

1998 HURRICANE MITCH FLOOD FLOW

ITS RELATIONSHIP TO CHANNEL MORPHOLOGY ON THE RIFFLE-POOL REACH OF RIO PLÁTANO BIOSPHERE RESERVE, NORTHEASTERN HONDURAS: A PRISTINE CENTRAL AMERICAN RAINFOREST WATERSHED

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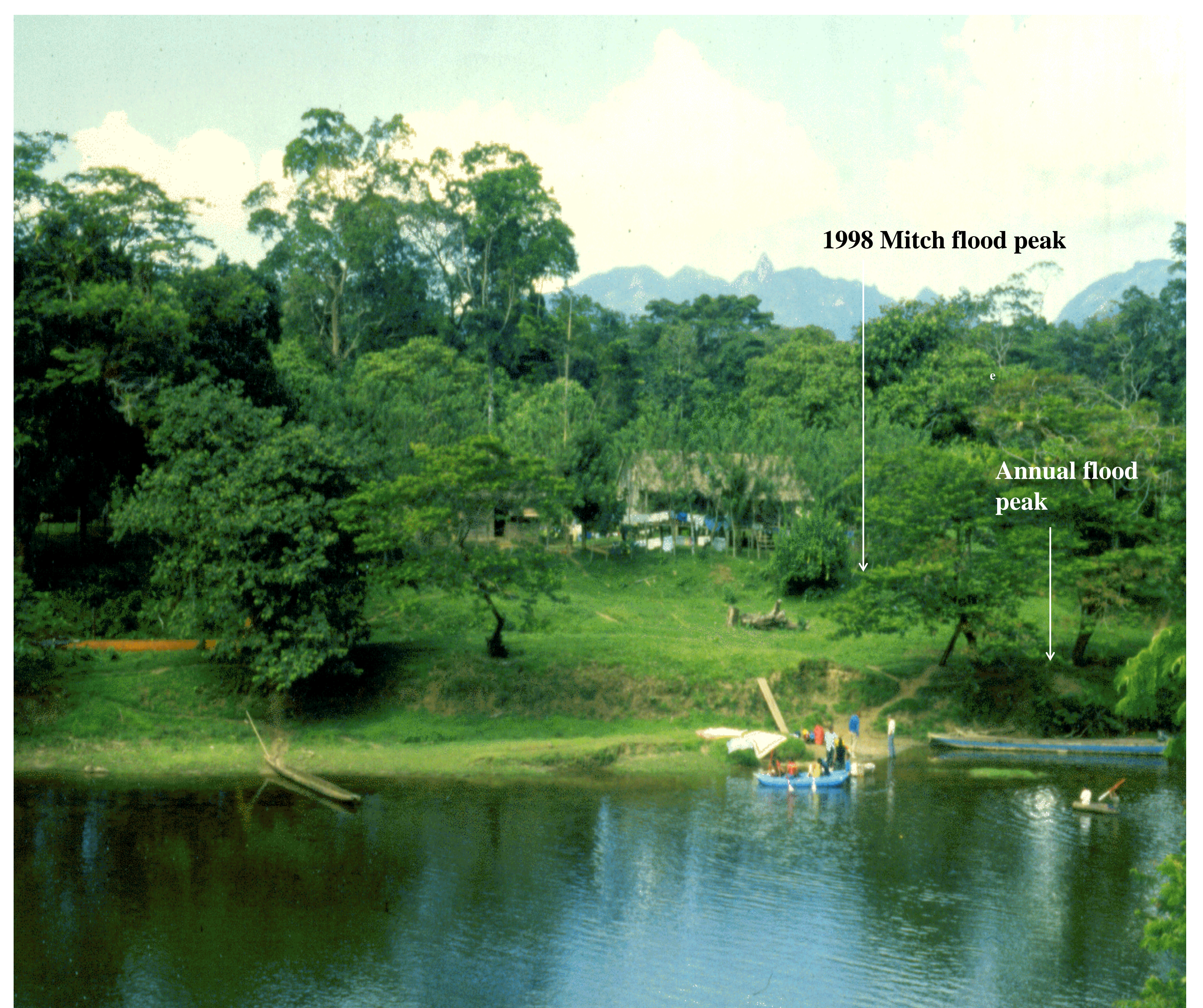
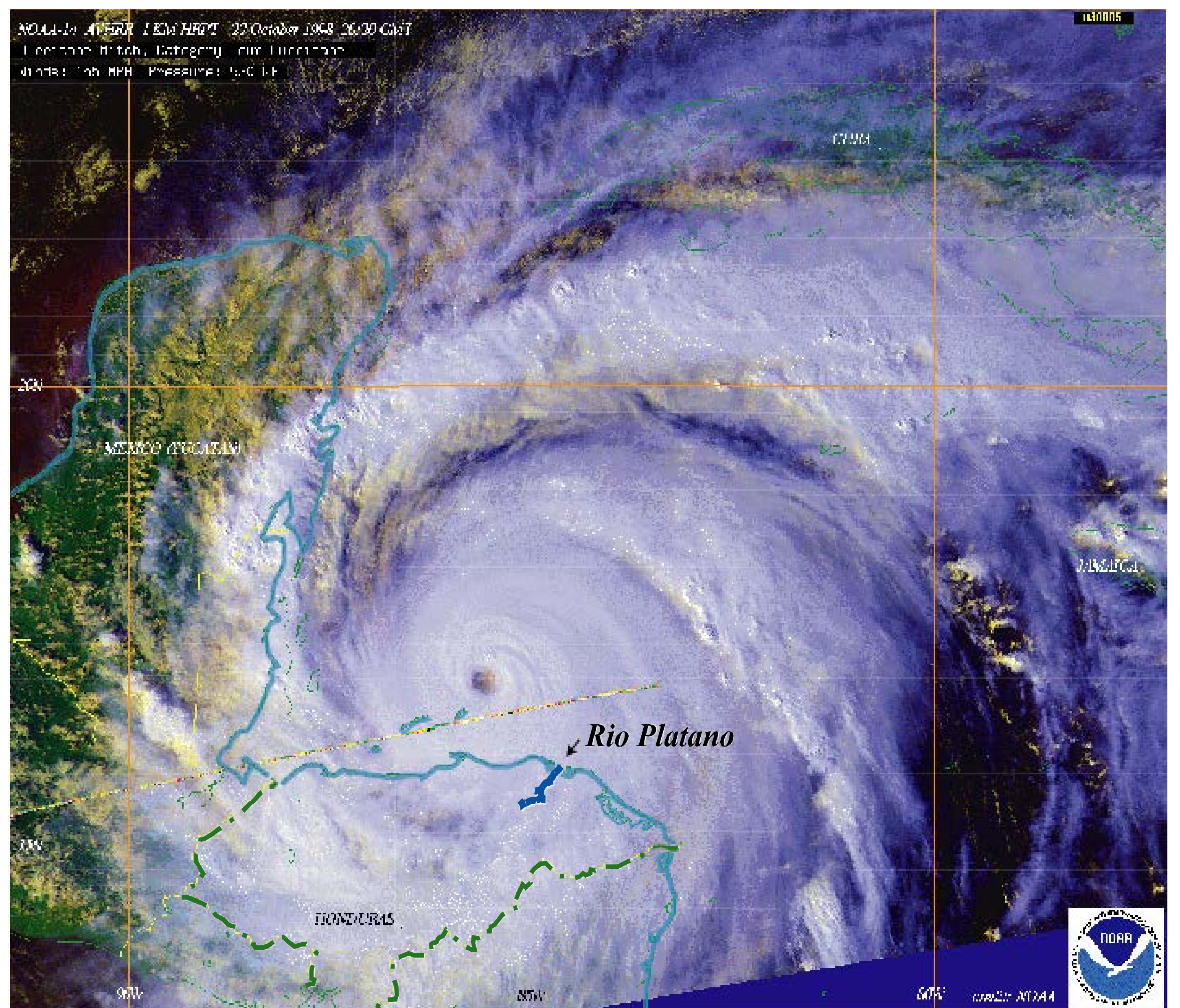
PURPOSE OF STUDY

To document the peak stages of flood flow of Hurricane Mitch in a tropical rain forest river, and their relation to channel morphology.

These flood stages were the highest of the century on this river according to indigenous people living along the river bank.

Results

- The typical channel of the Rio Plátano in the riffle-pool reach has a mud inner bank above which is a tread (a narrow flood plain) about 10 m wide, and an upper bank. Peak stages of the hurricane were 1.5 to 3 m above the tread.
- This two-bank profile is the result of lower bankfull annual rainy season floods, and an upper bank cut by rare floods such as that of Hurricane Mitch.
- The floodplain tread overtopped by the flood is all ready revegetated with successional trees and plants one year later when we observed the river in December of 1999.
- Peak flows calculated using Mannings equation were $1600 \text{ m}^3/\text{s}$ (57,000cfs), or $1.63 \text{ m}^3/\text{s per km}^2$ (150cfs/mile²) from the 990-km² mountainous-rainforest biosphere reserve above the Las Marias, 75 river kms above the river mouth into the Caribbean.
- These flows were much lower than those devastating flows (2.2 to $19.1 \text{ m}^3/\text{km}^2$) experienced elsewhere in Honduras because the biosphere reserve was just east of the region of intense precipitation, and the rainforest vegetation is largely undisturbed.



Hydrology

The Rio Plátano flows through one of the remaining montane and lowland tropical rain forests in central America (Figure 3).

Our long term goal is to describe the hydrology of the natural rainforest river.

We traveled 80 miles upriver in December, 1998, one year after the Hurricane flow, and relied on reports from Mosquito people who live along the banks of the river.

Calculated bank full discharge of the Rio Plátano of a typical 2.5-m high bank is $620 \text{ m}^3/\text{s}$, which we suggest is the annual rainy season flood flow lasting for several weeks.

Few hydrographs are available for undisturbed rain forest rivers. None have been measured on the Rio Plátano. The only available example is shown at the right for the partially cleared rainforest watershed of the Rio Sarapiquí in northern Costa Rica.

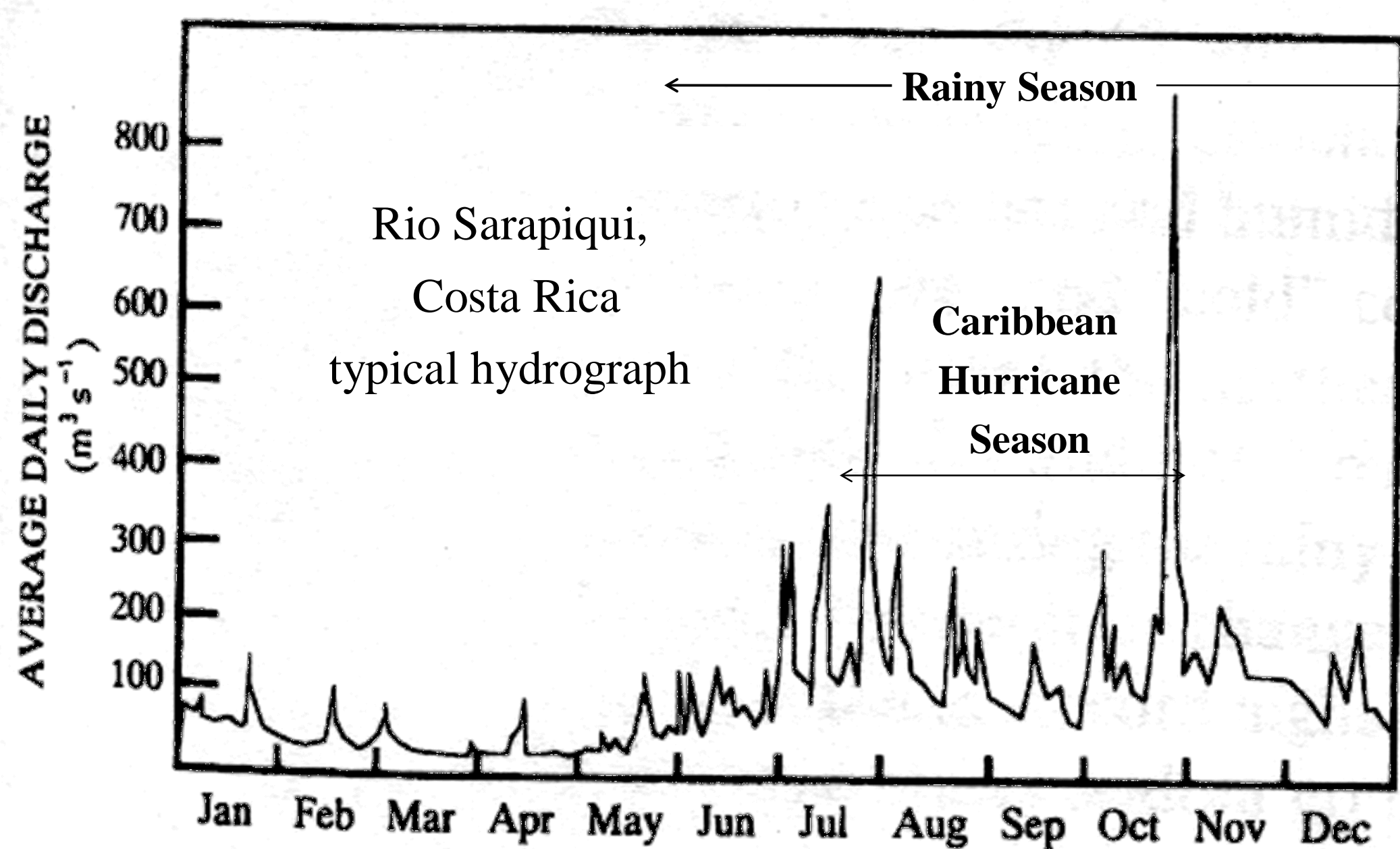


Fig. 4 Representative hydrograph from the Rio Sarapiquí, Costa Rica, one of few hydrographs available for Central American rainforest streams (from De La Rosa, 1996; adapted from Mayfield and Gallo, 1988).

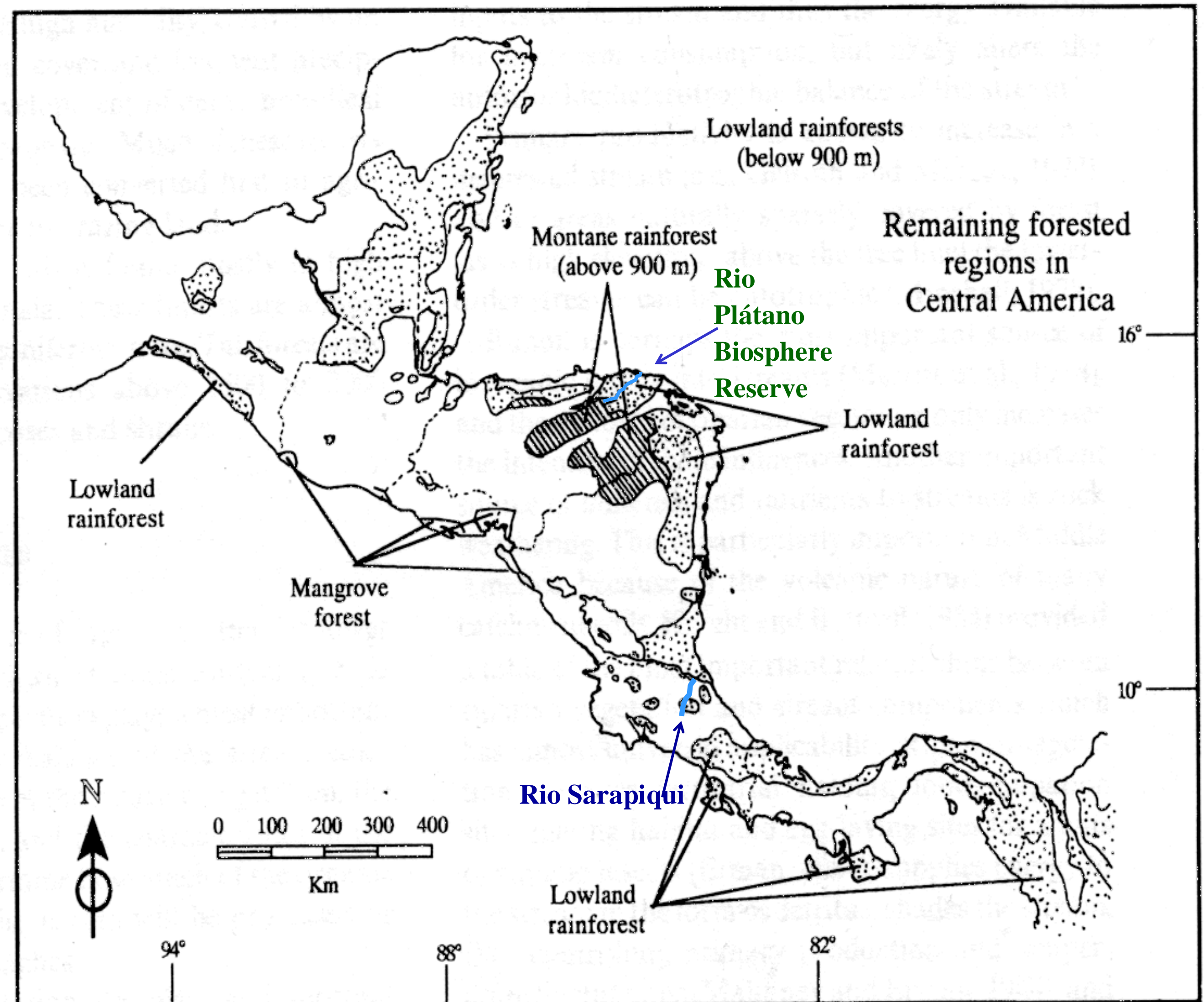


Fig. 3 . Remaining forest regions in Central America showing location of the Rio Sarapiquí, Costa Rica hydrograph and the Rio Plátano bioreserve in Honduras (after De La Rosa, 1995).



Figure . Gravel bar along a typical riffle-pool reach of the Rio Plátano above Las Marias, 75 km above the river mouth into the Caribbean.

The watershed of the Rio Platano above Las Marias is 990 km². Precipitation between 10 and 20 cm over the 3 day period is from satellite estimates shown below by Ferraro and other (1999). Total storm precipitation was reported as 70 cm at Trujillo, 100 km west of the Rio Platano. We compare the Rio Platano peak flows to those estimated by the USGS (1999) for 3 other small drainages along the north coast, west of Trujillo, although it is likely that rainfall was highly variable.

USGS-reported slope-area-calculated flows in partially cleared rainforest watersheds were: the Rio Bonito (4758 m³/s from about 150 km²), Rio Cangrejal (6688 m³/s from about 350 km²), Rio Lean (2124 m³/s from about 800 km²) and the adjacent Rio Aguan basin (21,240 m³/s from about 9,700 km²).

These measurements suggest (1) flood peak flows from the undisturbed rainforest are 2/3 to 1/10 those catastrophic peak flows (2.2 to 19.1 m³/km²) from the regions of partially cleared rainforest watersheds or (2) the Rio Platano and Rio Lean basins are off the track of most intense precipitation .

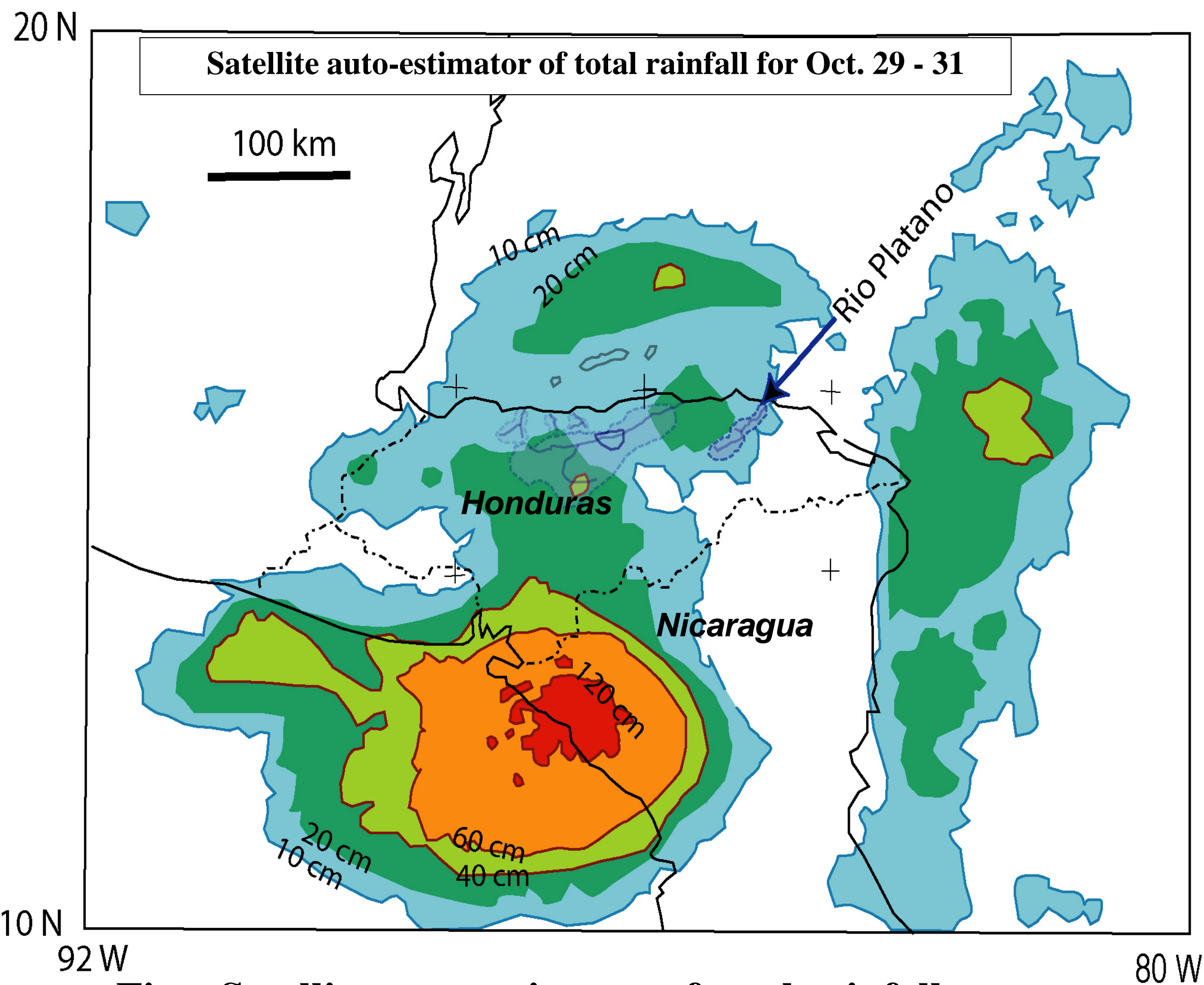


Fig. Satellite auto-estimator of total rainfall accumulation (cm) for the 3-day period of October 29-31, 1998 (from Ferraro and others, 1999)

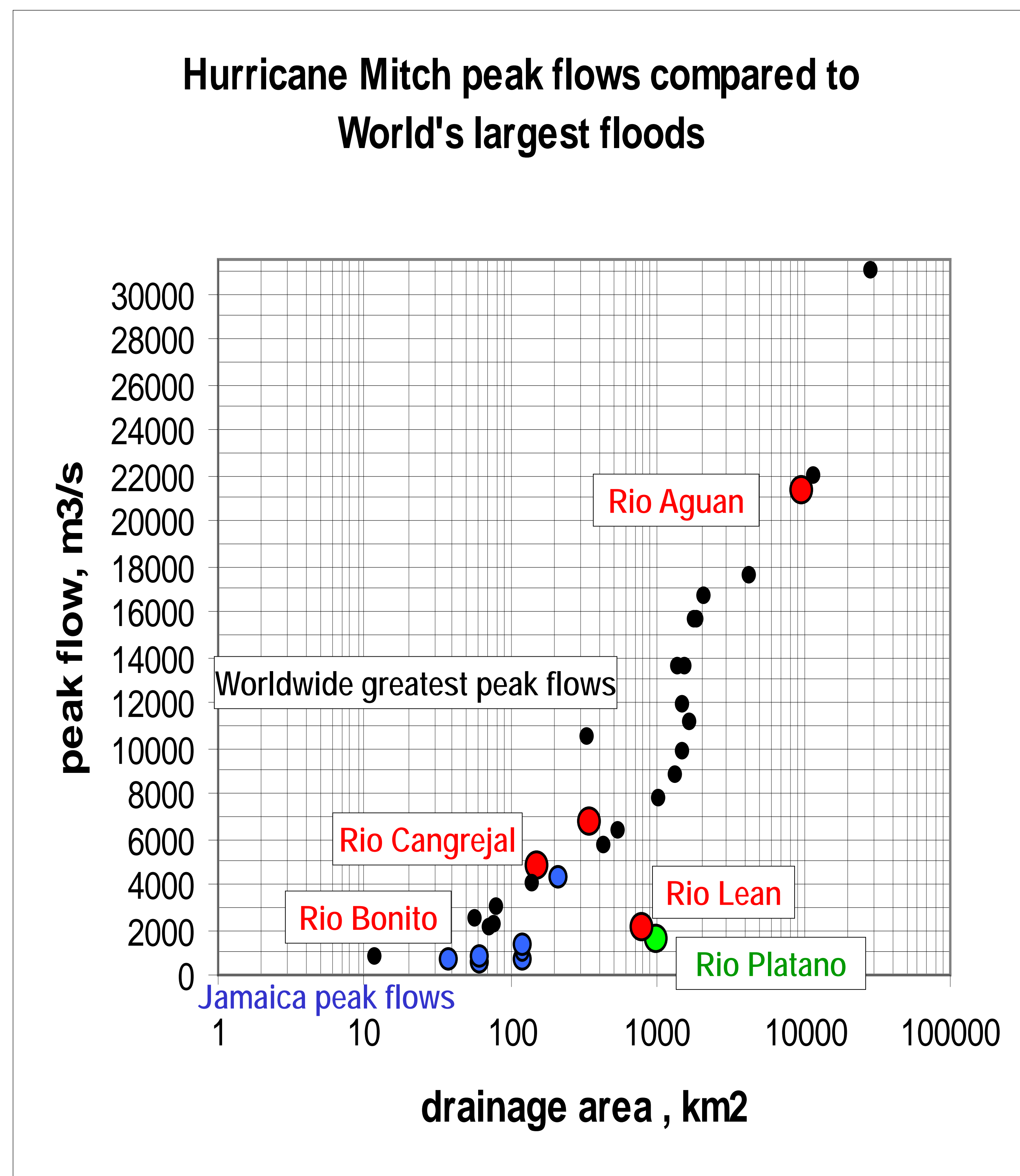


Fig. Plot of drainage area vs. Hurricane Mitch flood peaks in Honduras (USGS, 1999) compared to other hurricane flood peaks in Jamaica (from Ahmad and others, 1993), and world's greatest flood peaks (from Costa, 1987)

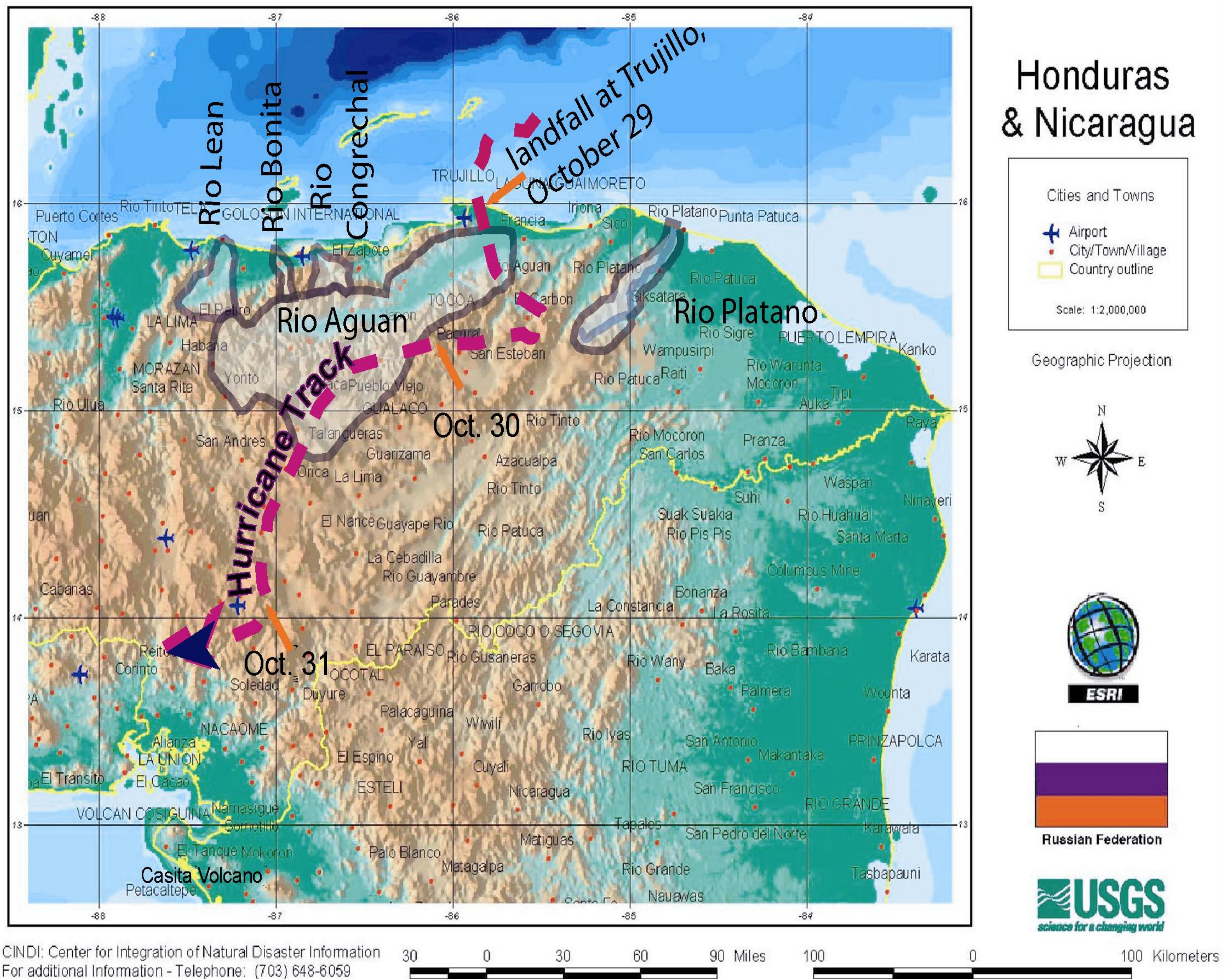


Fig. Map show showing track of 1998 Hurricane Mitch across Honduras, the Rio Platano Biosphere Reserve, and drainage basins for which peak flows are reported by USGS and this study



Figure 1. Typical two mud banks of the Rio Platano, the lower one formed by the annual rainy-season flood, and the upper one formed by rare floods such as the October, 1998 Hurricane Mitch.



Figure 2. View of the Rio Platano at Bernardo's

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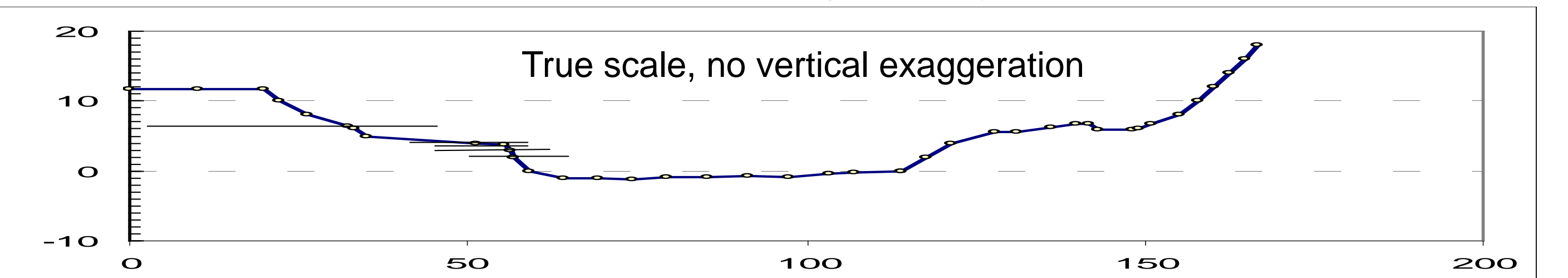
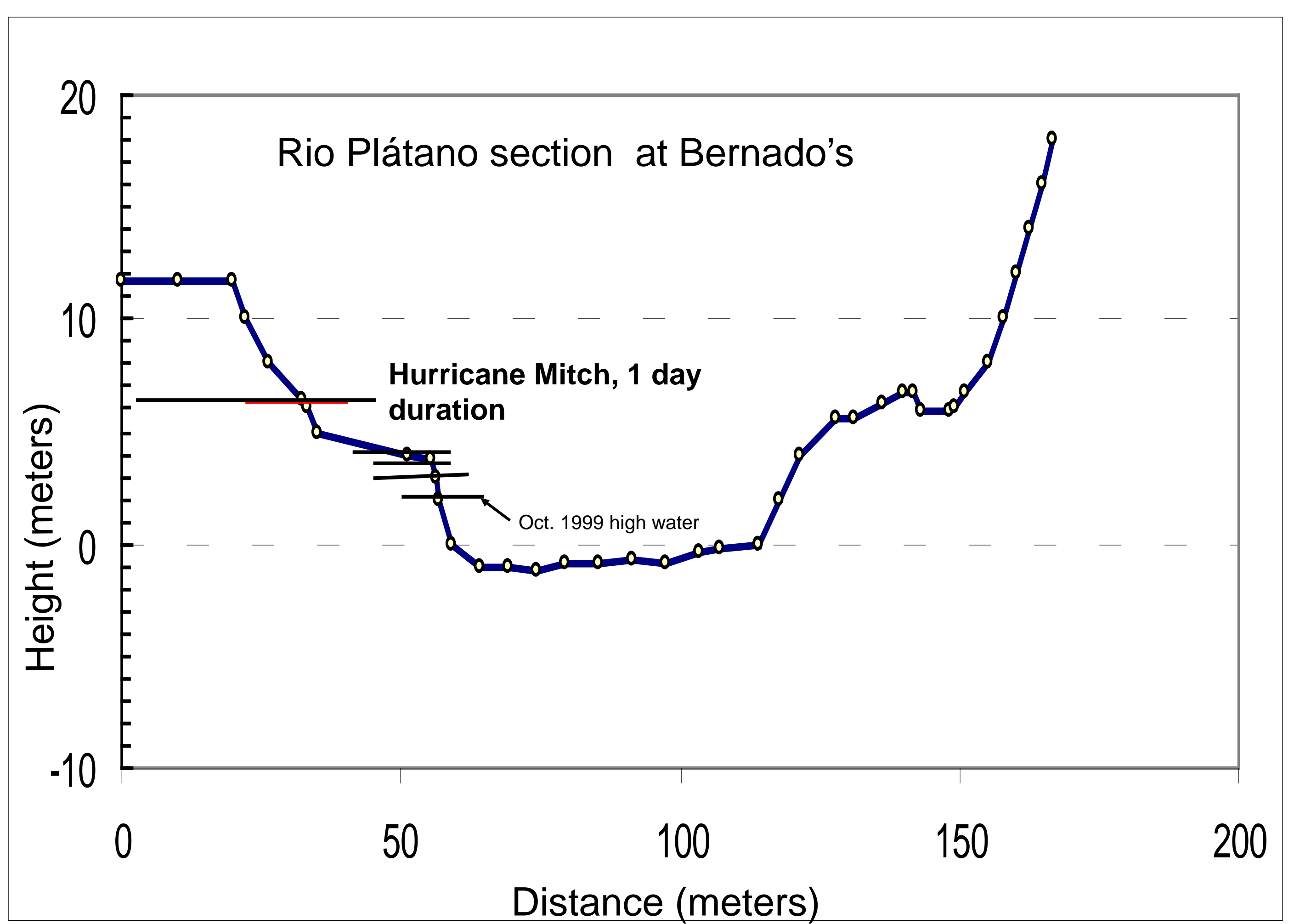
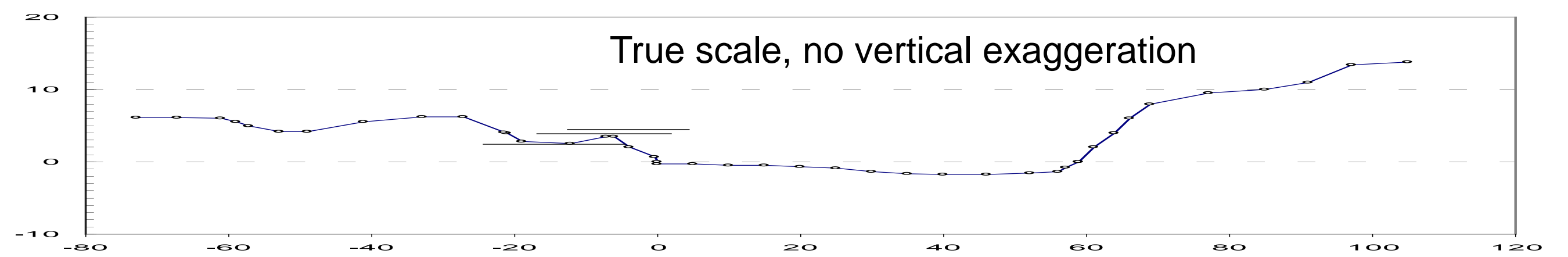
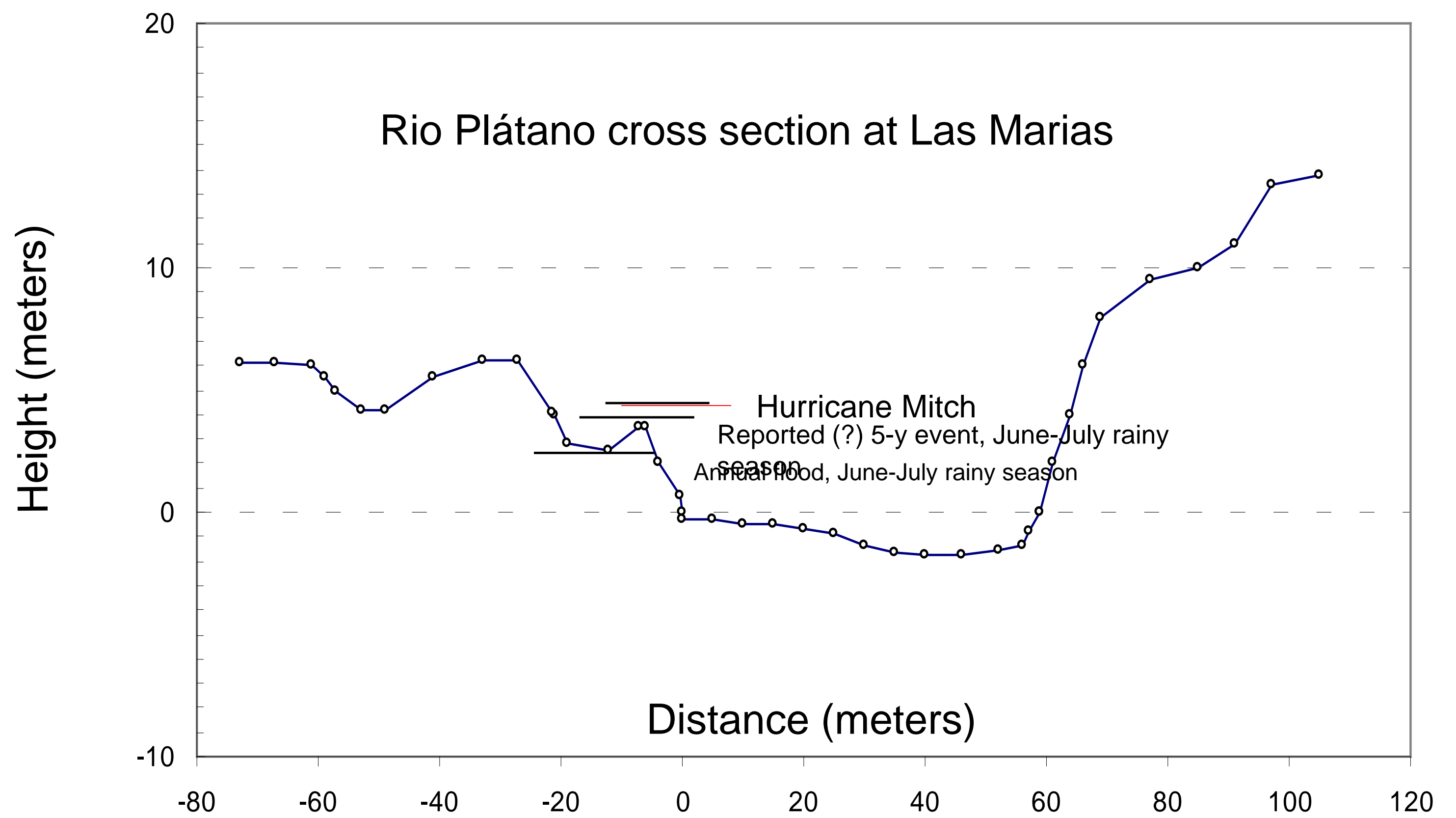


Figure 3. Cross profiles of the Rio Plátano in the riffle-pool reach at and above Las Marias. Profiles show the inner bank formed by annual rainy-season flows, and the flood plain and upper bank formed by rare events. Location of flood stage of the October 29-31 Hurricane Mitch flood flows was obtained from interviews of residents along the river bank.

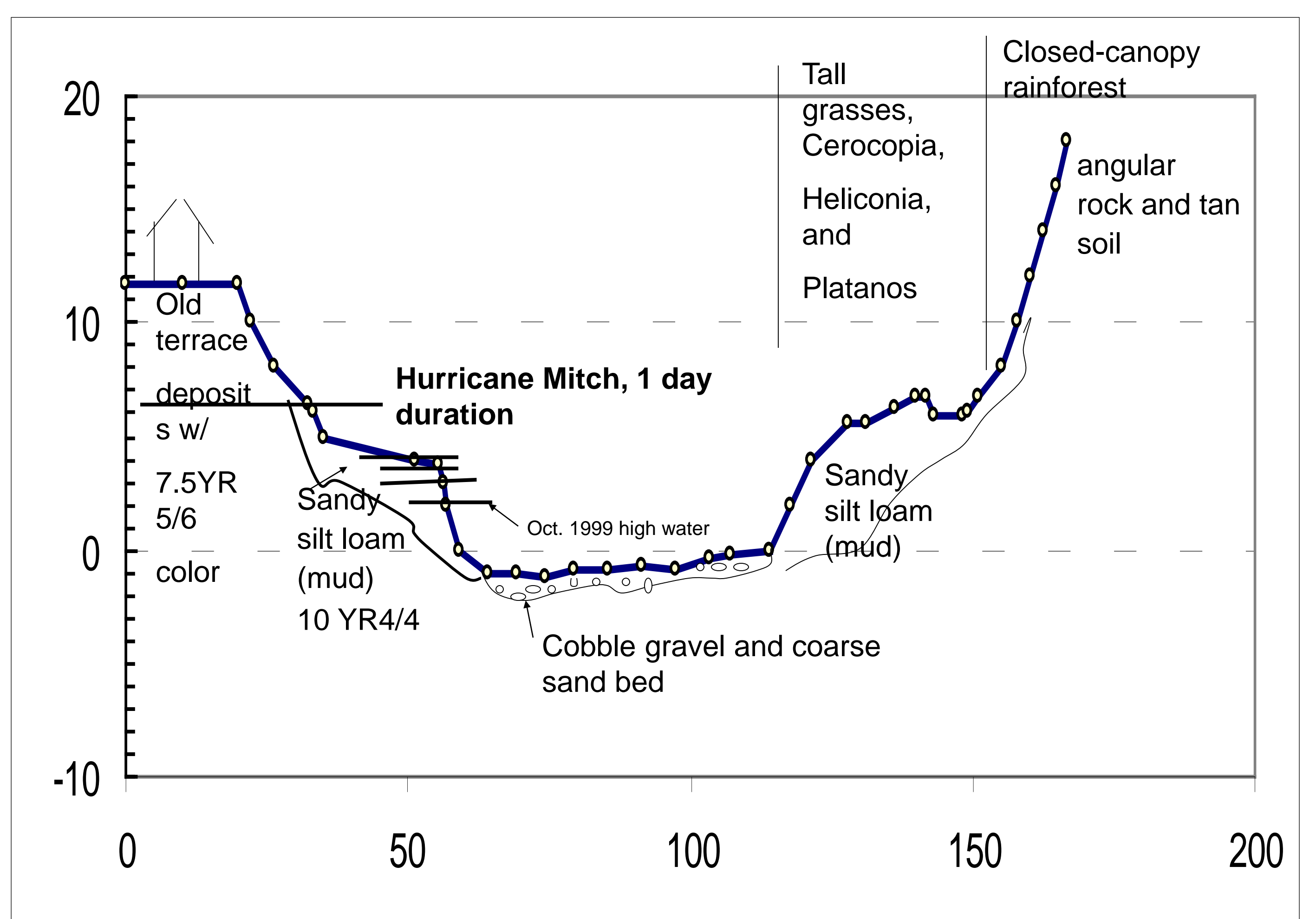


Figure 4. Typical section of river, showing mud banks and a cobble-sand bed, and the upper bank formed by rare flood events.