The climate system and its interactions with biodiversity and human livelihoods

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Royal Society and GBSC Workshop
Biodiversity – Climate Interactions: adaptation, mitigation and human livelihoods
12-13 June 2007, London UK

Biosphere – Atmosphere relations might explain the inferred capacity of the rainforest to resist climate forcing

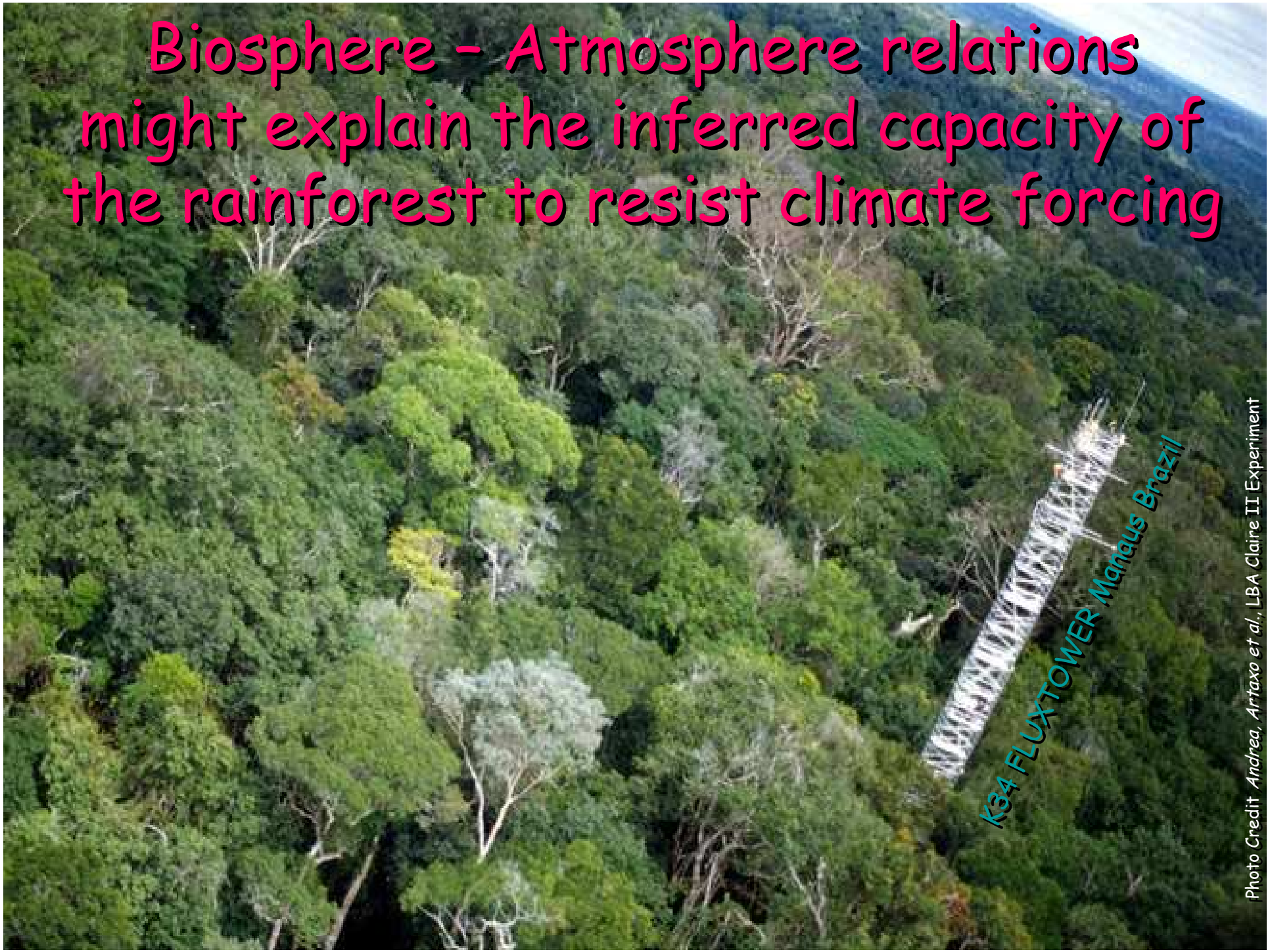
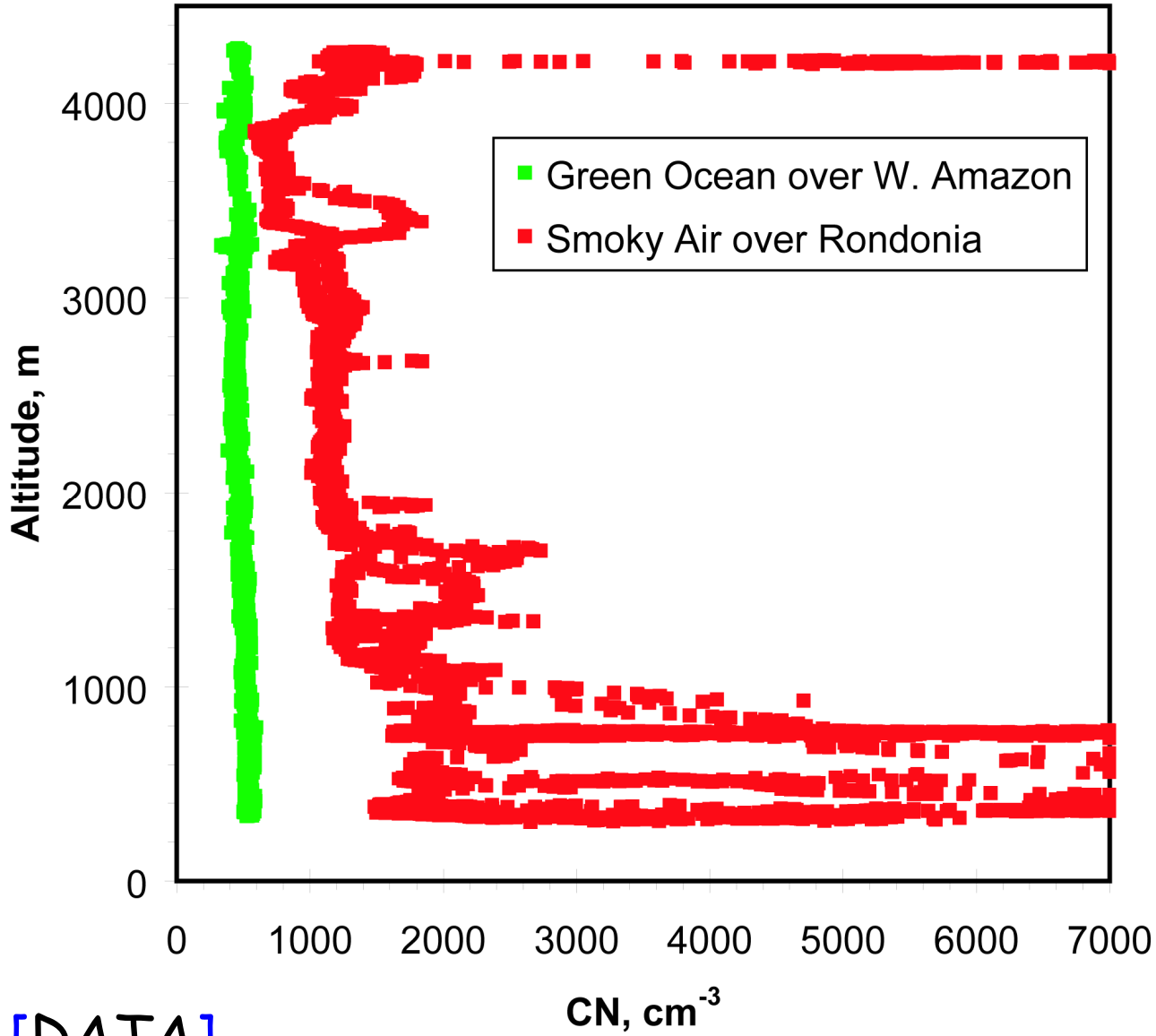


Photo Credit *Andrea, Artaxo et al.*, LBA Claire II Experiment

The Green Ocean

Photo Credit *Andrea, Artaxo et al*
.LBA Smocc Experiment

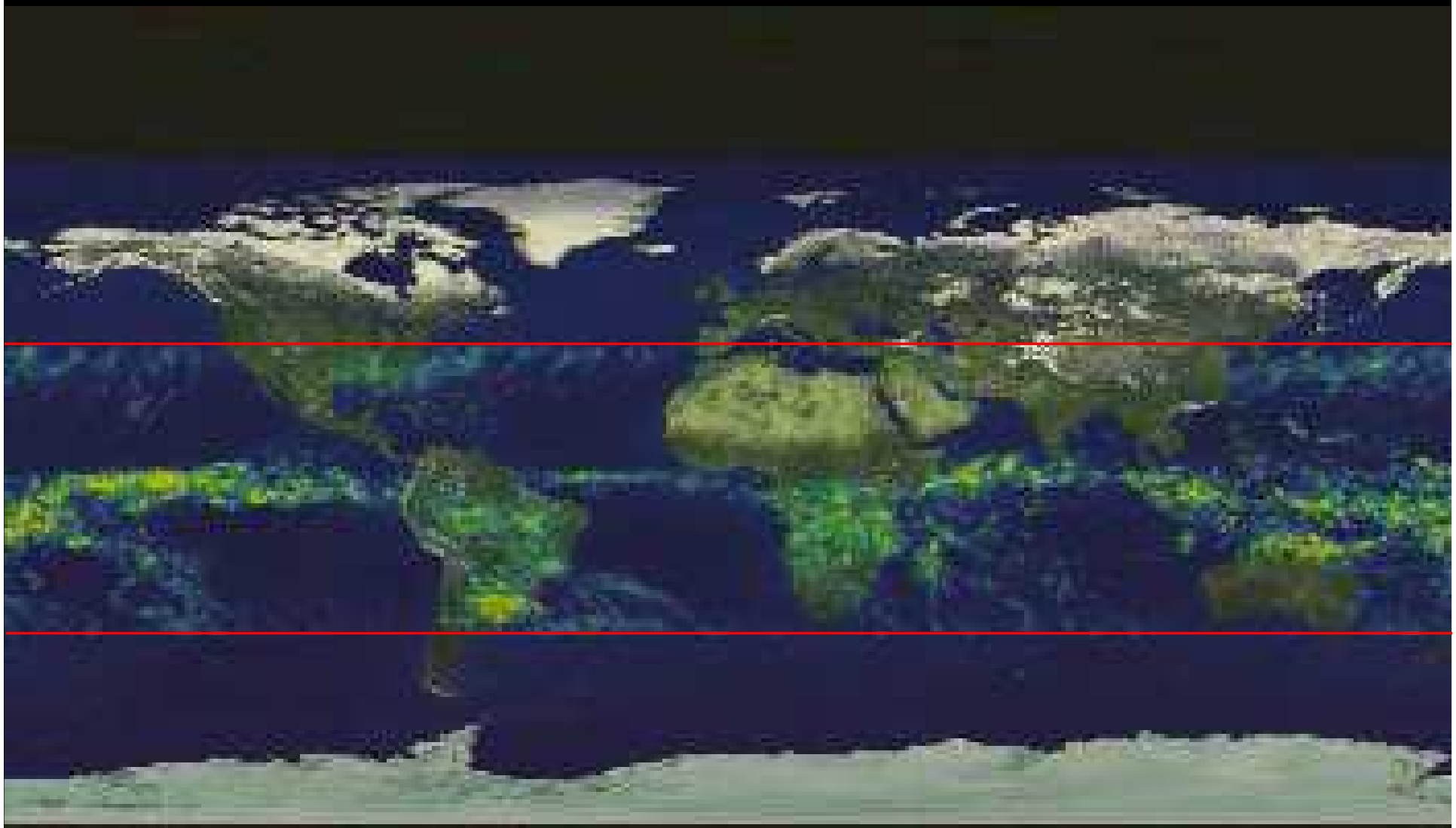


Vertical Distribution of Aerosols

[DATA]

Andrea, Artaxo et al., LBA Experimento Smocc

TROPICAL RAINFALL



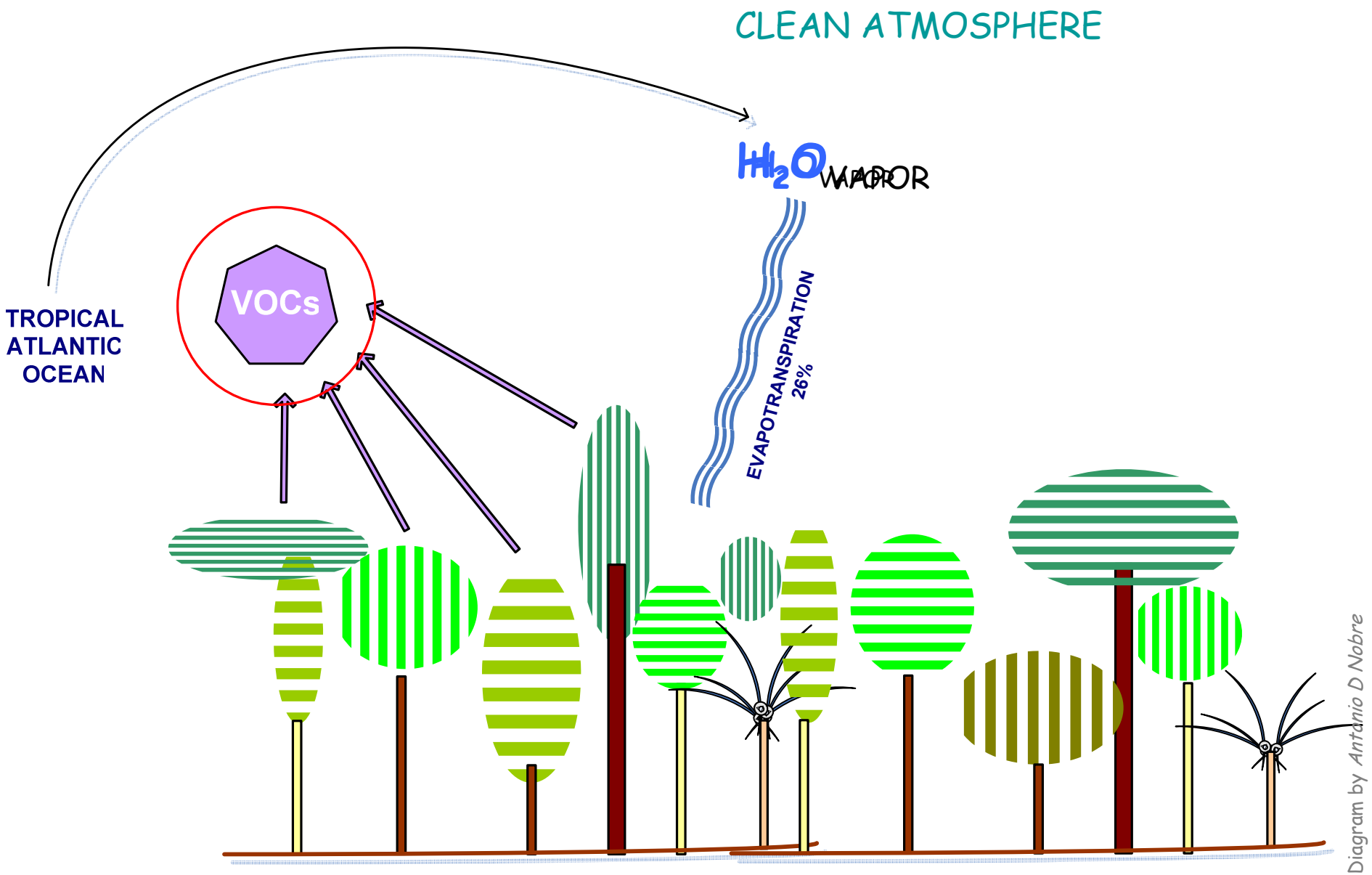
2 years data from TRMM satellite

Animation Credit NASA Goddard

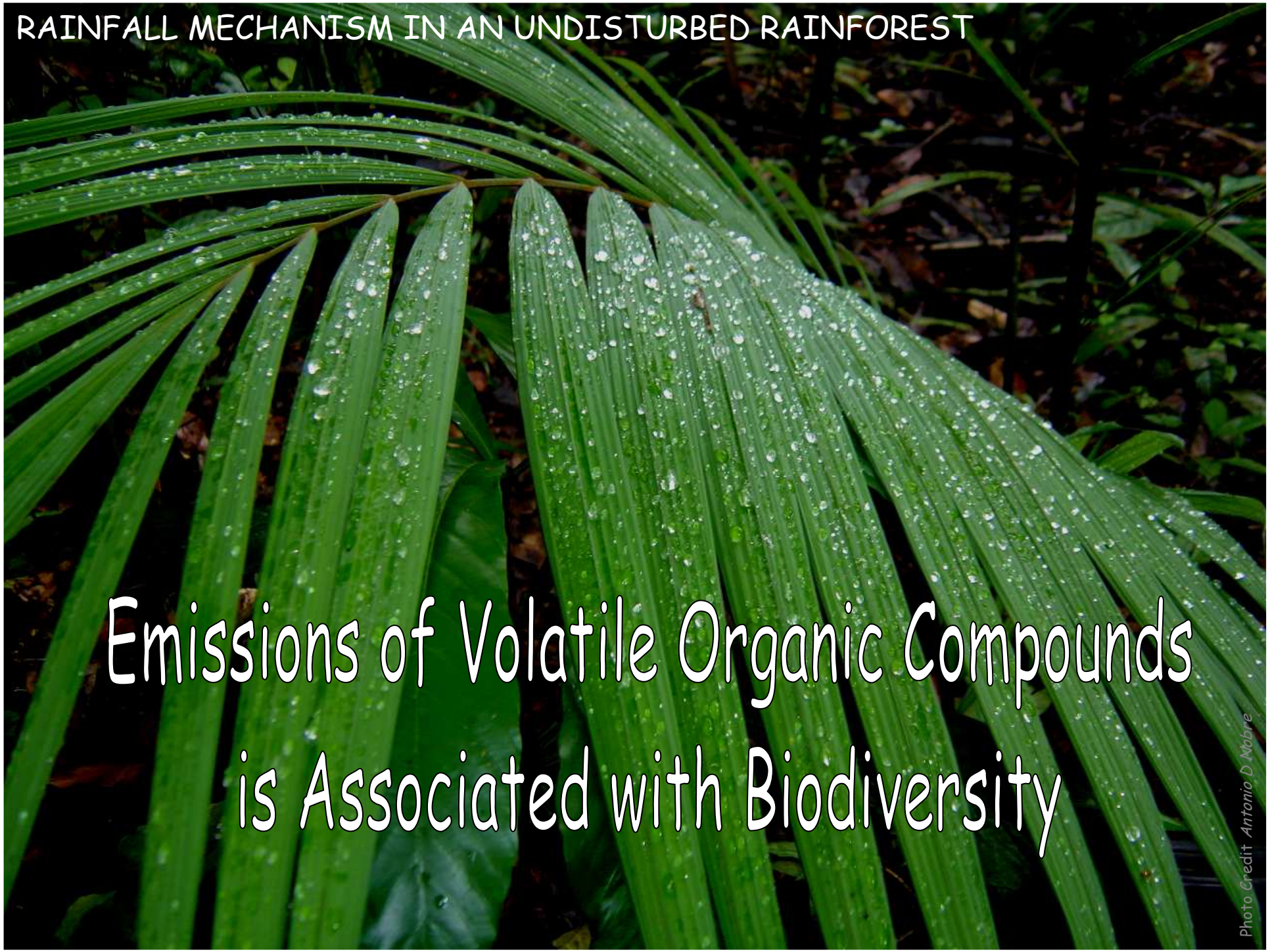
[DATA]

RAINFALL MECHANISM IN AN UNDISTURBED RAINFOREST
Photo Credit Antonio D Nobre

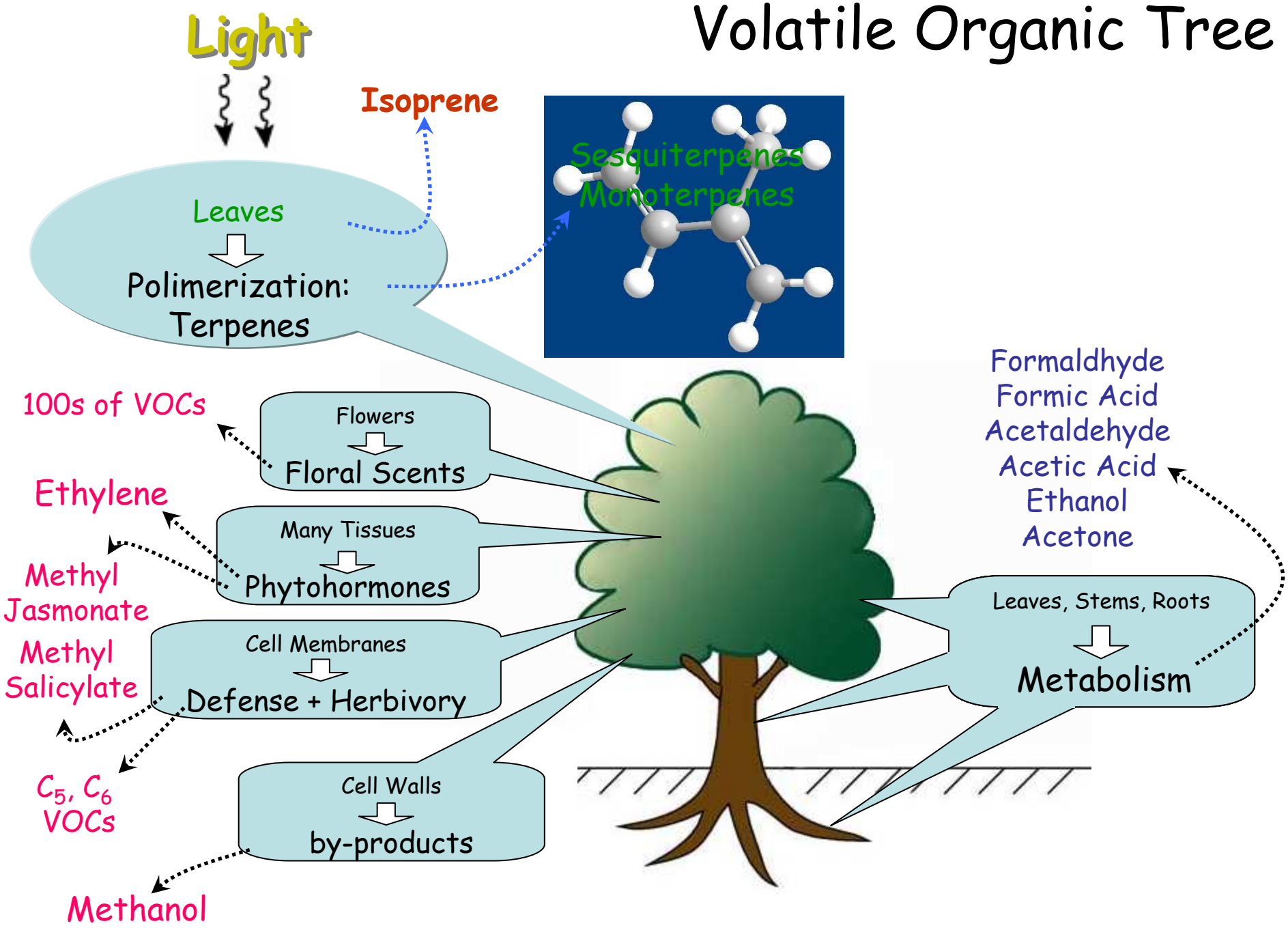
RAINFALL MECHANISM IN AN UNDISTURBED RAINFOREST [MODEL]



based on results of LBA: Claeys et al and Andrea et al. *Science* 2004; Marengo et al 2004, 2005; others


RAINFALL MECHANISM IN AN UNDISTURBED RAINFOREST
Emissions of Volatile Organic Compounds
is Associated with Biodiversity
Photo Credit Antonio D Nobre

Volatile Organic Tree



Modified from *Fall, R.*, University of Colorado, Boulder at http://www.rfall.net/

VOC atmosphere chemistry

isoprene

[MODEL]

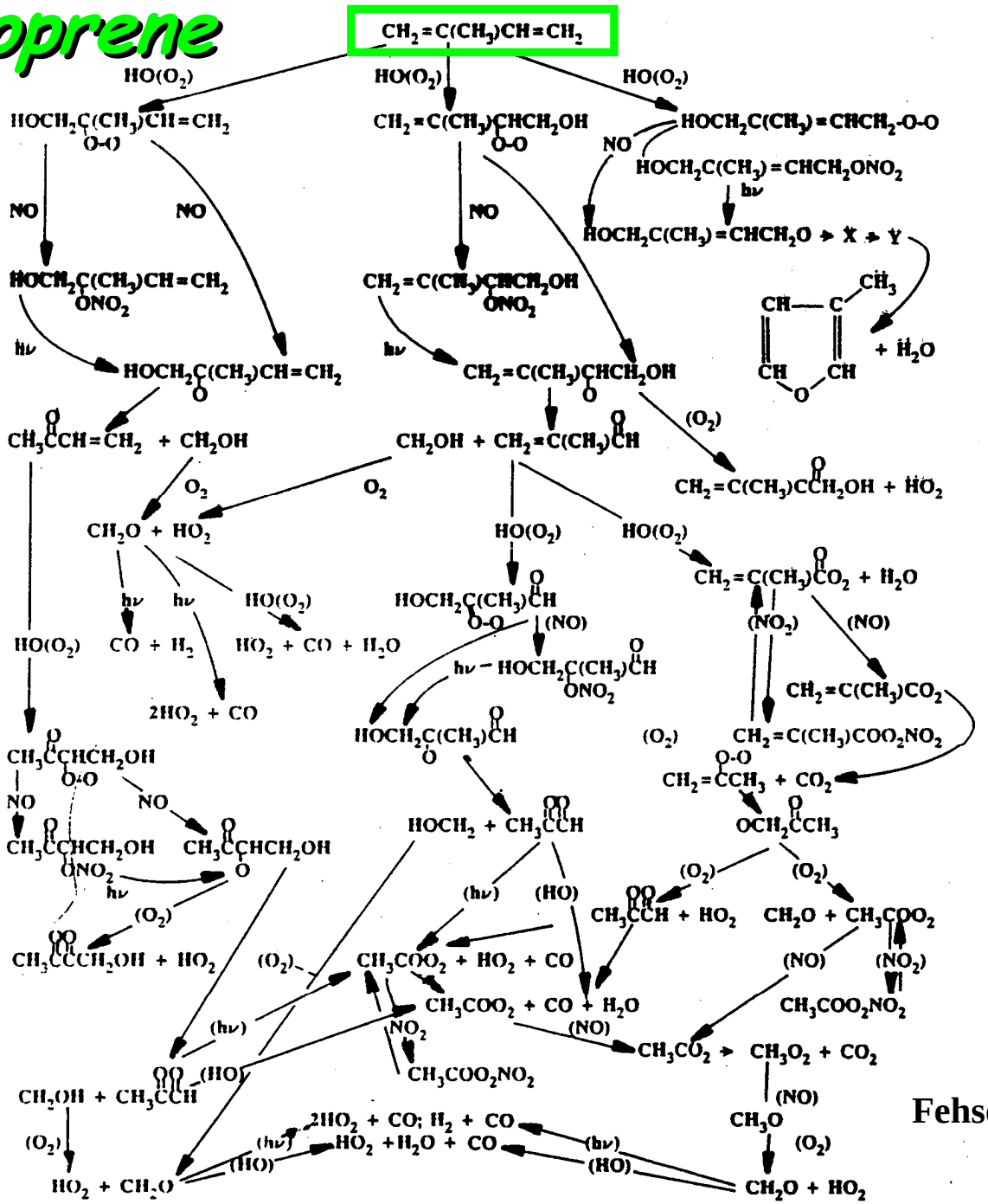
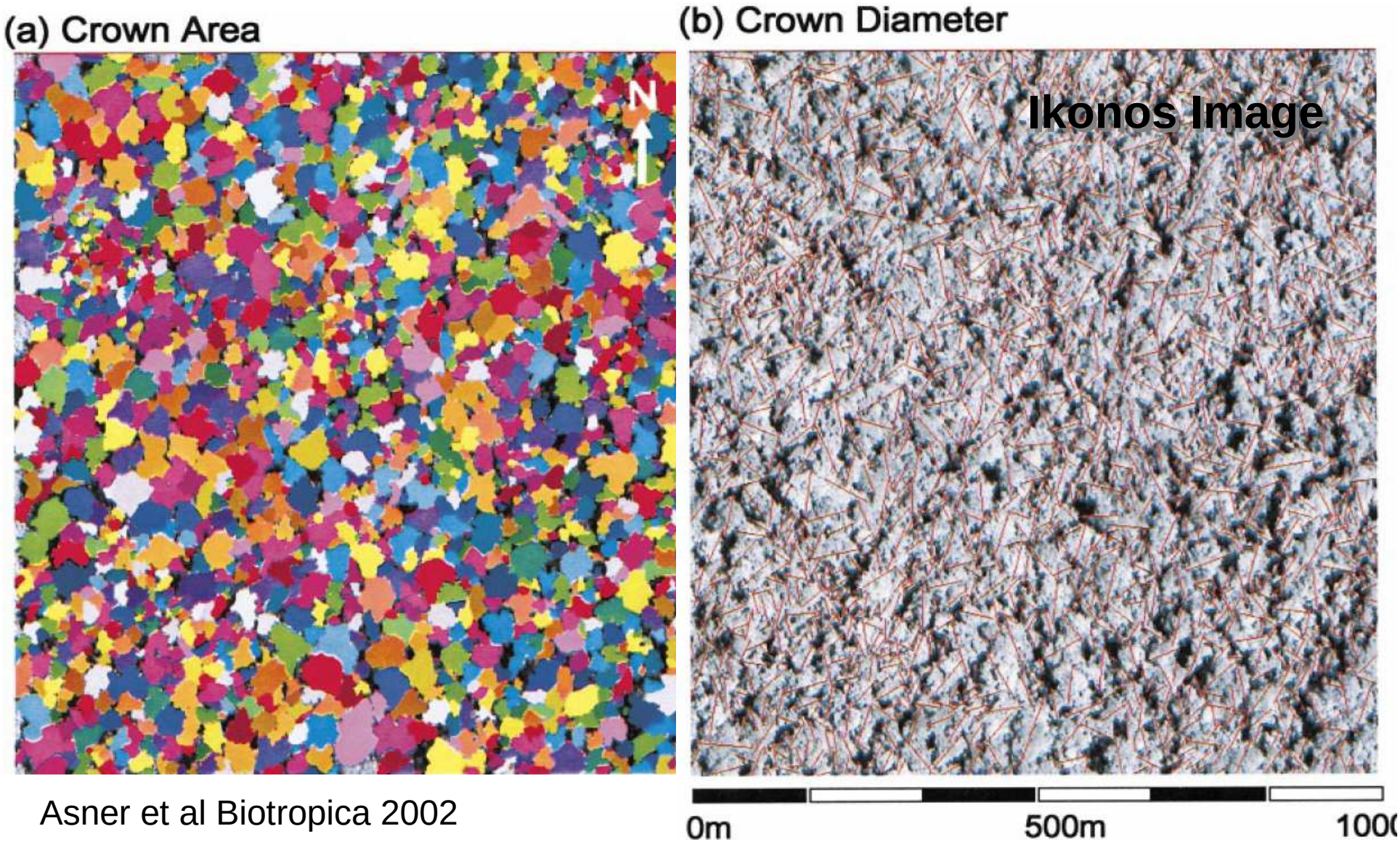


Fig. 20. Major reaction pathways for isoprene oxidation in atmospheres high in [NO_x].

Fehsenfeld,1992

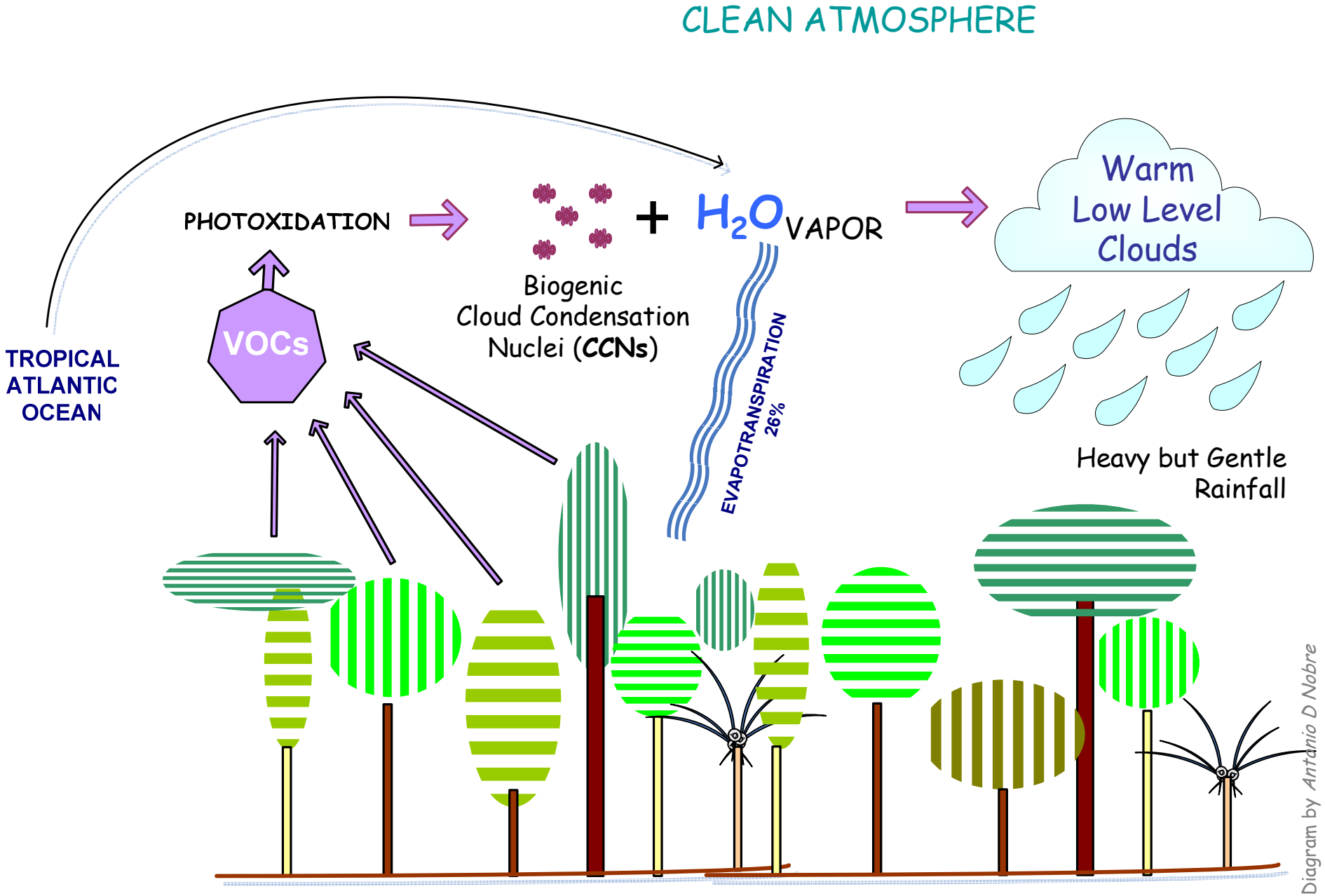
[DATA]

Complexity in the Tree Tapestry



Asner et al Biotropica 2002

RAINFALL MECHANISM IN AN UNDISTURBED RAINFOREST [MODEL]



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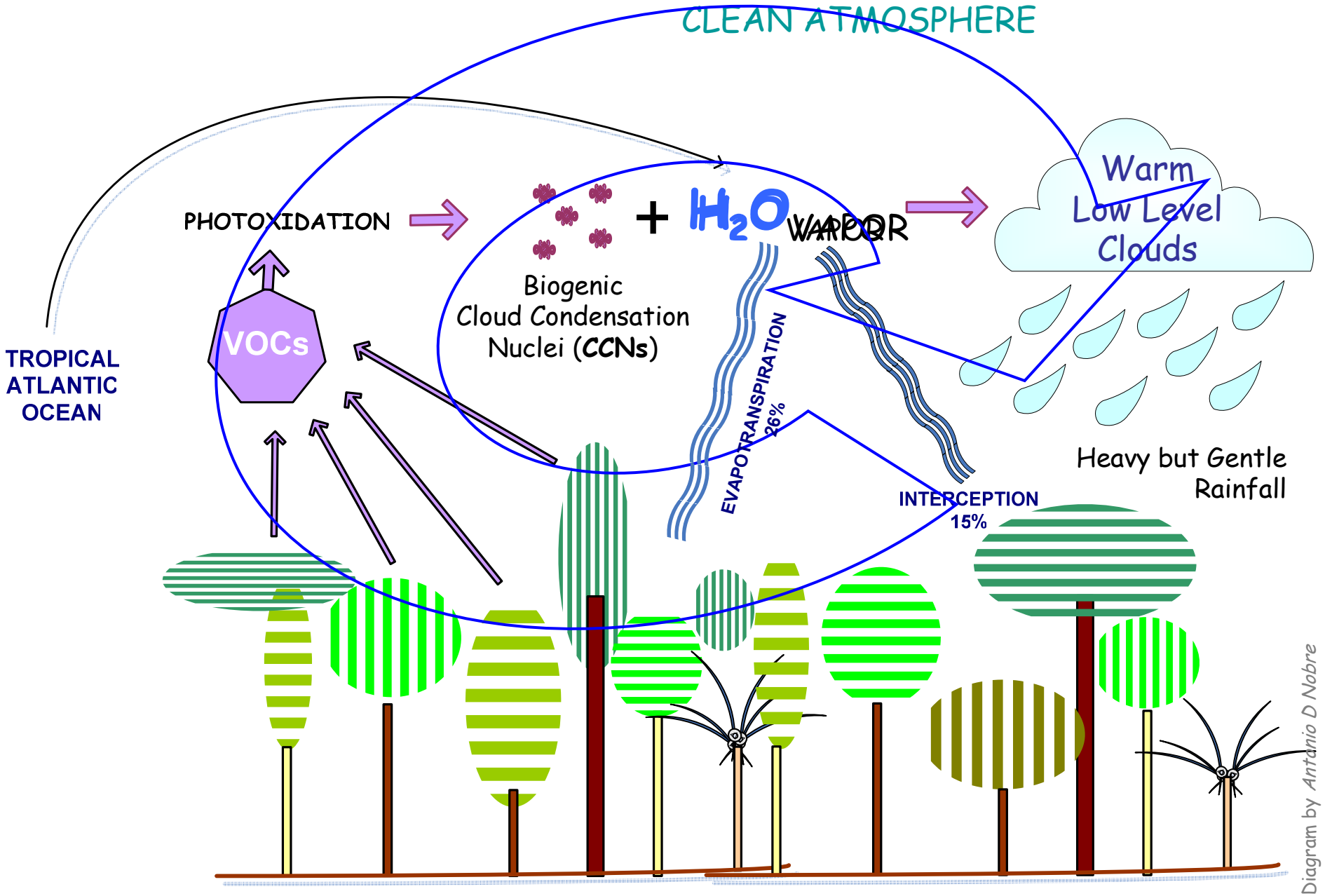
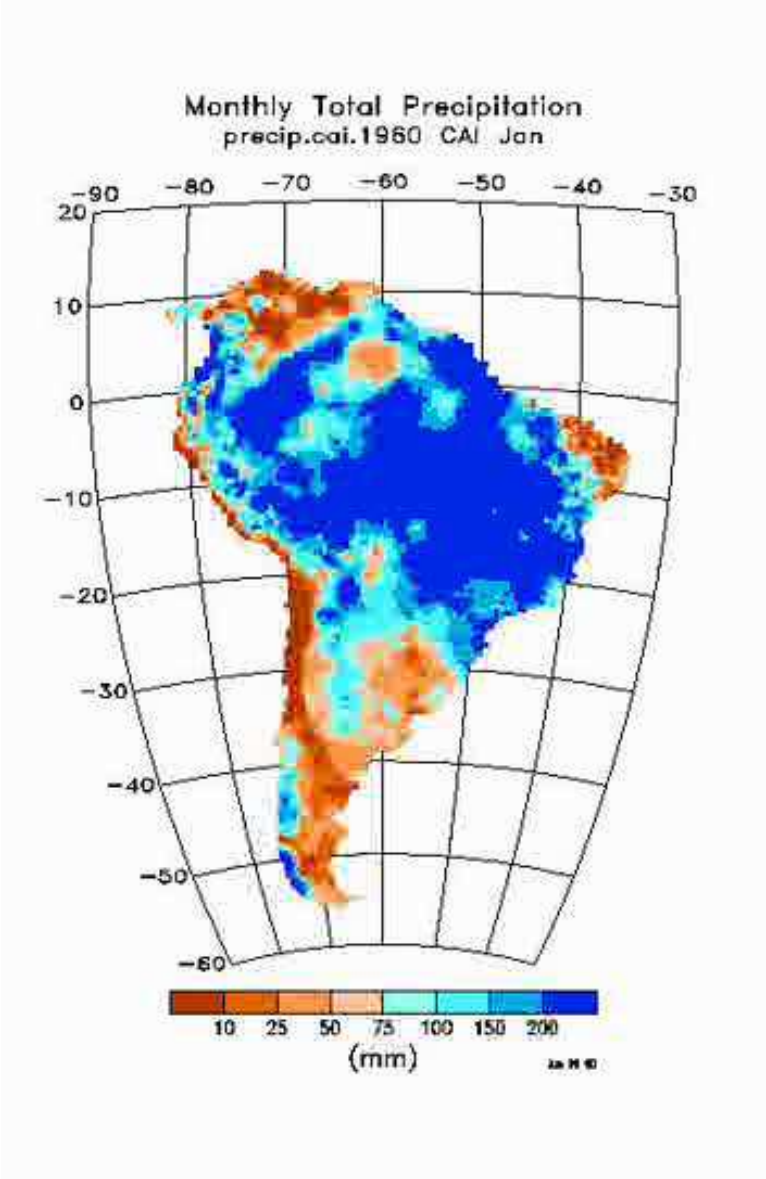
RAINFALL MECHANISM IN AN UNDISTURBED RAINFOREST [MODEL]



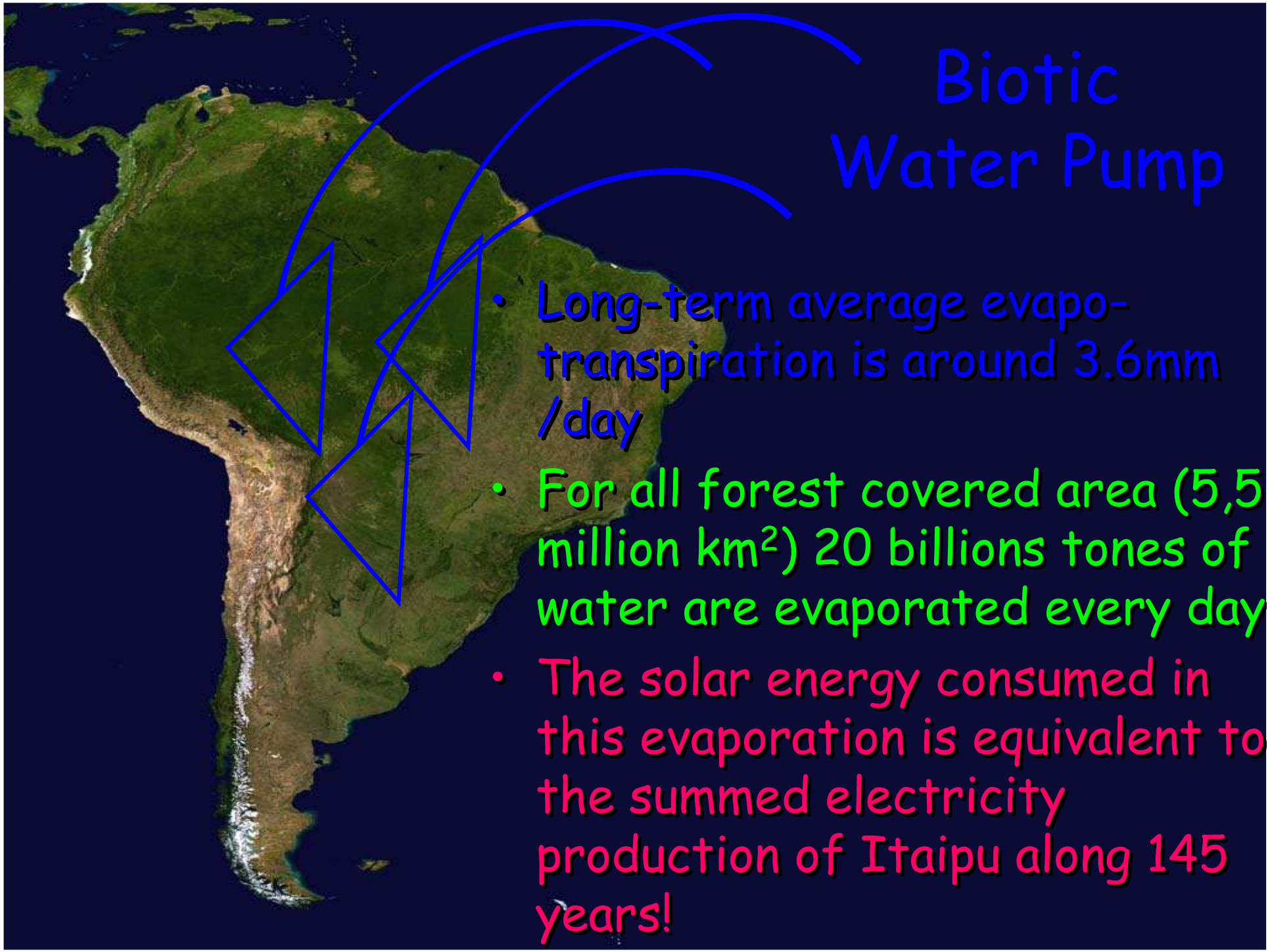
based on results of LBA: Claeys et al and Andrea et al. *Science* 2004; Marengo et al 2004, 2005; others

30 years of South America rainfall



[DATA]

Fonte: *Willmot & Webber*, 1998, http://daac.ornl.gov//LBA/guides/lba_willmott.html



Biotic Water Pump

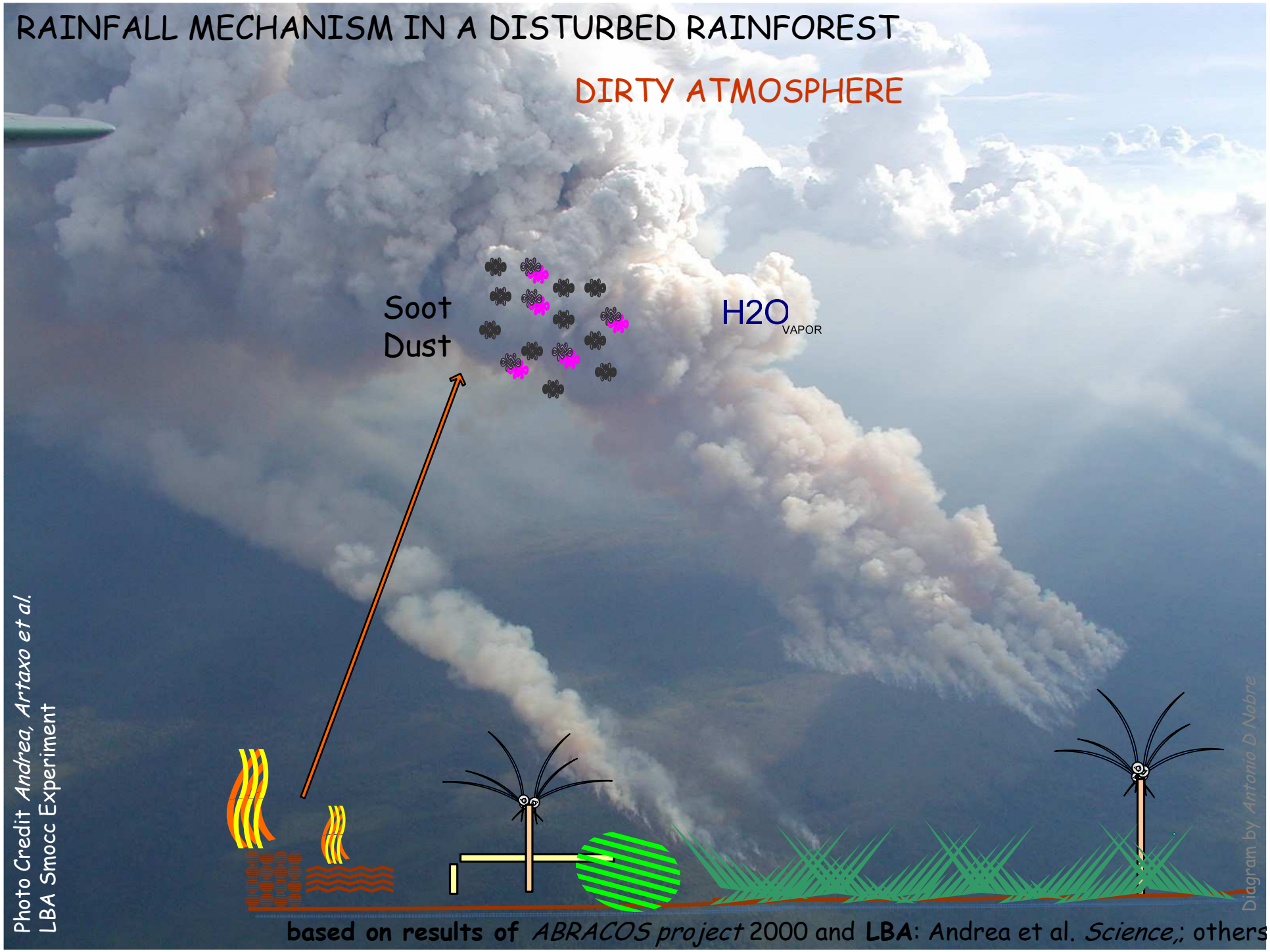
- Long-term average evapo-transpiration is around 3.6mm /day
- For all forest covered area (5,5 million km^2) 20 billions tones of water are evaporated every day
- The solar energy consumed in this evaporation is equivalent to the summed electricity production of Itaipu along 145 years!

HUMAN LIVELIHOODS

RAINFALL MECHANISM IN A DISTURBED RAINFOREST

based on results of *ABRACOS project* 2000 and **LBA**: Andrea et al. *Science*,; others

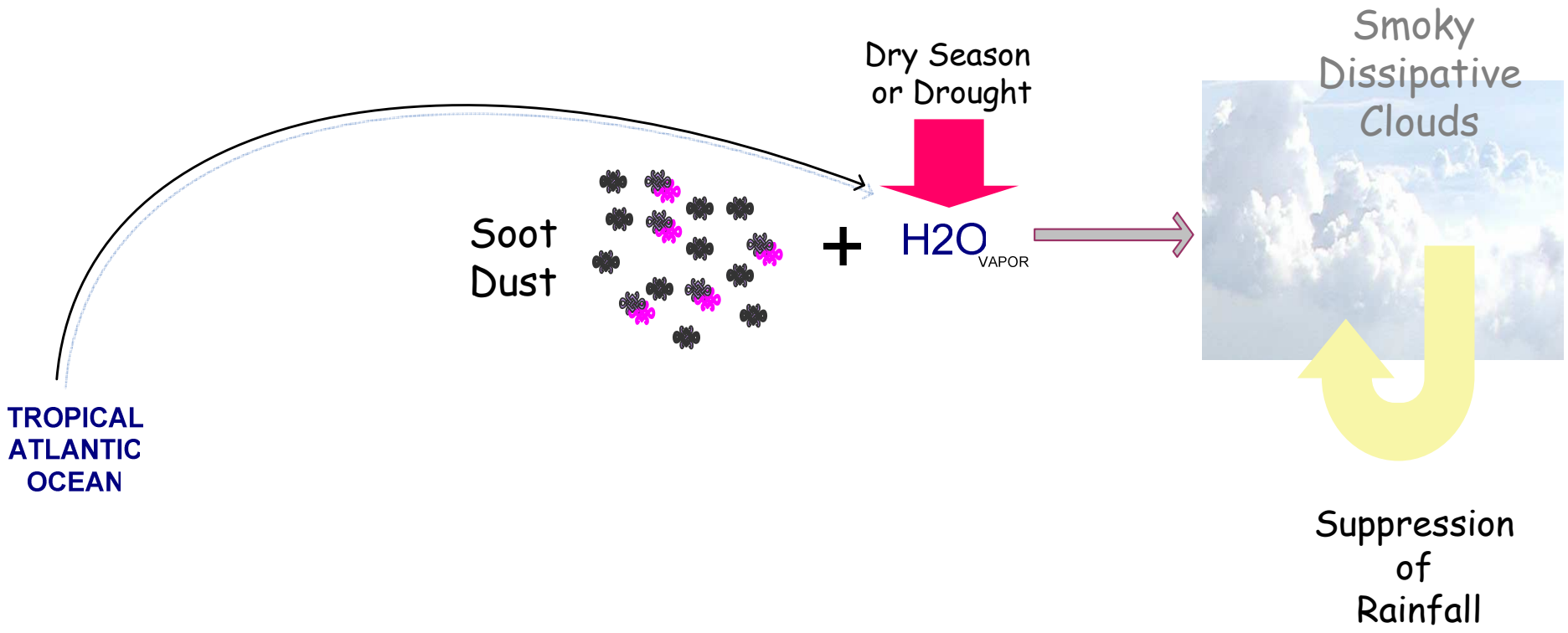
RAINFALL MECHANISM IN A DISTURBED RAINFOREST

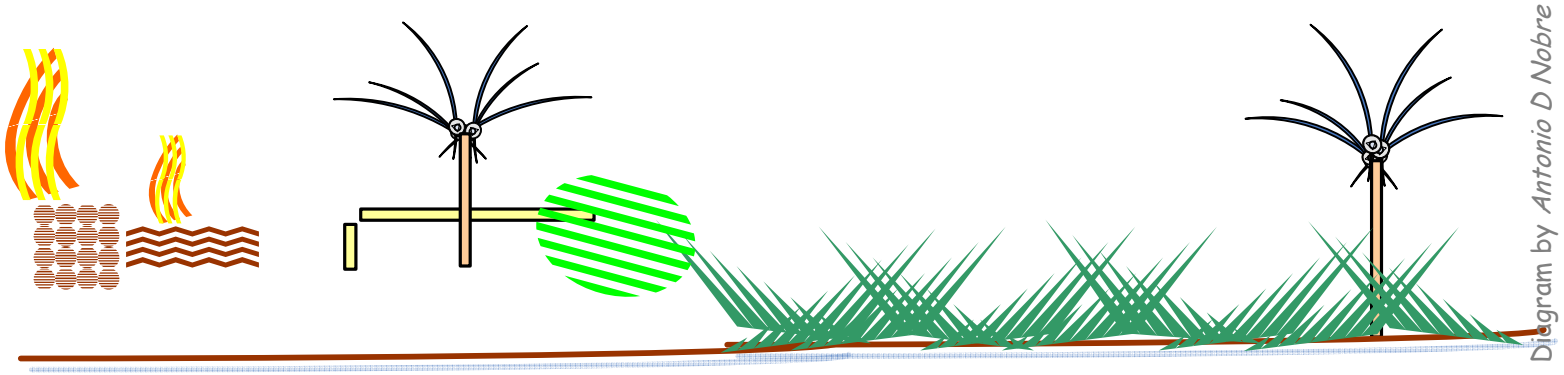


based on results of *ABRACOS project* 2000 and **LBA**: Andrea et al. *Science,*; others

RAINFALL MECHANISM IN A DISTURBED RAINFOREST

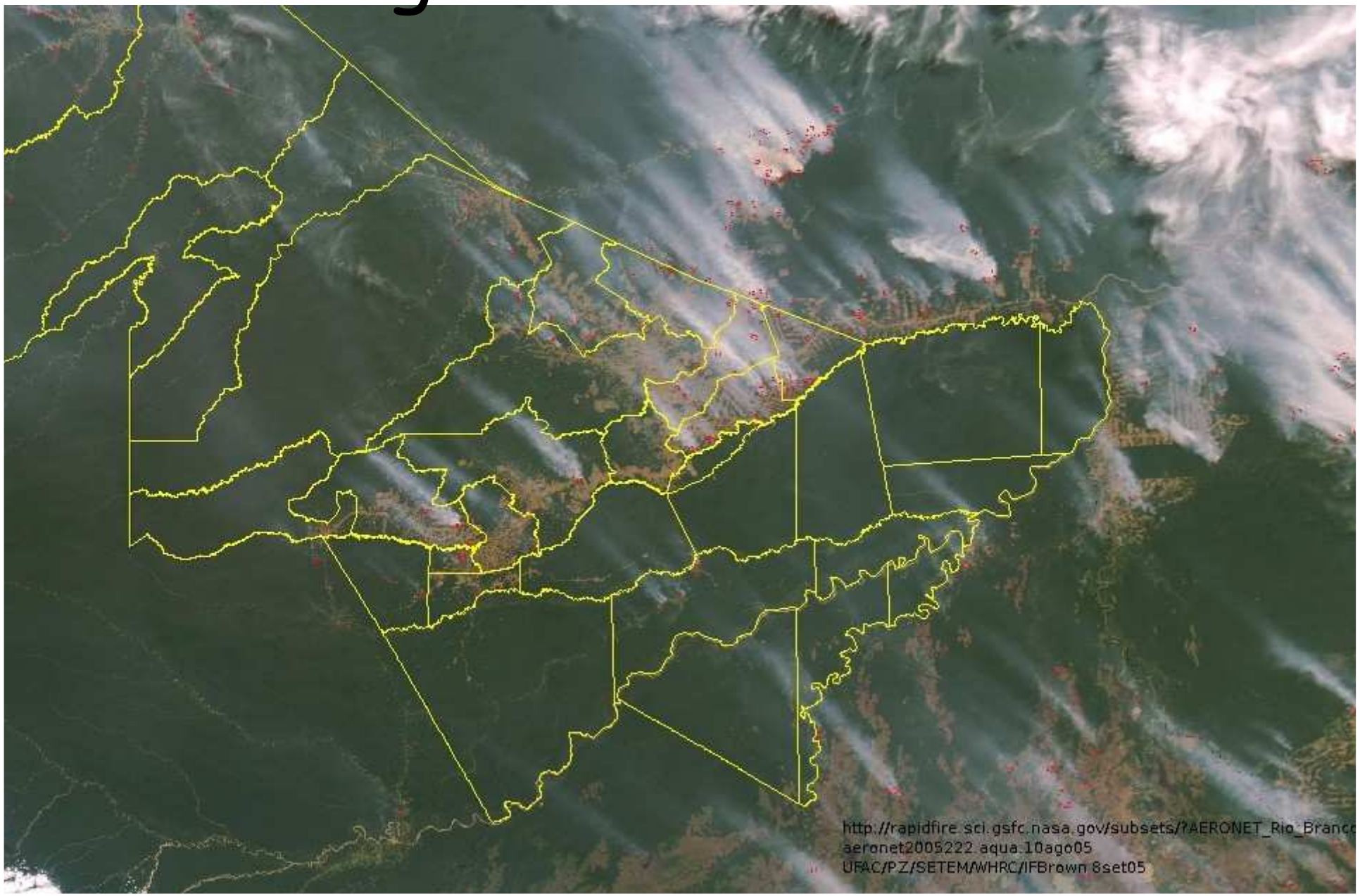
DIRTY ATMOSPHERE



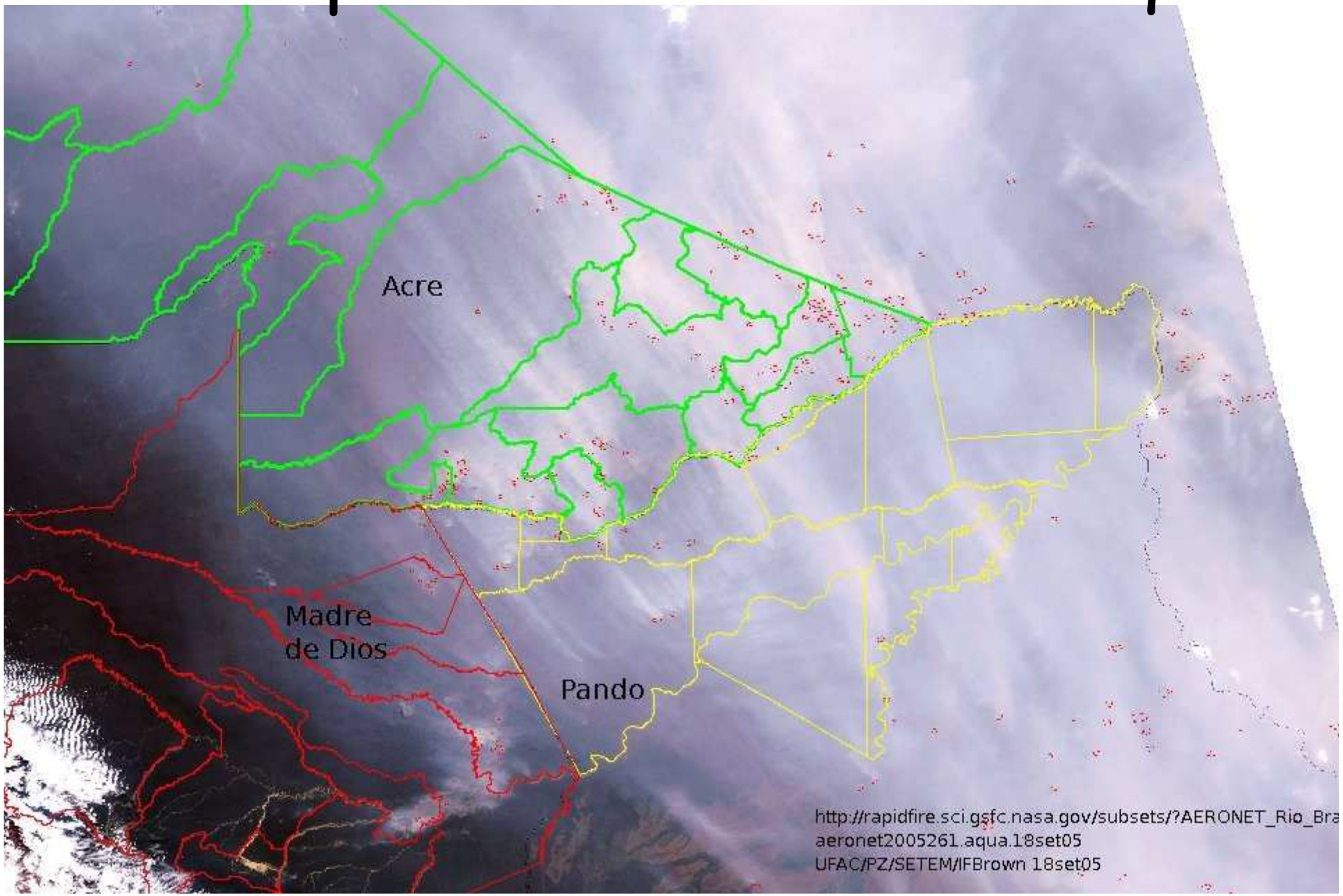


based on results of *ABRACOS project* 2000 and **LBA**: Andrea et al. *Science*,; others

10/August/05 Modis Terra



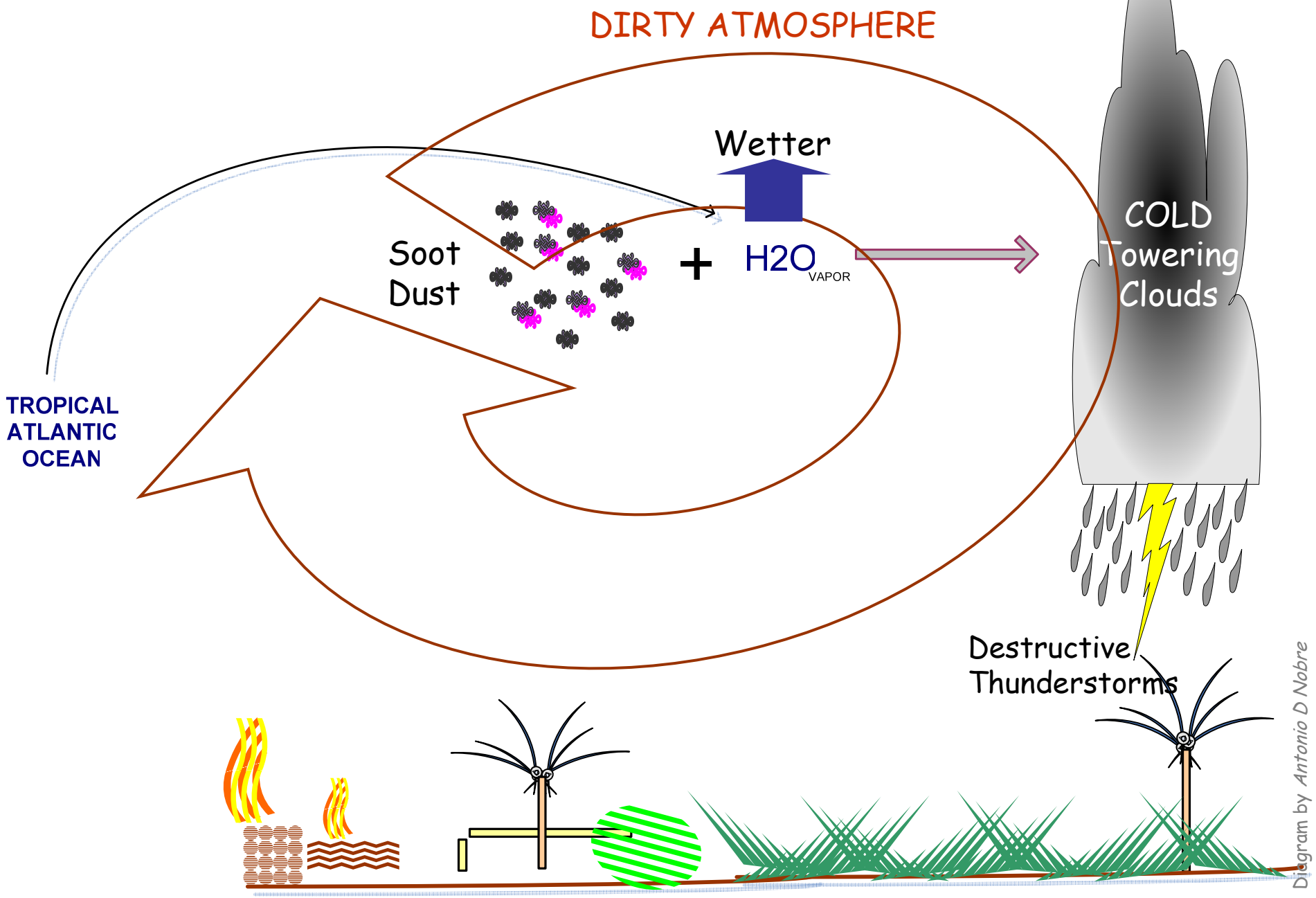
18/Septembre/05 Modis Aqua



http://science.nasa.gov/headlines/y2005/15sep_solarminexplodes.htm

Slide by F.Brown
& C. Salimon

RAINFALL MECHANISM IN A DISTURBED RAINFOREST



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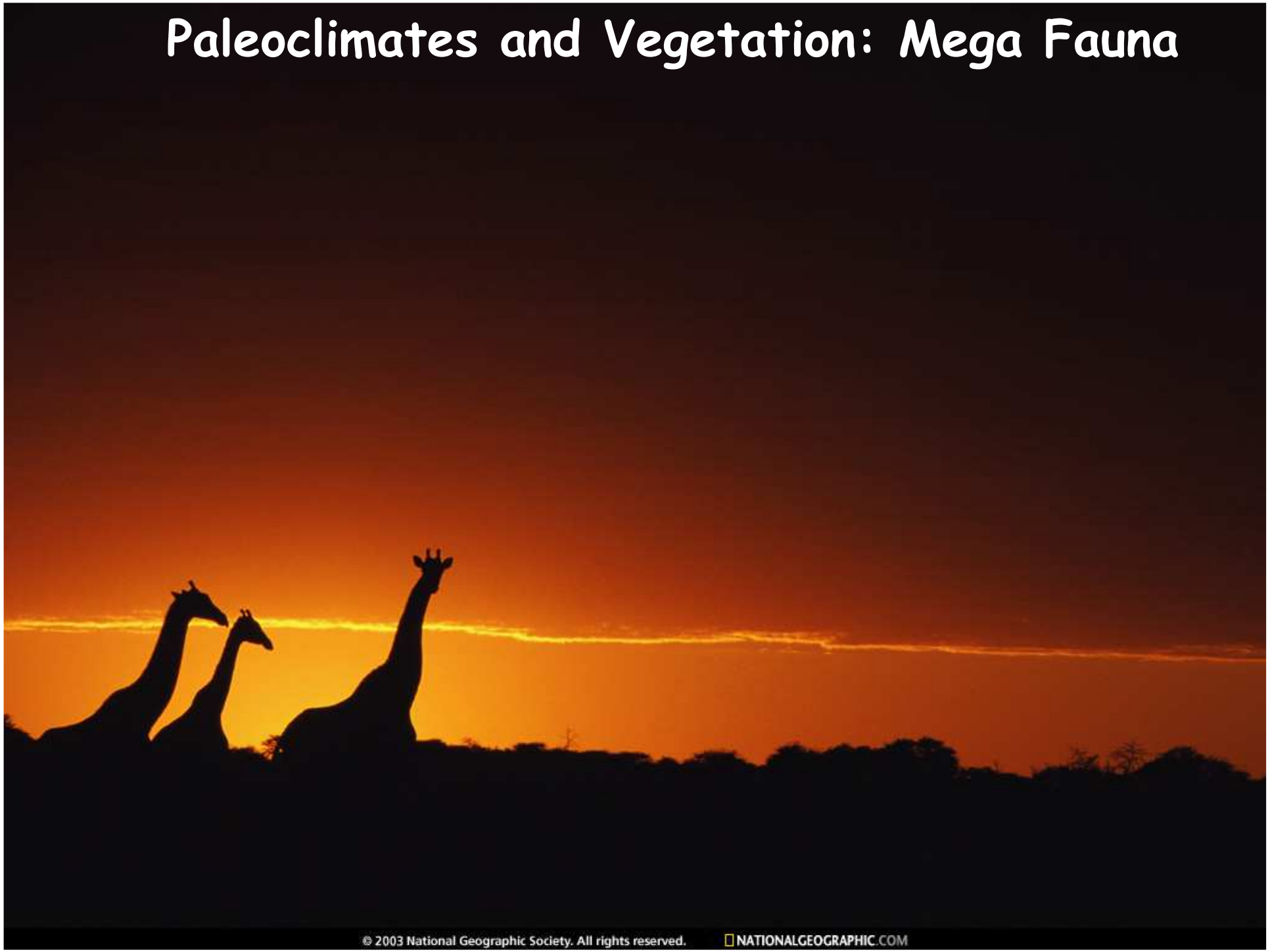
DISRUPTING THE INLAND TRANSPORT OF MOISTURE

Paleoclimates and Vegetation: Mega Fauna