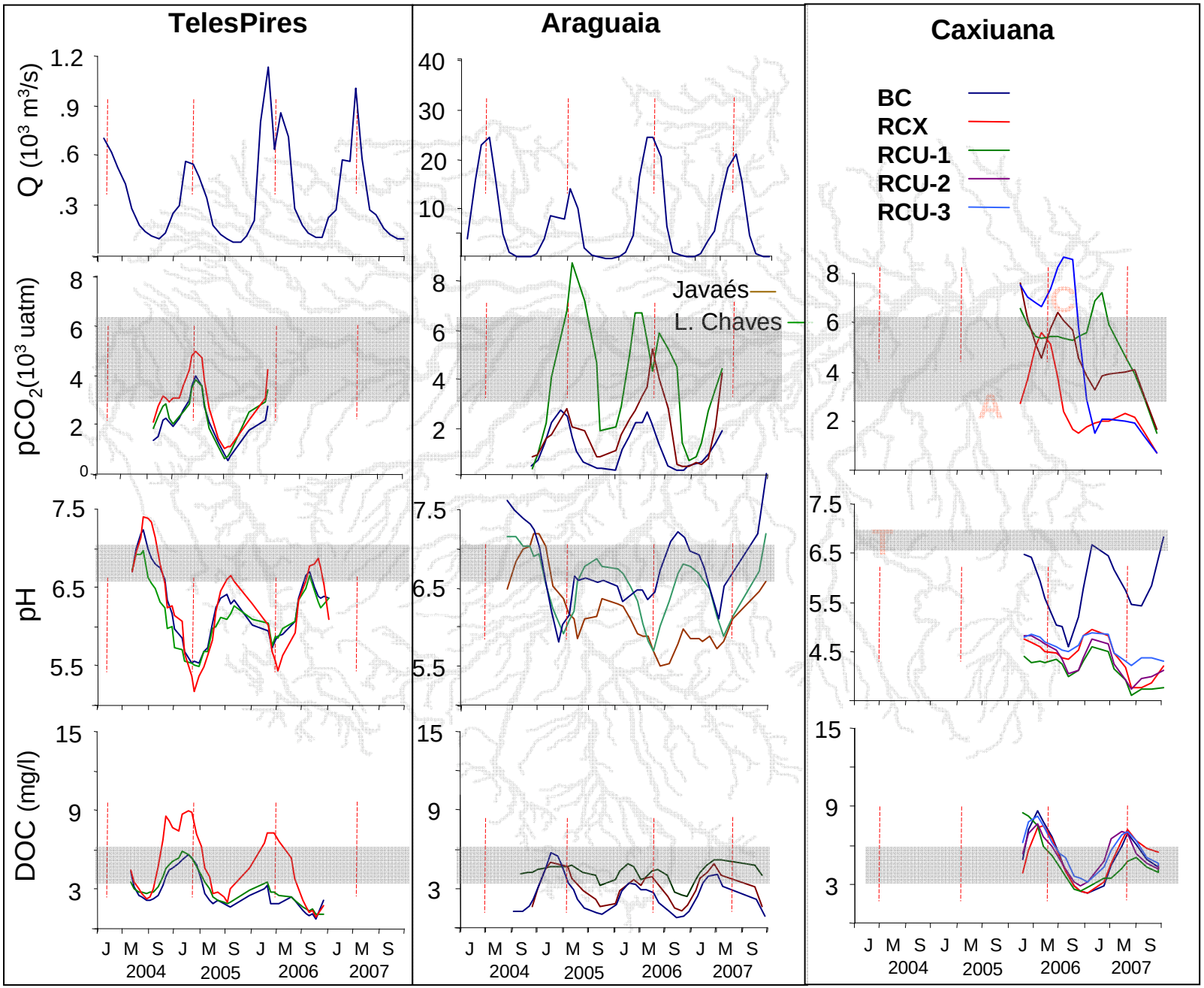
from: JPL OnEarth WMS Global Mosaic, a high resolution global image mosaic of the earth, produced from more than 8200 individual Landsat7 scenes.


Macapa
0º
800 km
Belem
R Negro
Obidos
Santarem
Manaus
R Xingu
R Tocantins
R Tapajos
R Madeira
5º
R Purus
60º
55º
50º
10


Q (10^3 m^3/s)
Jun 2
Oct 20
250
200
150
100
50
NO_3 (µM)
20
15
10
5
FSS (mg/l)
400
200
DOC (mg/l)
8
6
4
pCO_2 (µM)
6000
3000
Obidos (or New Orleans, London, Cairo, Shanghai,…)

DISCHARGE TO THE SEA (m^3/s)

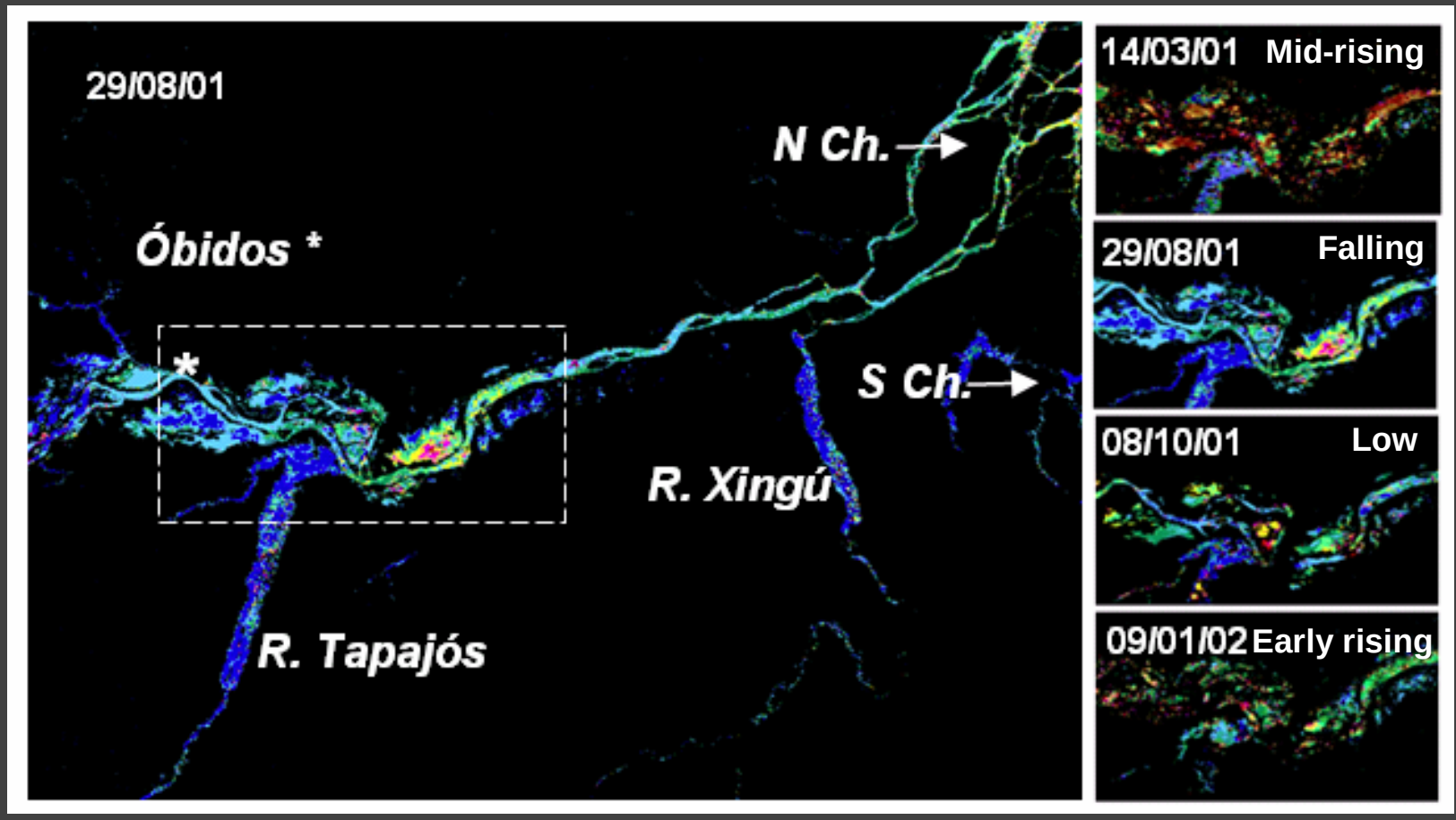




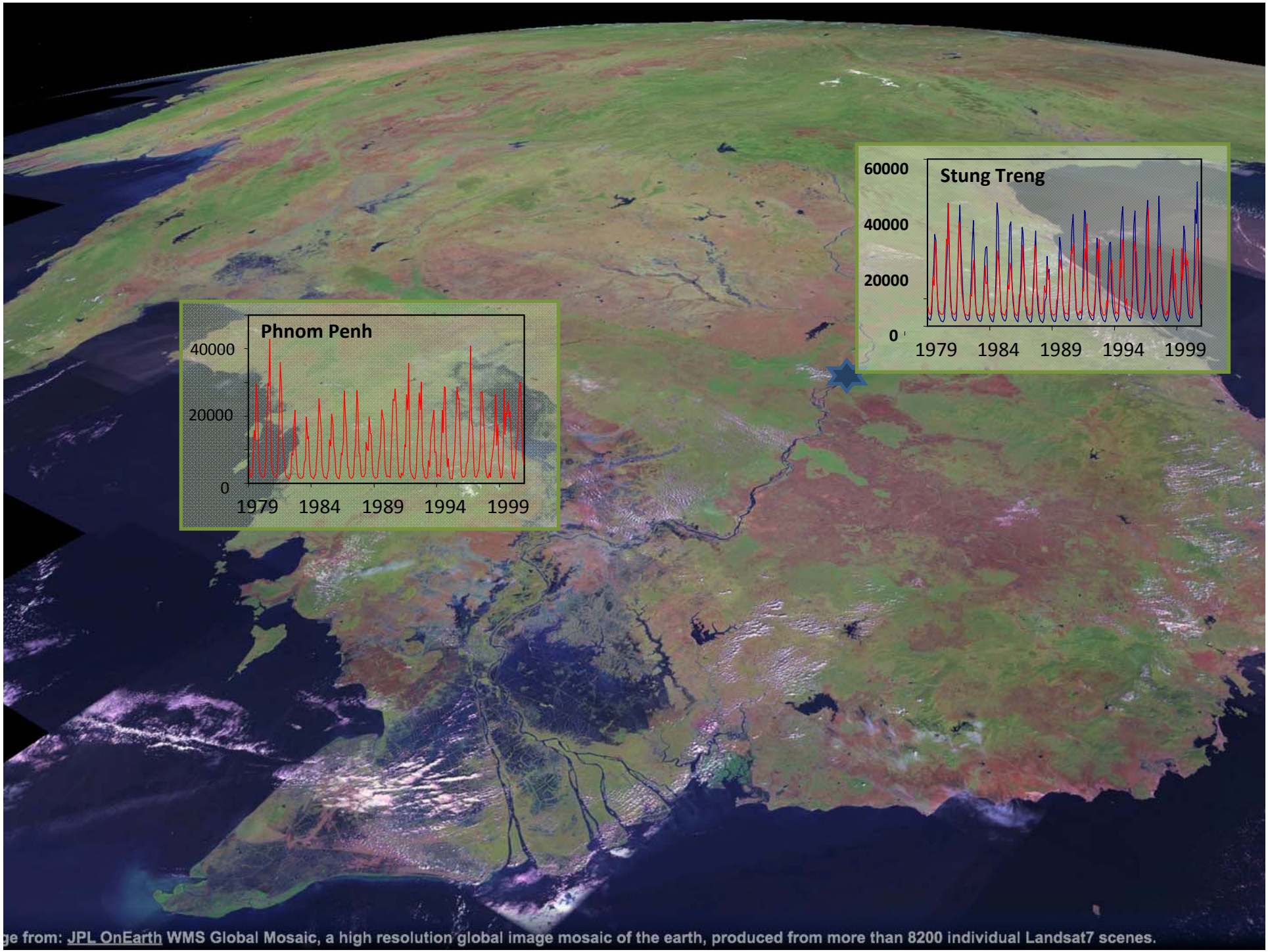
***Rede Beija Rio* in prep**

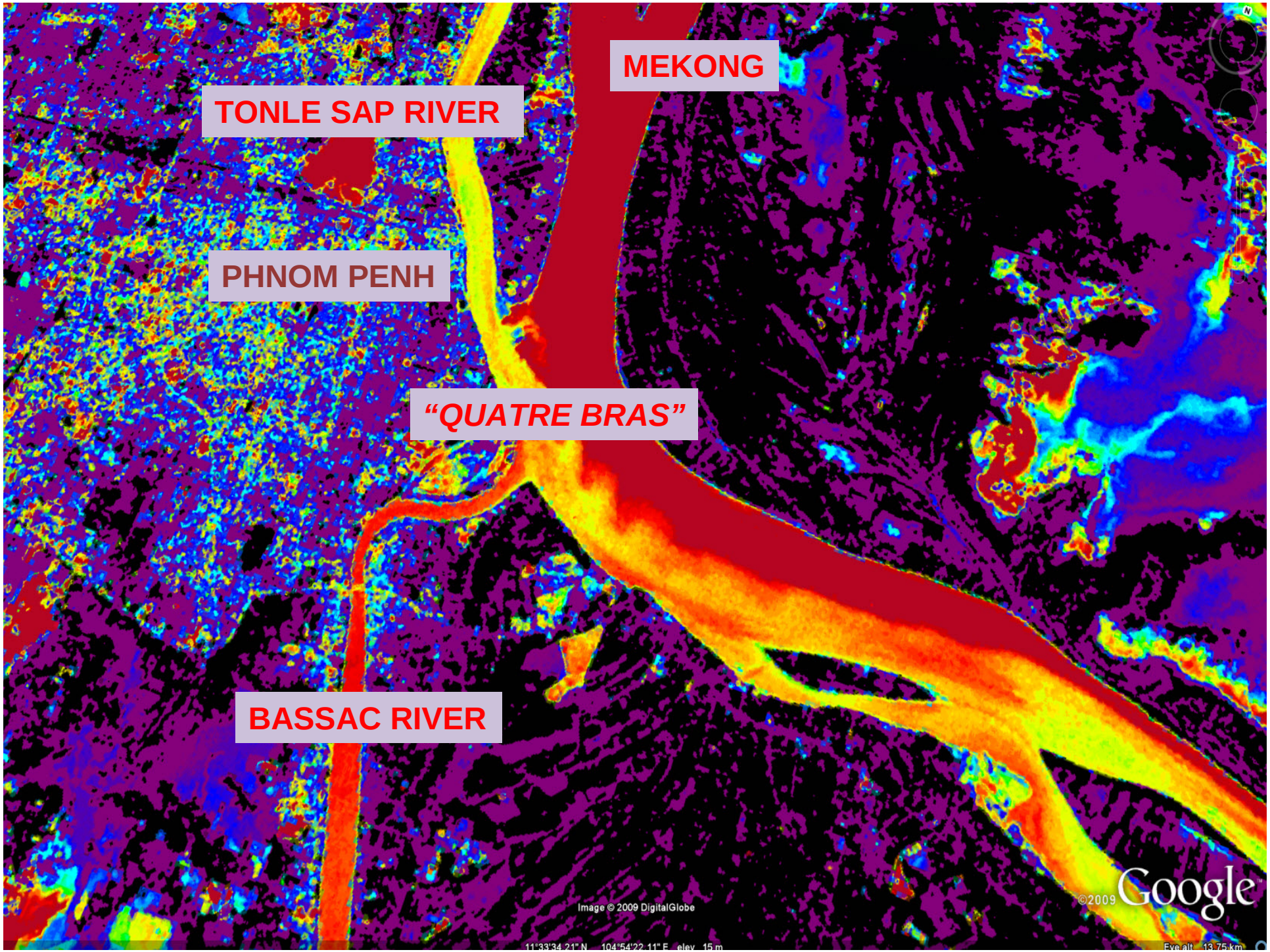
Surface TSS (mg/L) from MODIS for lower Amazon

"Test of concept" calibration (from dark blue (0)-to red (~250

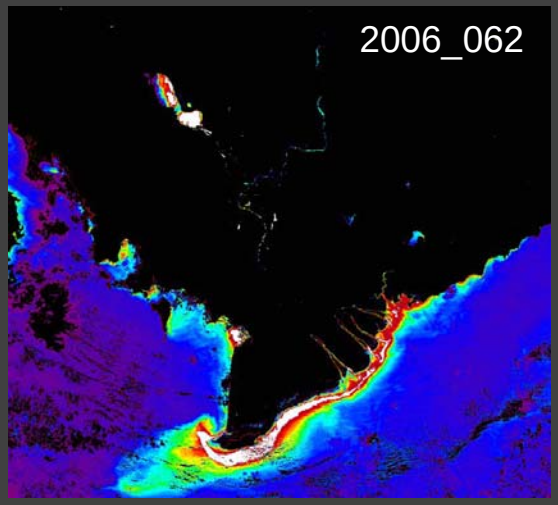


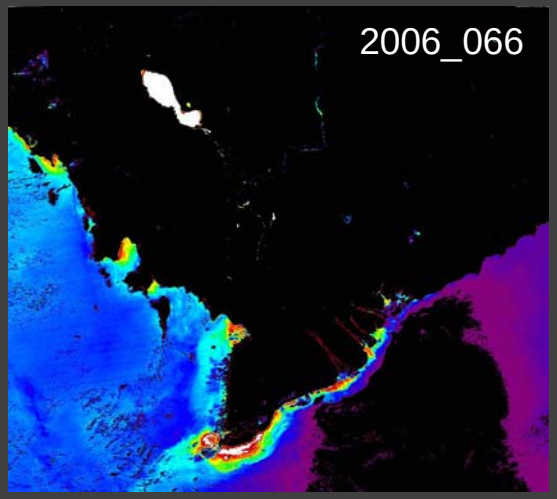
L.A.K. Mertes, unpubl. data, in memory

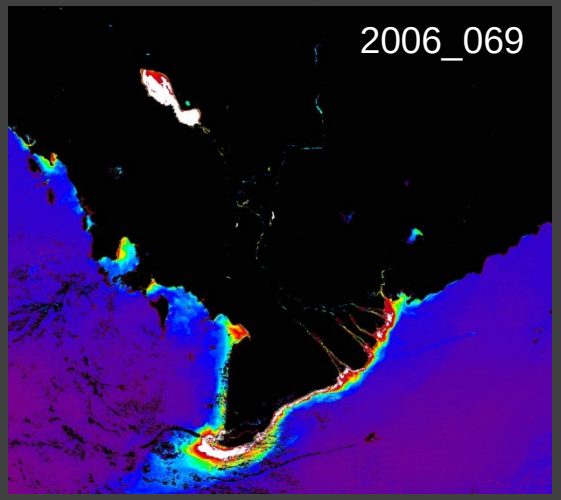

Phnom Penh
40000
20000
0
1979
1984
1989
1994
1999
Stung Treng
60000
40000
20000
0
1979
1984
1989
1994
1999
ge from: JPL OnEarth WMS Global Mosaic, a high resolution global image mosaic of the earth, produced from more than 8200 individual Landsat7 scenes.

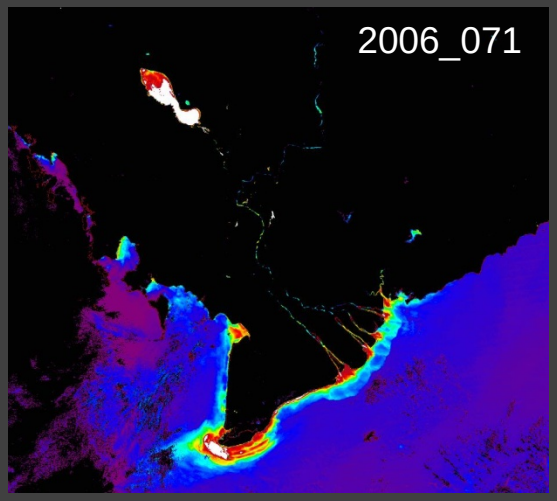

MEKONG
TONLE SAP RIVER
PHNOM PENH
“QUATRE BRAS”
BASSAC RIVER
Image © 2009 DigitalGlobe
©2009 Google

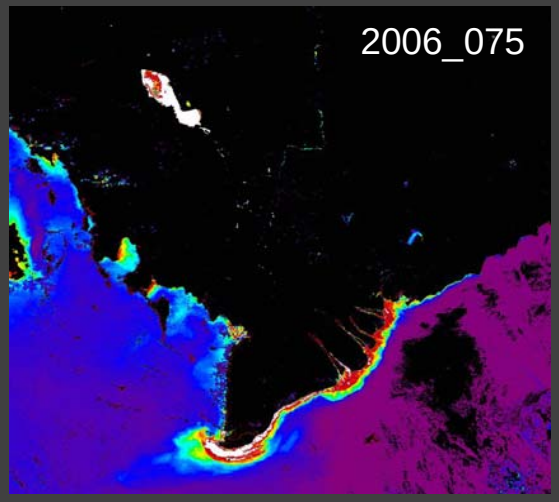
LOWER MEKONG TURBIDITY

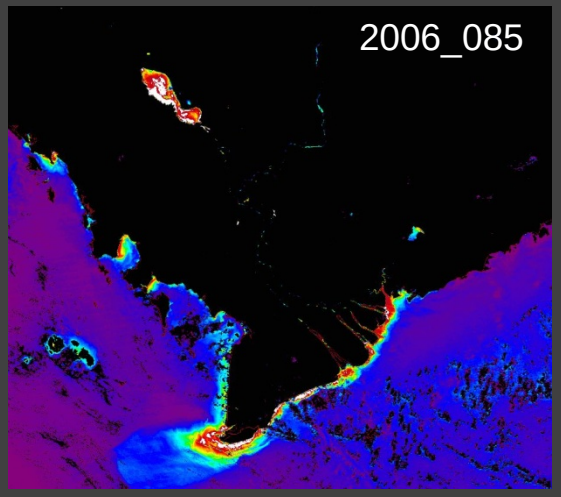




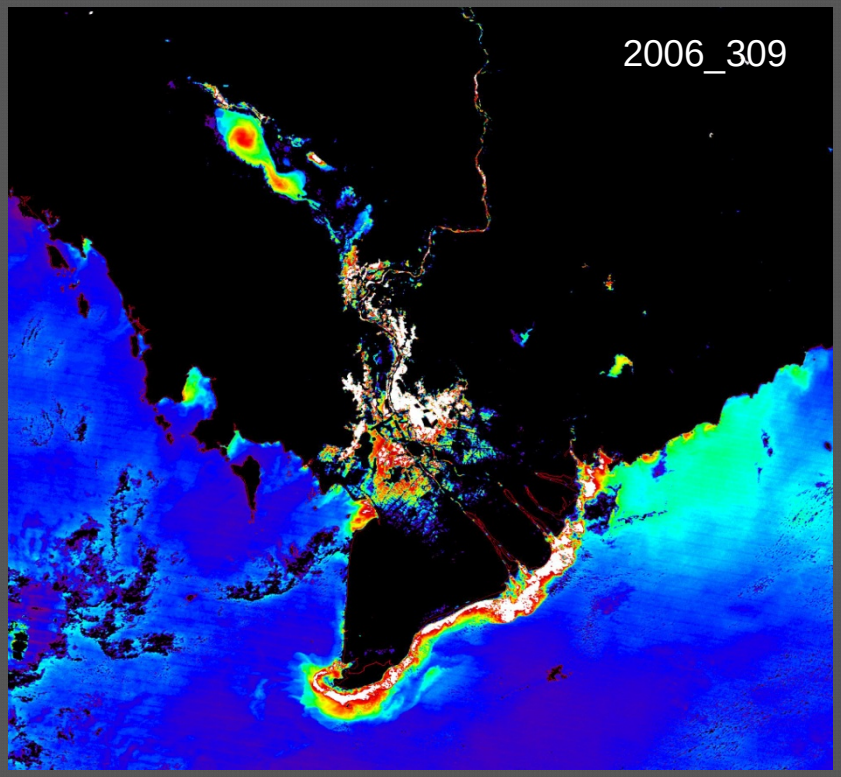


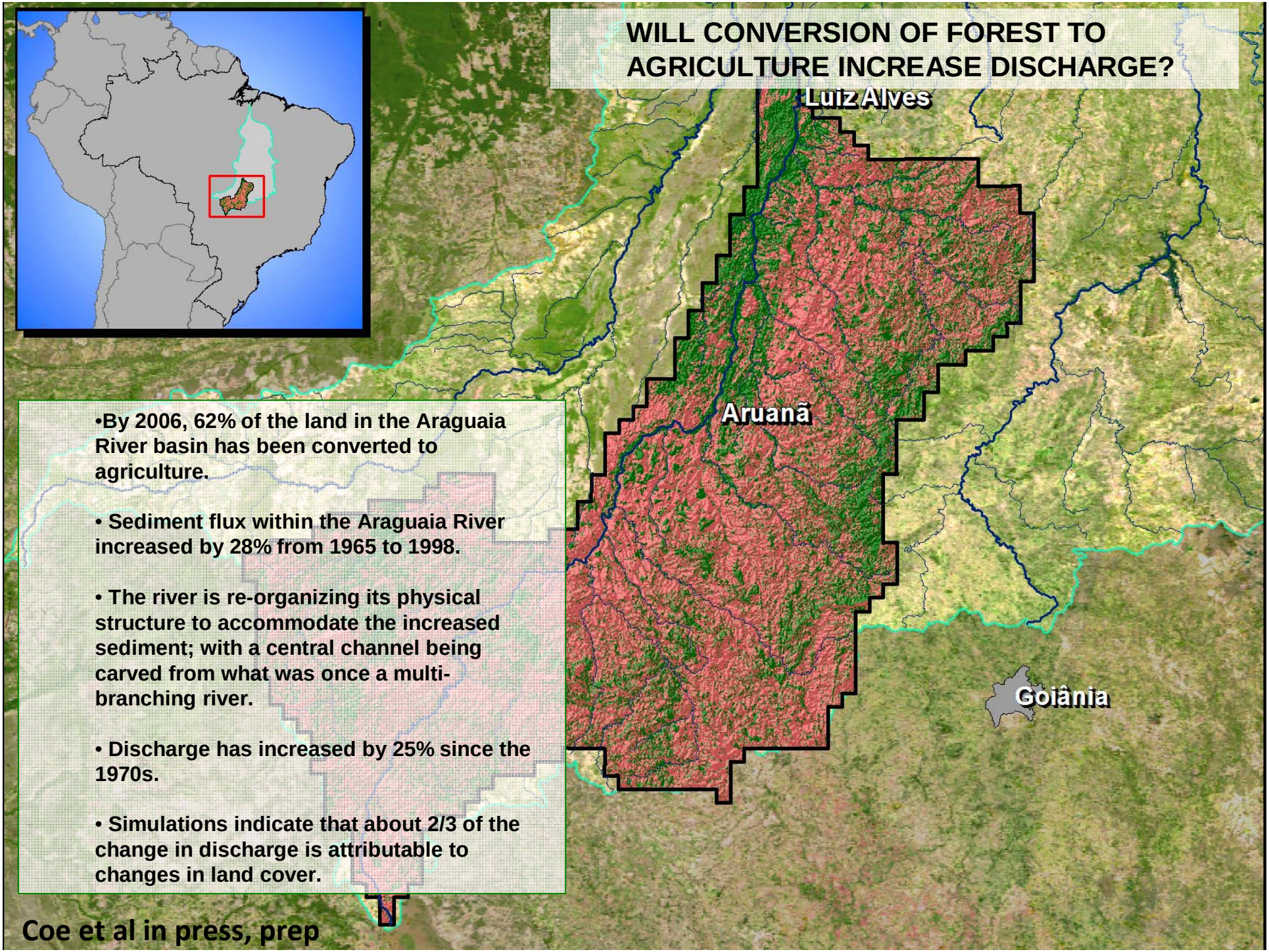




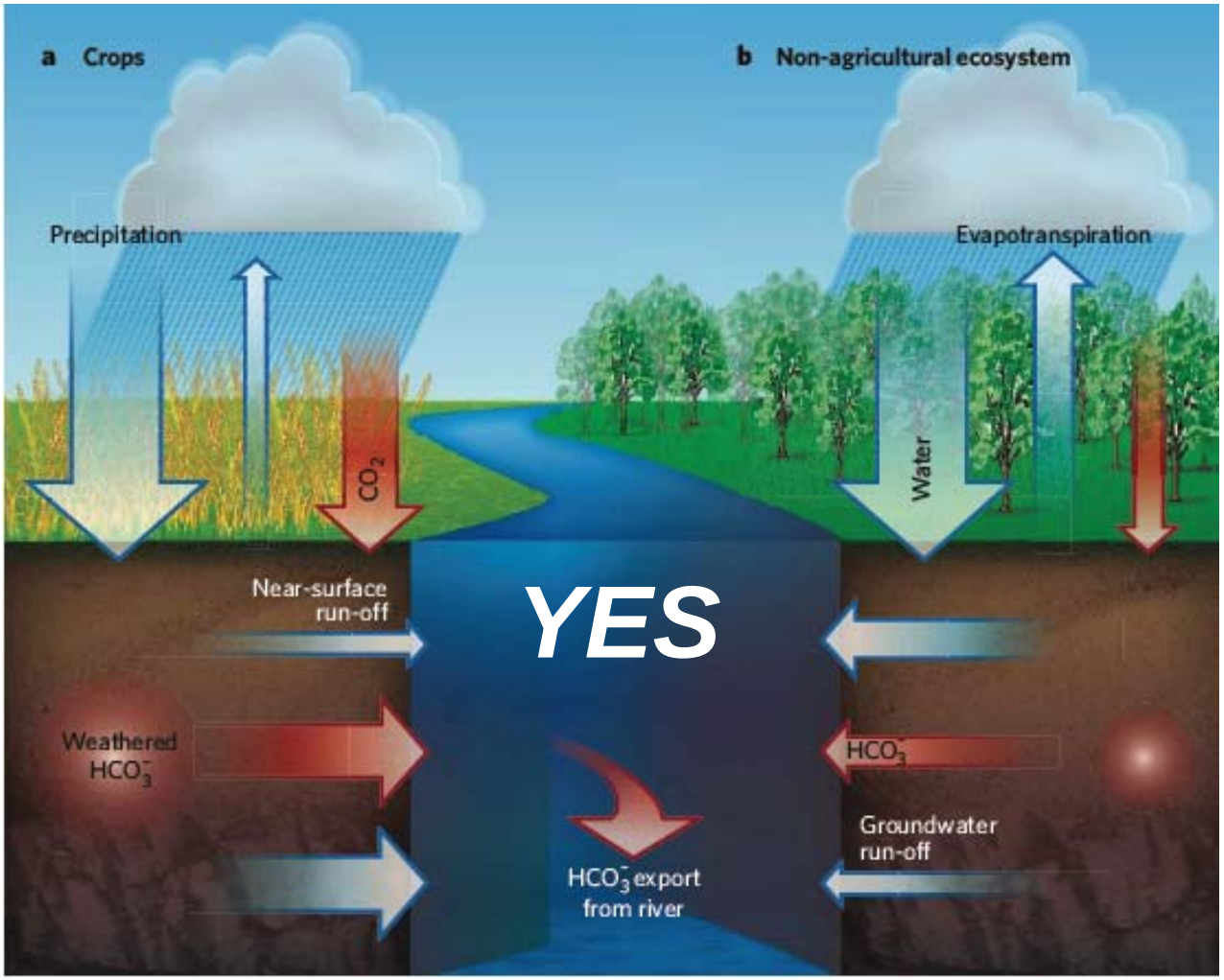


LOWER MEKONG TURBIDITY




WILL CONVERSION OF FOREST TO AGRICULTURE INCREASE DISCHARGE?
Luiz Alves
Aruanã
Goiânia
•By 2006, 62% of the land in the Araguaia River basin has been converted to agriculture.
• Sediment flux within the Araguaia River increased by 28% from 1965 to 1998.
• The river is re-organizing its physical structure to accommodate the increased sediment; with a central channel being carved from what was once a multi-branching river.
• Discharge has increased by 25% since the 1970s.
• Simulations indicate that about 2/3 of the change in discharge is attributable to changes in land cover.
Coe et al in press, prep

Landuse Change:
Carbon exchange and Nutrient Release



Mayorga 2008

HYDROPOWER DEVELOPMENT IN LAO PDR

Chansaveng BOUNGNONG

Director of Power Sector Planning Division

Department of Electricity, Ministry of Energy and Mines, Lao PDR

2nd BDP Forum, Chiang Rai, October 15, 2009

LIST OF DAMS ON THE MEKONG MAINSTREAM (LAOS)

No.	Name	MW
1	Pak Beng	1,230
2	Luang Prabang	1,410
3	Xayaboury	1,260
4	Pak Lay	1,320
5	Sanakham	570
6	Ban Khum	2,330
7	Lat Seua	800
8	Dong Sahong	240
	TOTAL	9,160

BIOGEOCHEMICAL IMPACTS OF CLIMATE CHANGE AND LANDUSE CHANGES ON MARINE ECOSYSTEMS

Are the "last" stations representative? Somewhat…

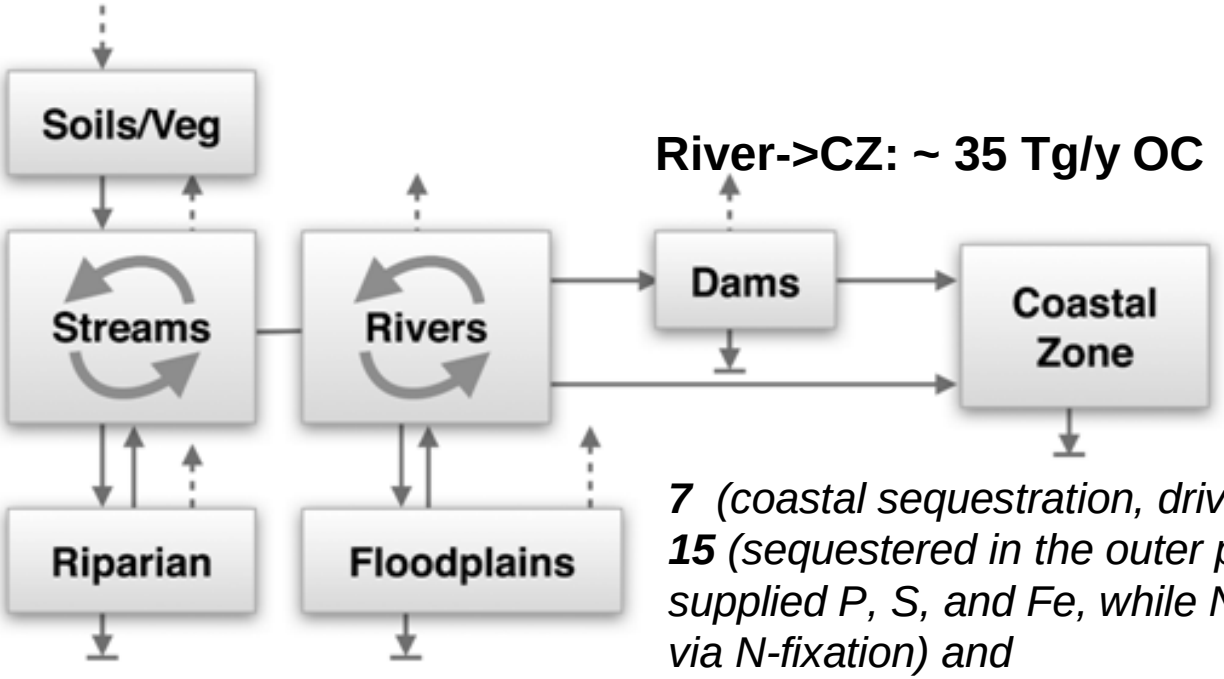
But issue is, how are the flow, sediment, nutrient, and carbonate systems modified through the lower reaches, across the salinity gradient to the plume, and does that matter to coastal sea calculations?

Will climate and landuse changes (including dams) cause impacts? river delivery (yes), deltas (yes), and at least plume ecosystems at a detectable level (?).

What is the "balance" between river inputs and marine fates?

Central Working Hypothesis ????

A dynamic equilibrium exists between the river and ocean across the Amazon continuum, where net river inputs of organic carbon and nutrients are roughly balanced by the subsequent processing of these materials in the sea. Climate and land-use changes will very likely alter this equilibrium.



River->CZ: ~ 35 Tg/y OC

7 *(coastal sequestration, driven directly by river N),*
15 *(sequestered in the outer plume, driven by river-supplied P, S, and Fe, while N is supplied primarily via N-fixation) and*
13 *(CO_2produced through photo-oxidation of riverine DOC).*


GRAZIE!!
ICTP Adriatco Guest House 9 Nov