Kinematic GPS in Venezuela:

Tectonic slip vectors

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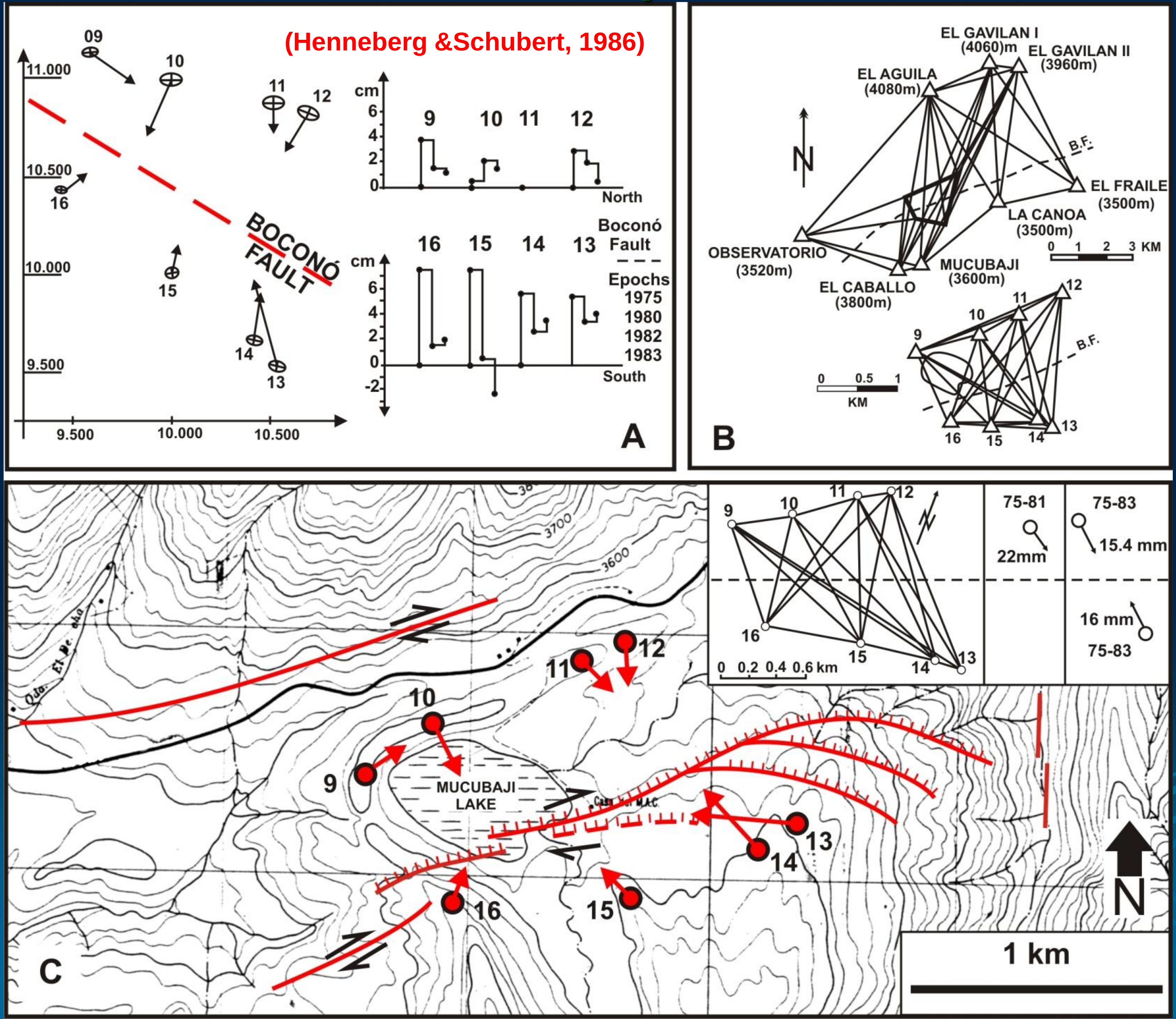
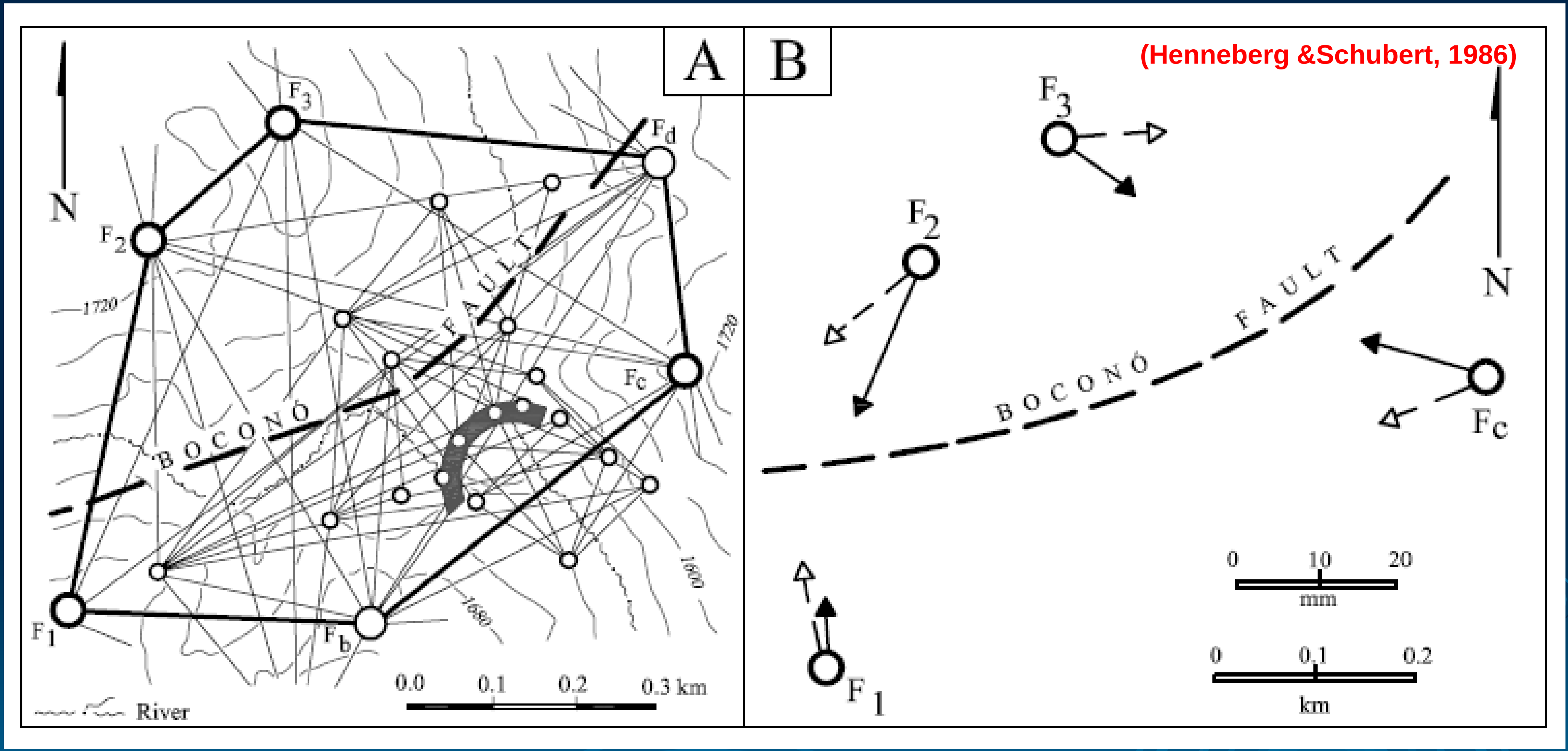
Conventional triangulation surveys for fault-slip determination



- First attempts
- Theodolite triangulation
- More shortening Than right-lateral Strike-slip

Mucubaji Pass, Boconó fault

Conventional triangulation surveys for fault-slip determination



Santo Domingo damsite, Boconó fault

Similar procedures and results to the other trinagulation network on the Boconó fault

CASA GPS project

- Installation in 1988.
- First repetition in 1991 (*except for Venezuela*).
- Venezuela measured in February 1993

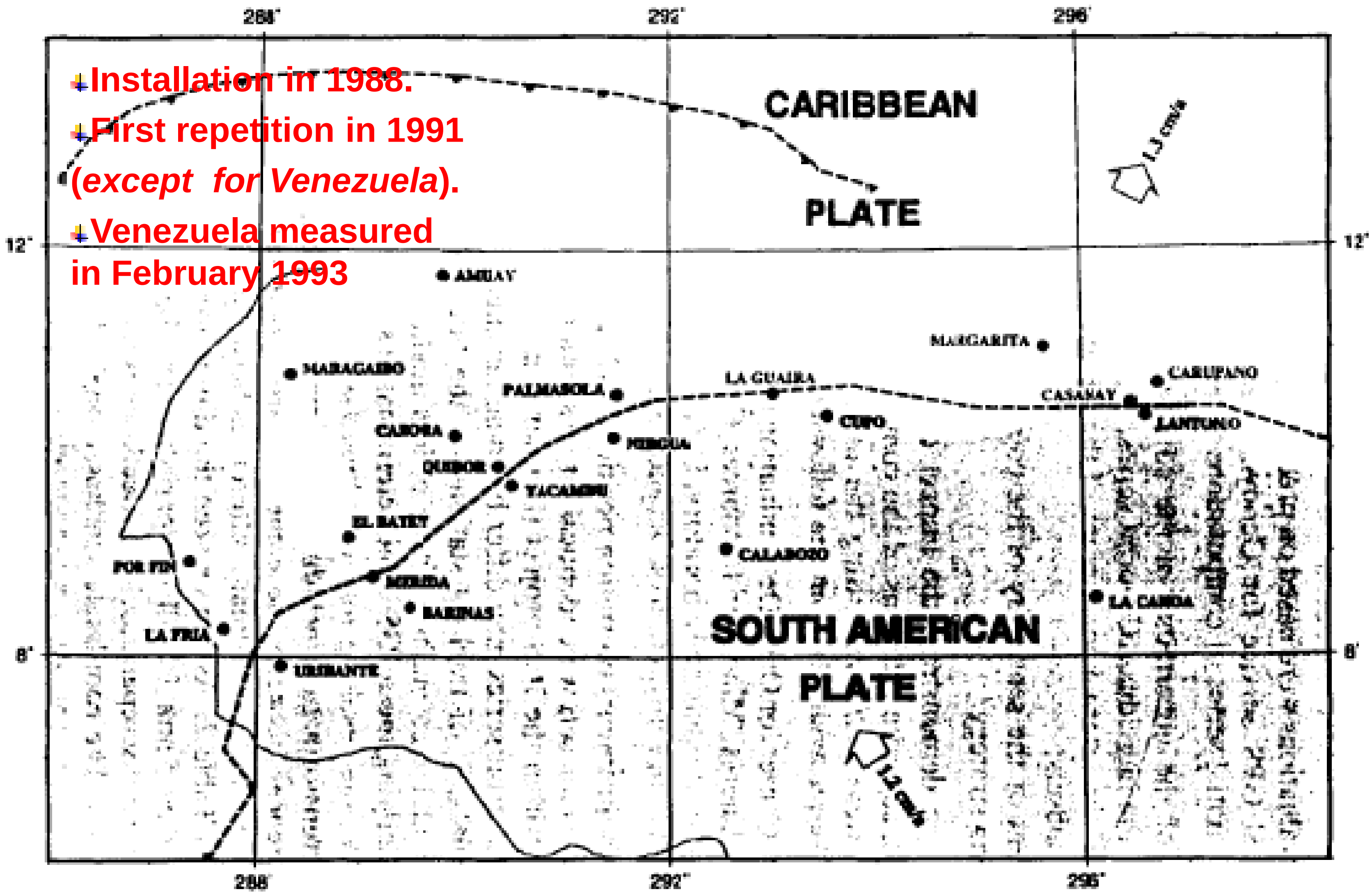


Fig. 2. Location of sites occupied during the CASA'93 campaign in Venezuela.

(Drewes et al., 1995)

CASA GPS project

Table 1. CASA'93 station occupation plan (Wild Leica 200 receivers only)

		Day of year 1993										
Number	Station name	46	47	48	49	50	51	52	53	54	55	56
1	Richmond Timer	X	X	X	X	X	X	X	X	X	X	X
2	Mérida	X	X	X	X	X	X	X	X	X	X	X
3	Maracaibo Mamon	X	X	X	X	X	X	X	X	X	X	X
4	Uribante	X	X	X								
5	La Fria	X	X				X	X				
6	Amuay	X	X	X								
7	Palmasola	X	X	X		X						
8	La Canoa	X	X	X								
9	Carupano	X				X	X					
10	Margarita	X	X	X								
11	Casanay		X	X	X							
12	Por Fin			X	X	X						
13	Carora				X	X	X	X	X			
14	Barinas					X	X	X				
15	Calabozo					X	X	X				
16	Juan Antonio						X	X	X			
17	Nirgua								X	X	X	X
18	Cupo								X		X	X
19	Quibor									X	X	X
20	La Guaira									X	X	X
21	Yacambu									X	X	X
22	El Batey									X	X	X

Venezuelan stations measured in February 1993

(Drewes et al., 1995)

CASA GPS project

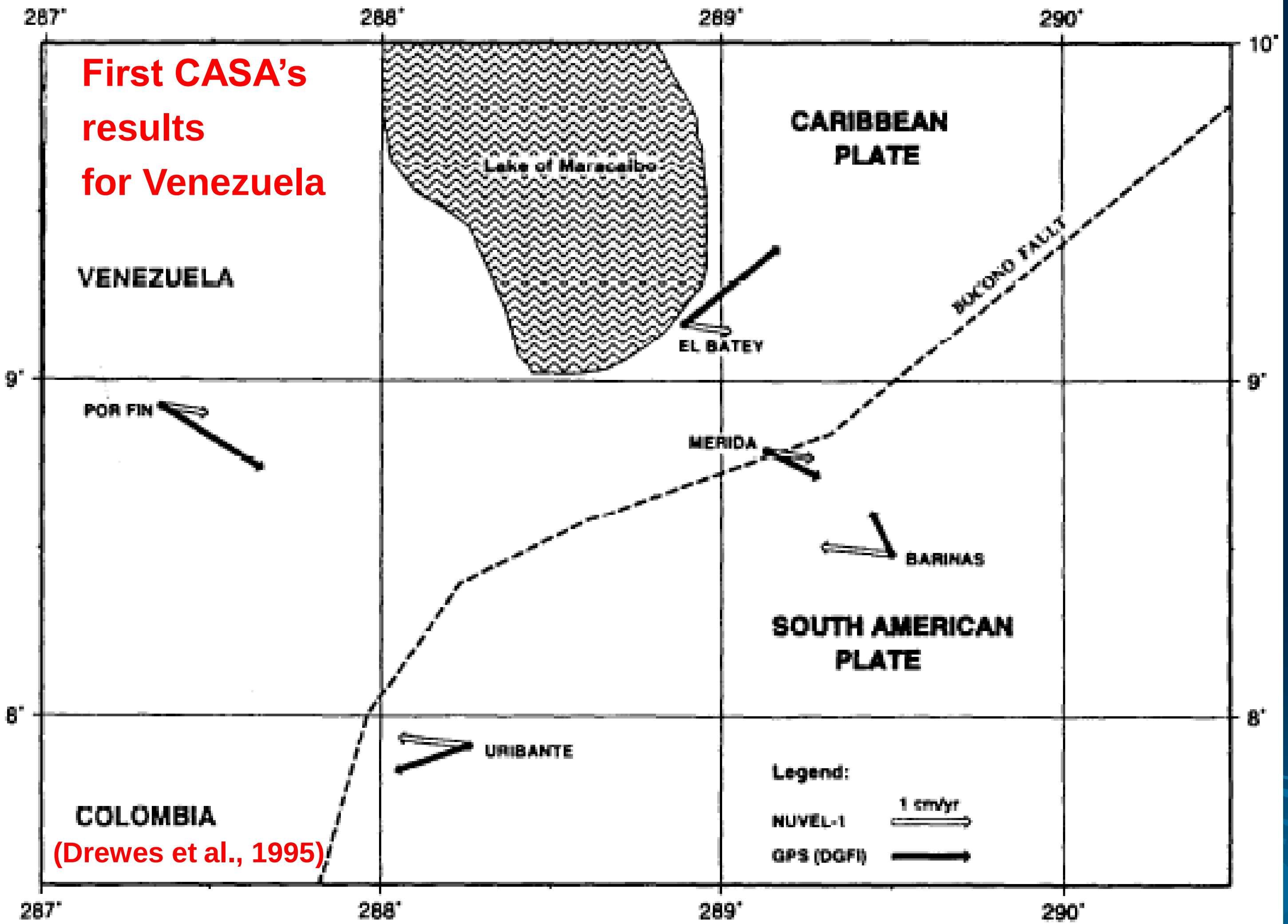
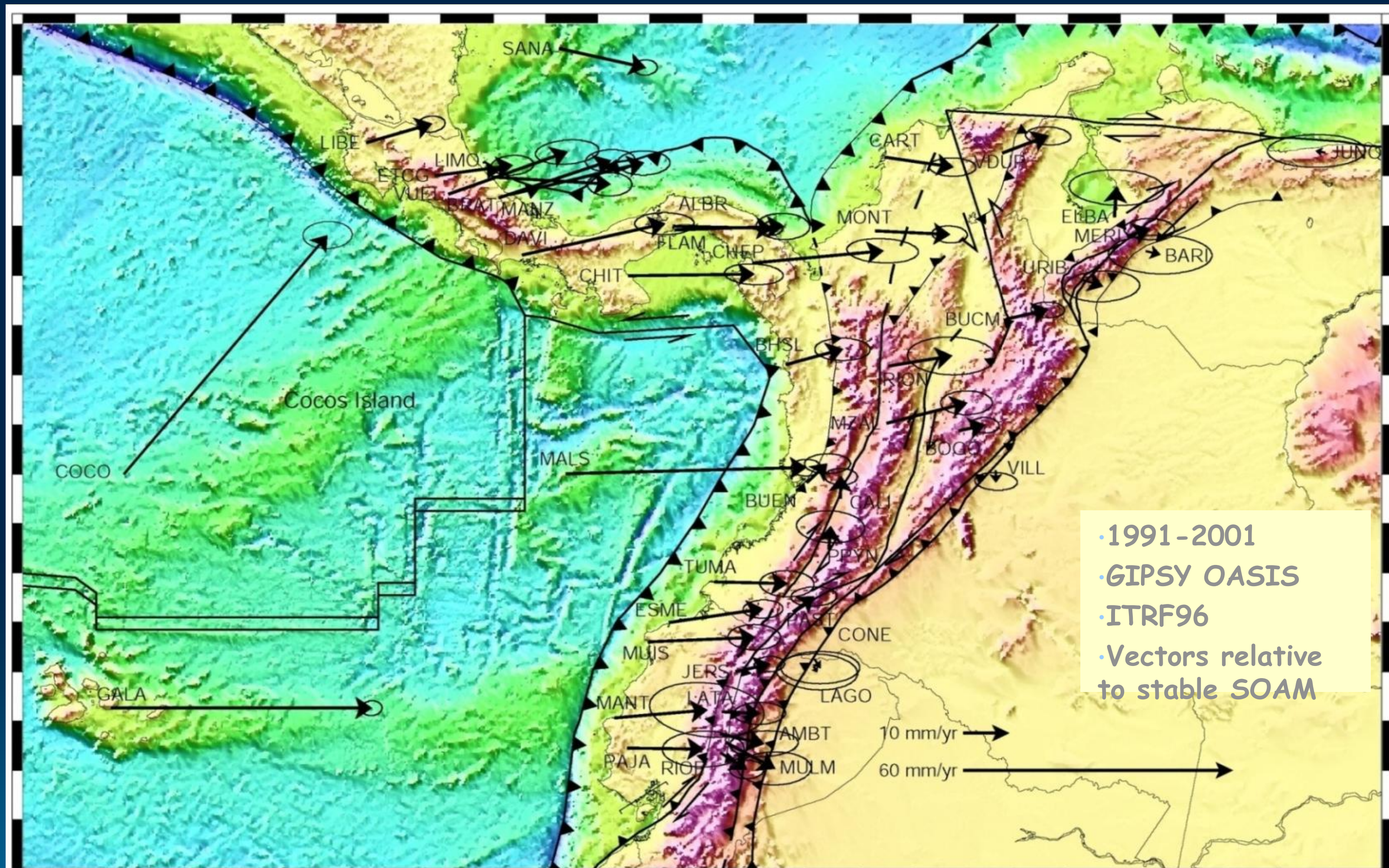


Fig. 4. Coordinate variations of 1988 and 1993 GPS campaigns after Helmert-transformation and plate motions after NNR-NUVEL-1 model.

CASA GPS project

Comparison between 1991-1998 campaigns



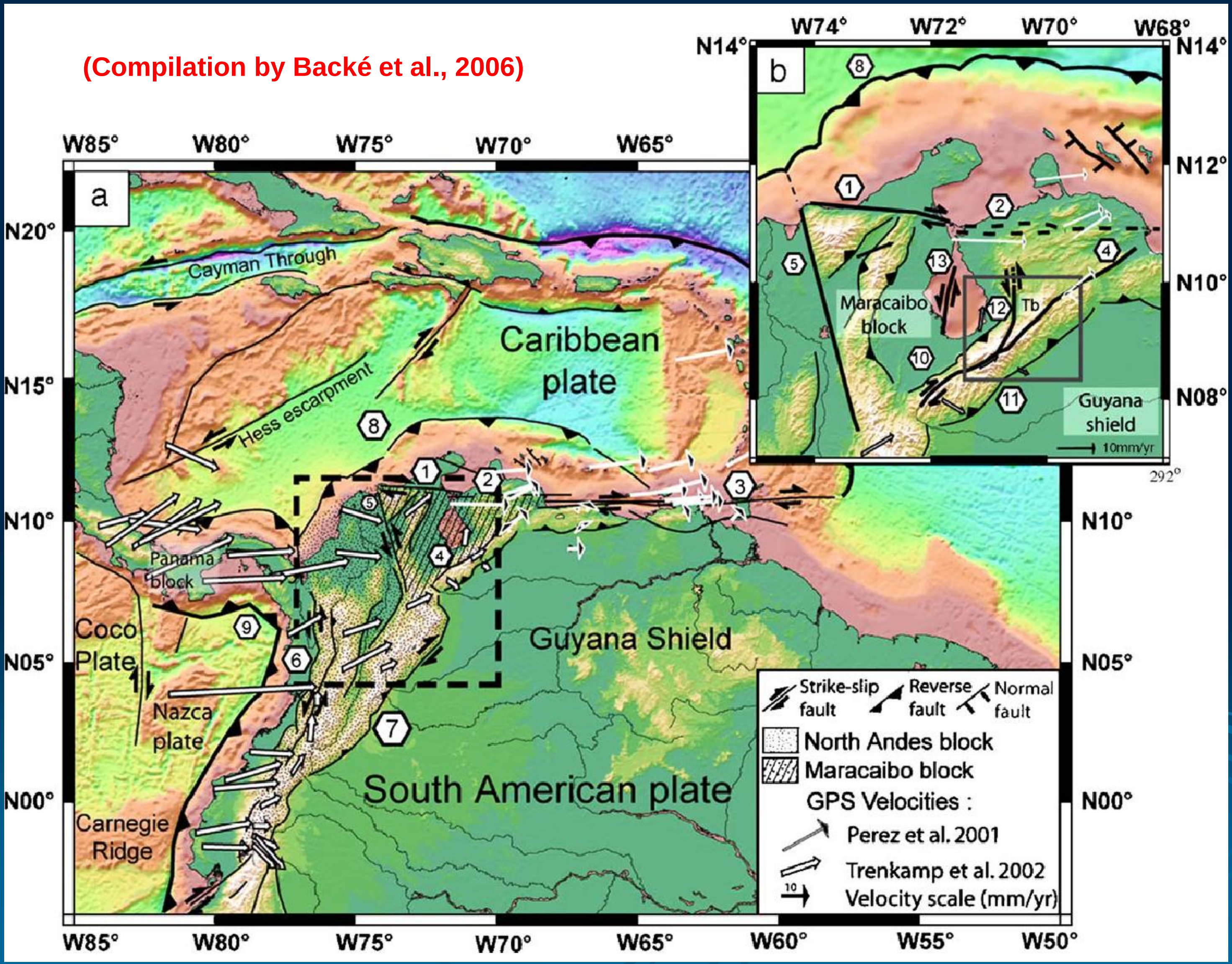
- 1991-2001
- GIPSY OASIS
- ITRF96
- Vectors relative to stable SOAM

Fig. 3. Station velocity vectors relative to stable South America at 95% confidence using the data from the 1991, 1994, 1996, and 1998 CASA campaigns. The Cocos Island vector (COCO) was calculated relative to South America using a vector reported in Freymueller et al. (1993). Location of the COCO vector has been shifted to maintain the clarity of the figure.

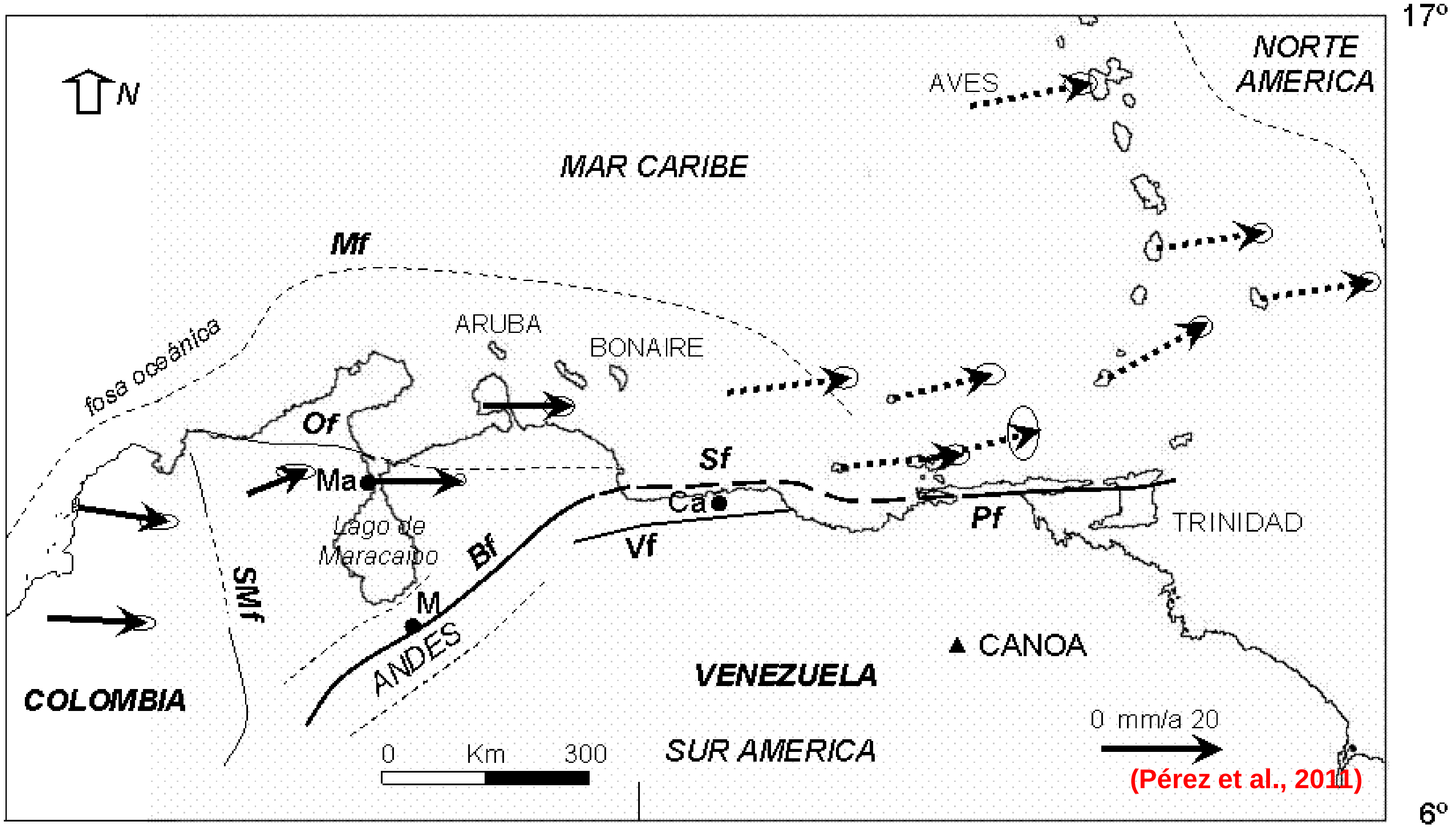
R. Trenkamp et al. / Journal of South American Earth Sciences 15 (2002) 157–171

Present-day block kinematics of the southern Caribbean from GPS data

(Compilation by Backé et al., 2006)

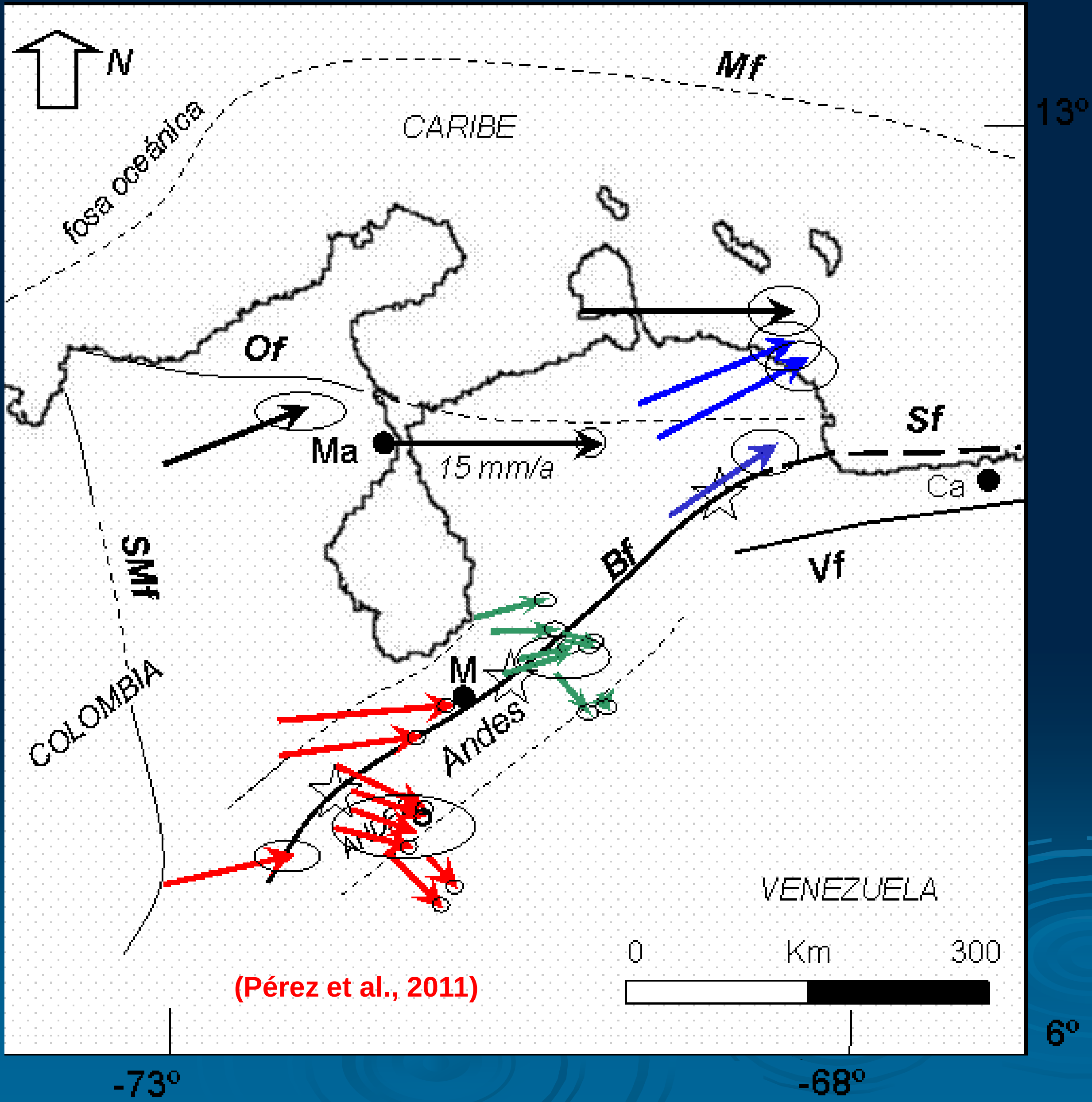


Present-day slip vectors for the southern Caribbean from GPS data



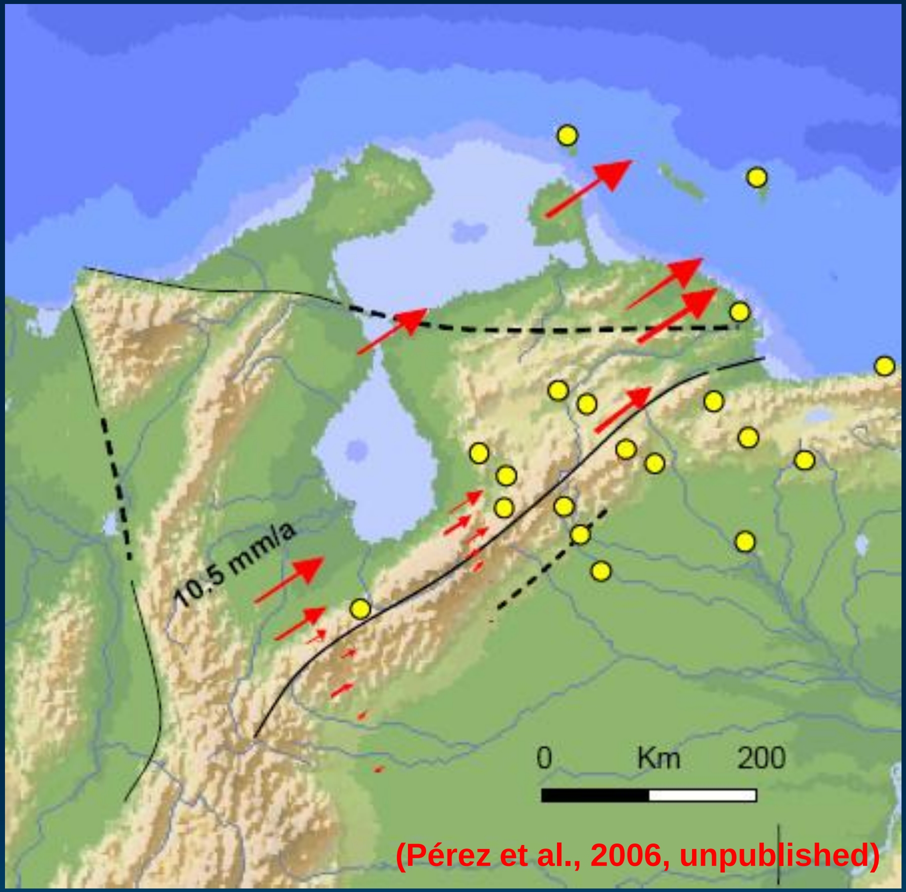
Solid vectors from Trenkamp et al. (2002) Dashed vectors from Pérez et al. (2001)

Latest slip rates across MA

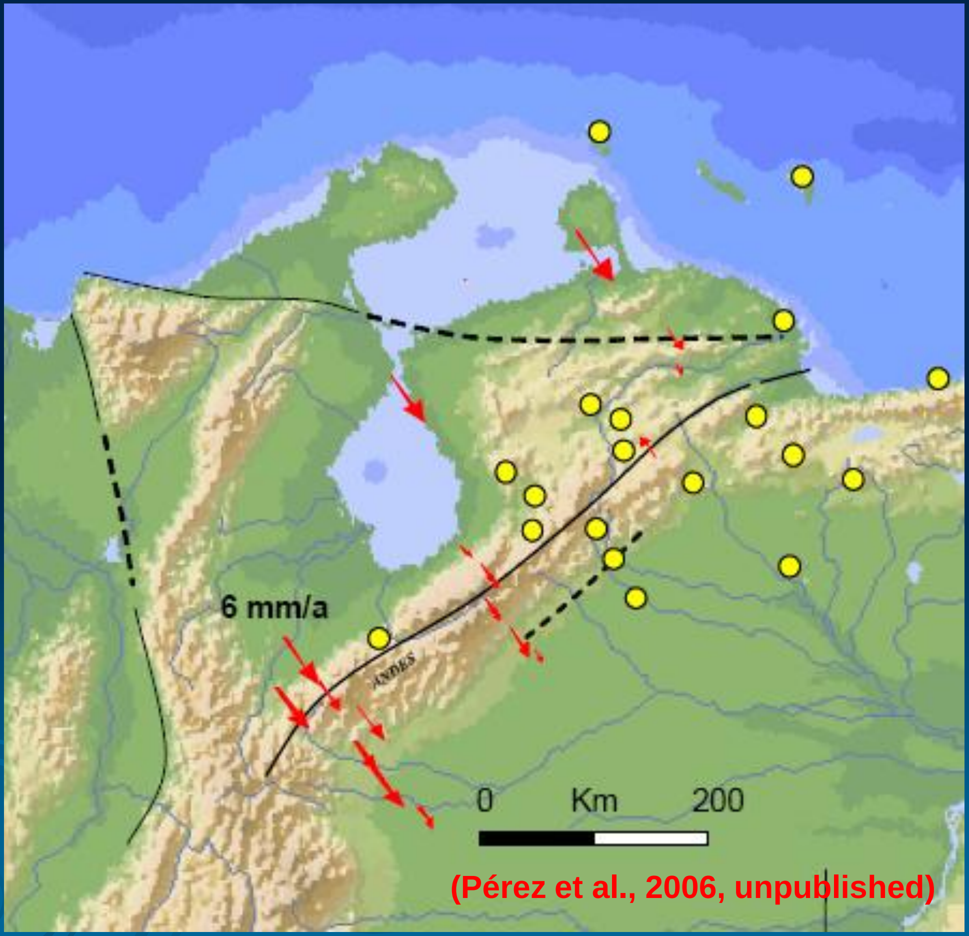


(Pérez et al., 2011)

SS and shortening slip rates across MA



Present-day dextral slip rates along the Boconó fault double normal-to-chain shortening rates

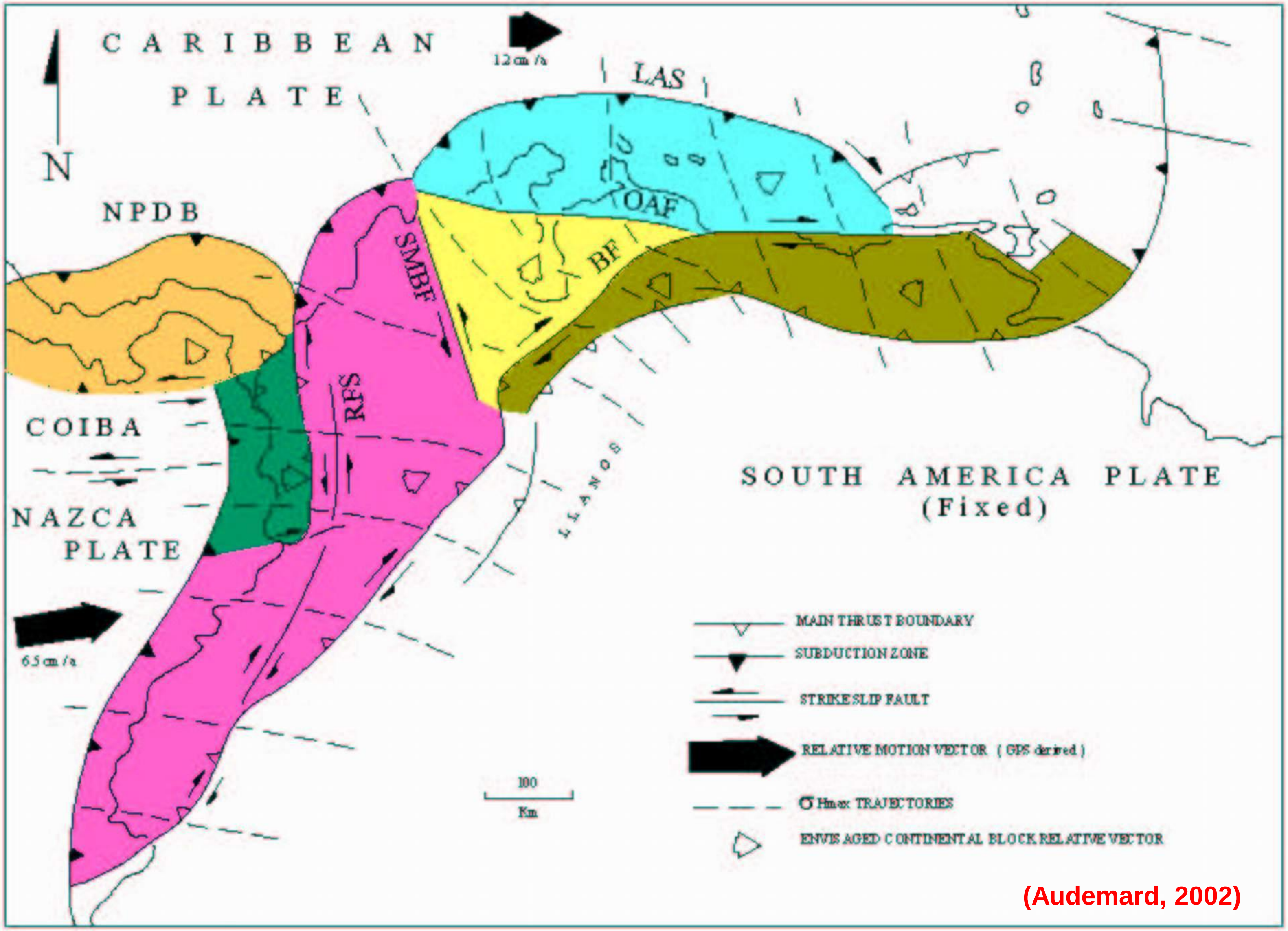


So, shortening dominated over dextral slip in earlier stages of MA strain partitioning

This happens in a time window of < 5 Ma

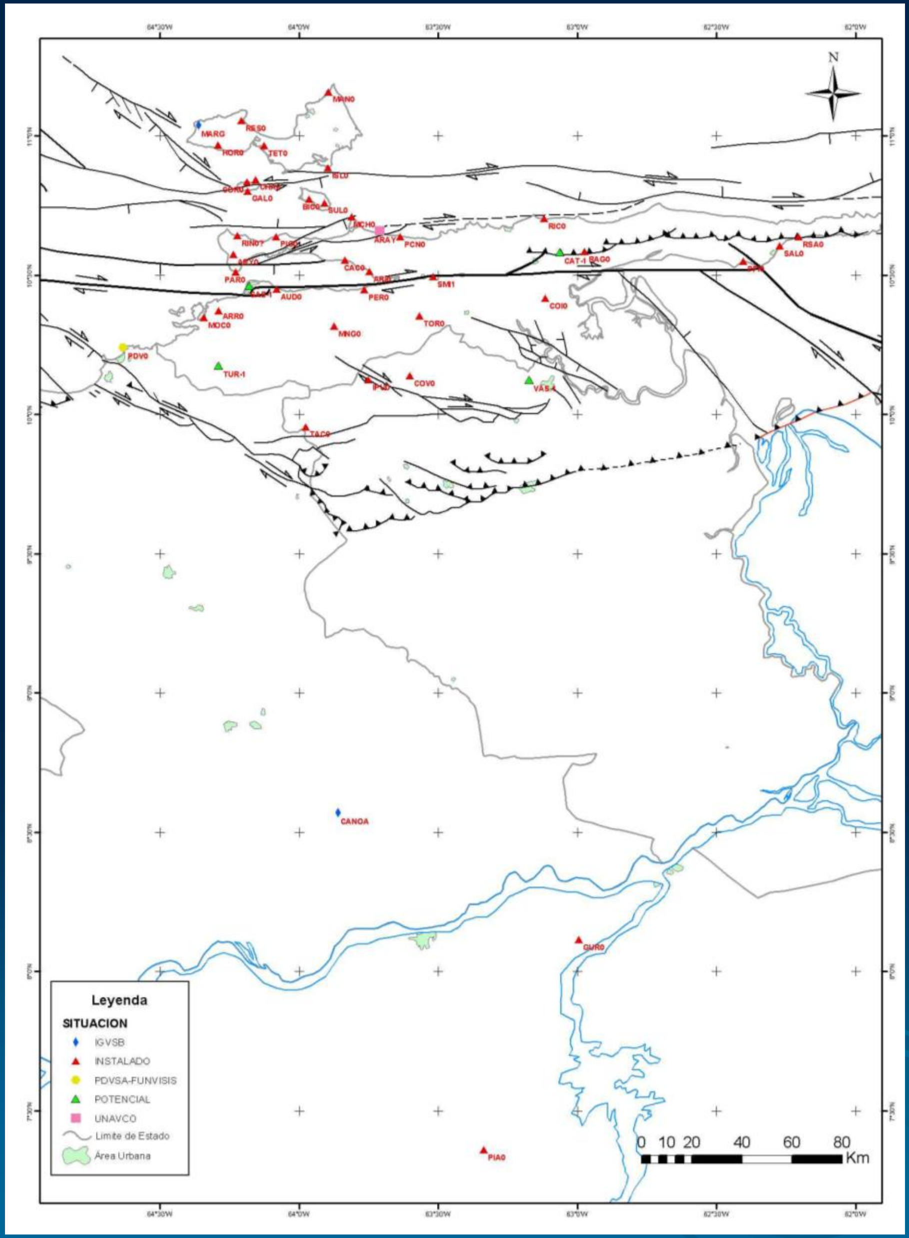
OTHER INITIATIVES

CA-SA-NA Plate Boundary:
Block tectonics and indentation-extrusion



(Audemard, 2002)

Current GPS Projects by FUNVISIS



Installation of 36 spits (August-November 2003)

+ 4 existing benchmarks (including CANOA) in eastern Venezuela

Current GPS Projects by FUNVISIS

- First occupation. End of 2003 (29/11-15/12/03)
- First repetition. End of 2005
- Second reptition. Failed in early 2010 (Temporary importation problems of the french INSU GPS Pool)

Estación La Canoa
(edo. Anzoátegui)

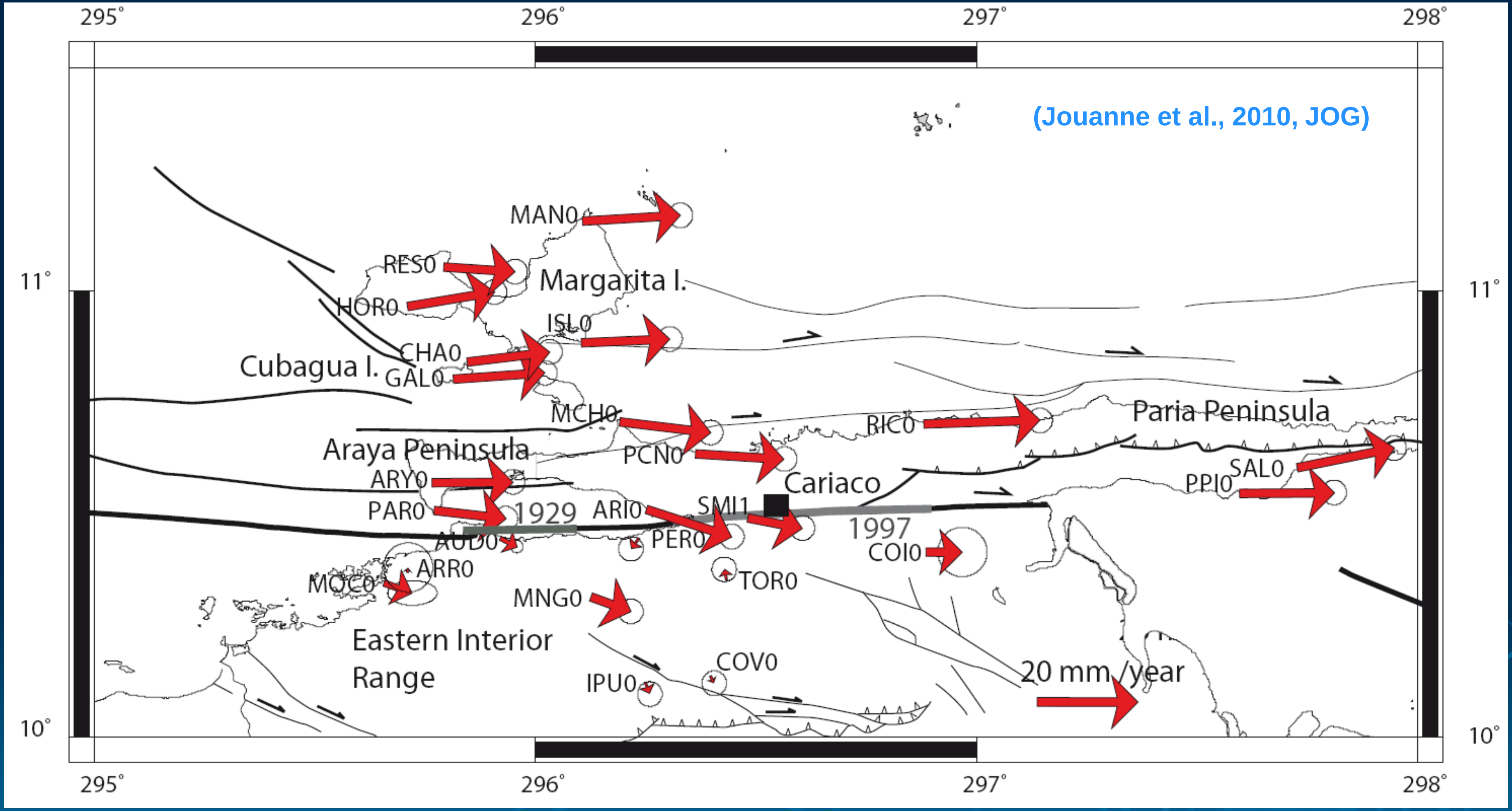
Estación Morro de Chacopata
(edo. Sucre)

Next occupation: End of 2011

(in the frame of a PhD thesis)

Current GPS Projects by FUNVISIS

First results

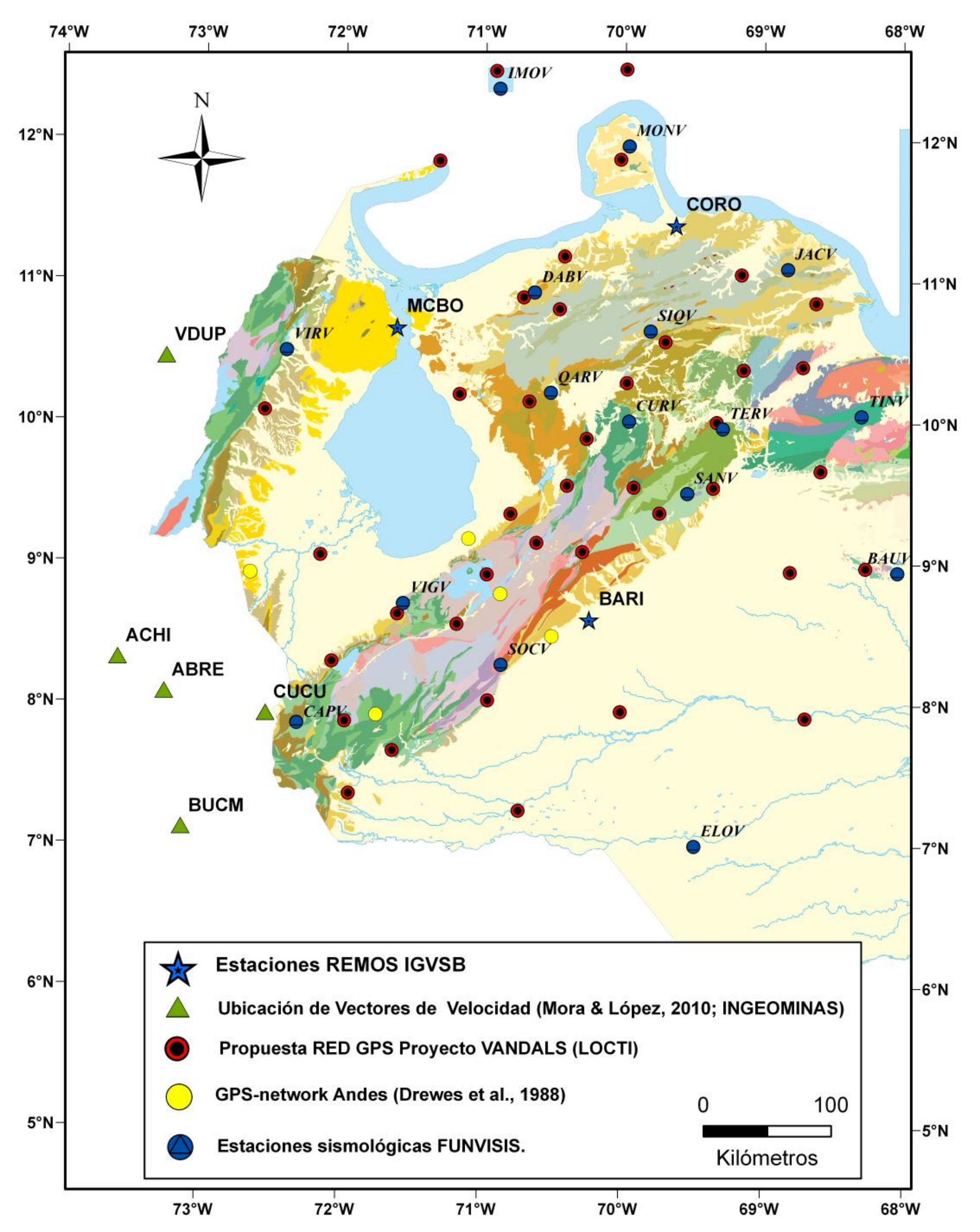


- Locking depth at 10 km
- 50% of slip corresponds to creep

2005-2003 comparison

THE PRESENT and THE NEAR FUTURE Of KINEMATIC GPS

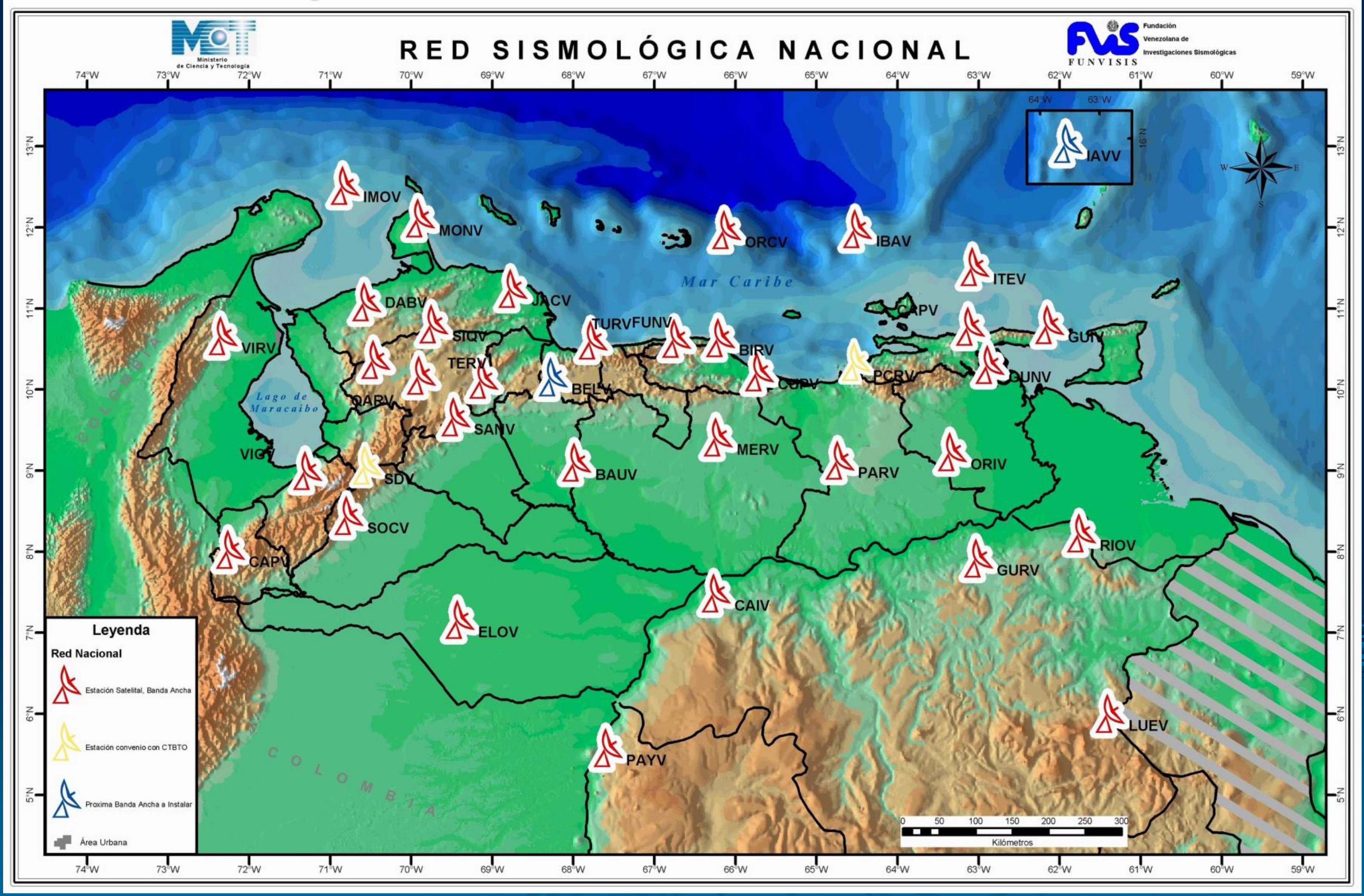
New GPS Projects by FUNVISIS



- Installation of some 40 new spits in western Venezuela in 2011.
- Financed by LOCTI (pending approval)
- In the frame of a PhD thesis

INSTALLED CAPACITY

for permanent GPS stations



35 + 3 BB stations. Satellite connected in real time

INSTALLED CAPACITY

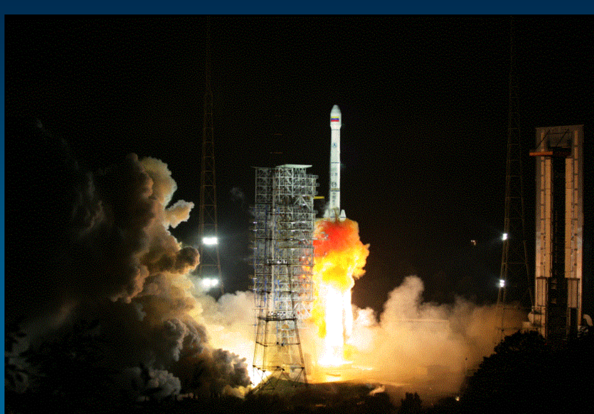
for permanent GPS stations

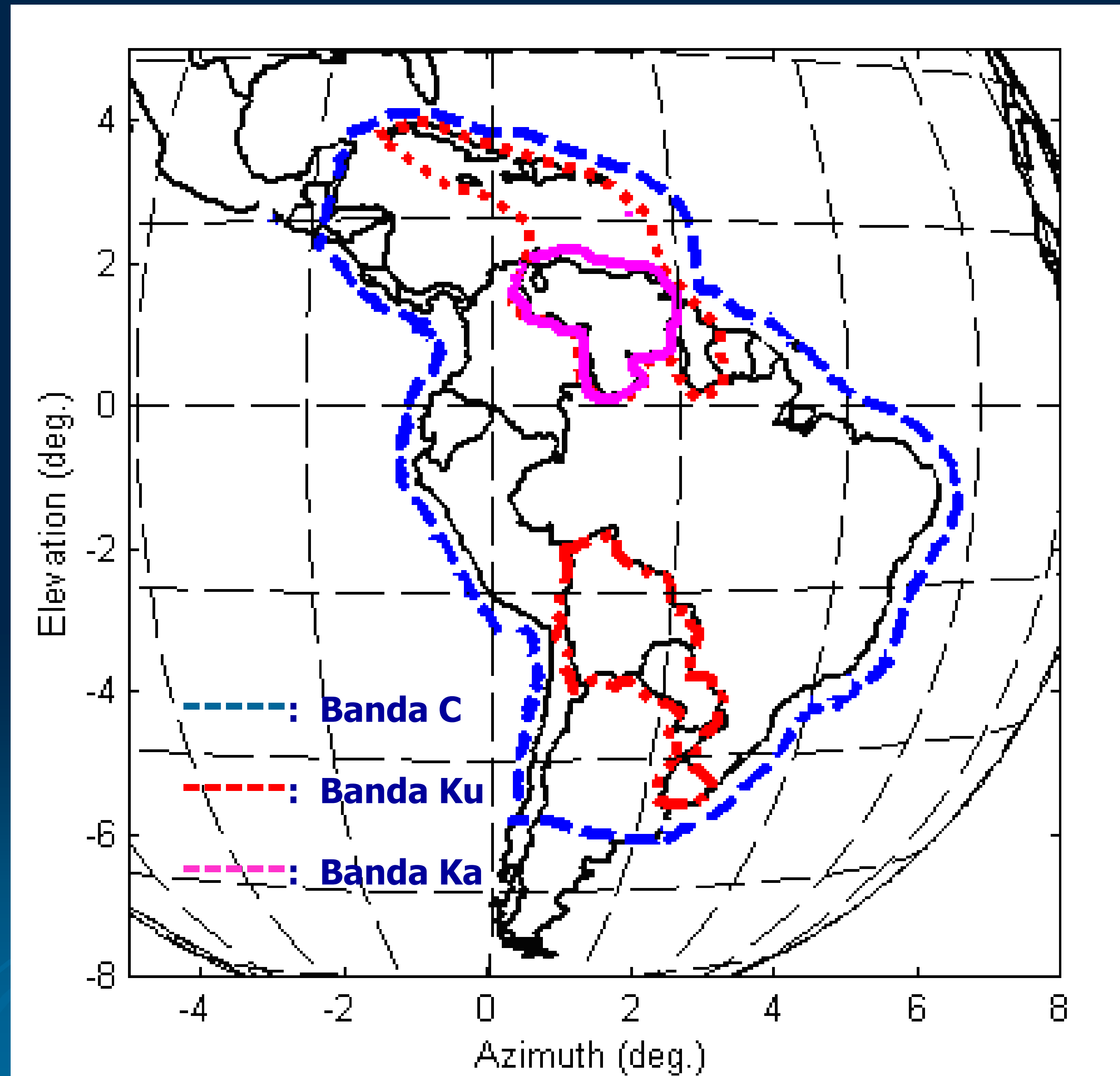
Seismologic station design may well be a limitation for installation of permanent GPS stations inside fence. However, the intention is to place them nearby.

INSTALLED CAPACITY

for permanent GPS stations

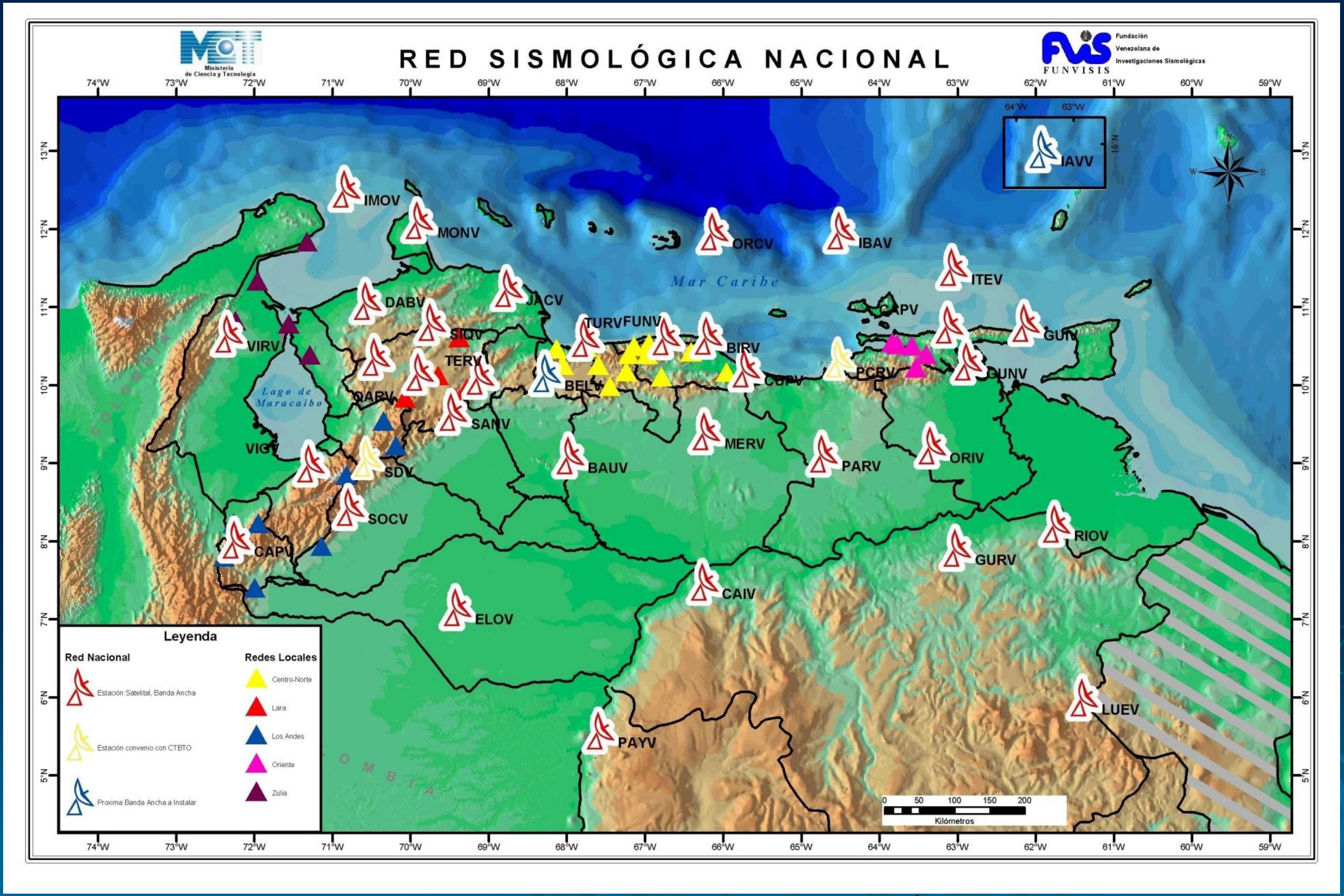
Data transmission by satellite Simón Bolívar





INSTALLED CAPACITY

for permanent GPS stations



Also, 5 local short-period networks.

Eventual emplacement of new GPS stations

LOCTI PROPOSAL

requesting permanent GPS stations

- Introduced in 2010
- Request of 10 permanent GPS stations
- Funding by LOCTI approved

  (awaiting money availability)
- Site selection under way

  (premise: close to existing BB stations and must respond to scientific issues)

LOCTI is currently the Venezuelan equivalent to US NSF

CLIMATE OBSERVATIONAL NETWORK

GNSS-REMOS Stations –IGVSB-

Estaciones REMOS (21 en 1era fase): Caracas, Maracaibo, Barinas, San Cristóbal, Coro, Cumaná, Ciudad Guayana, San Fernando, Carora, San Carlos, San Tomé, Elorza, Valle de La Pascua, Puerto Ayacucho, Manapiare, Maripa, Canaima, Encontrados, Santa Elena Uairén, Tucupita, Esmeralda

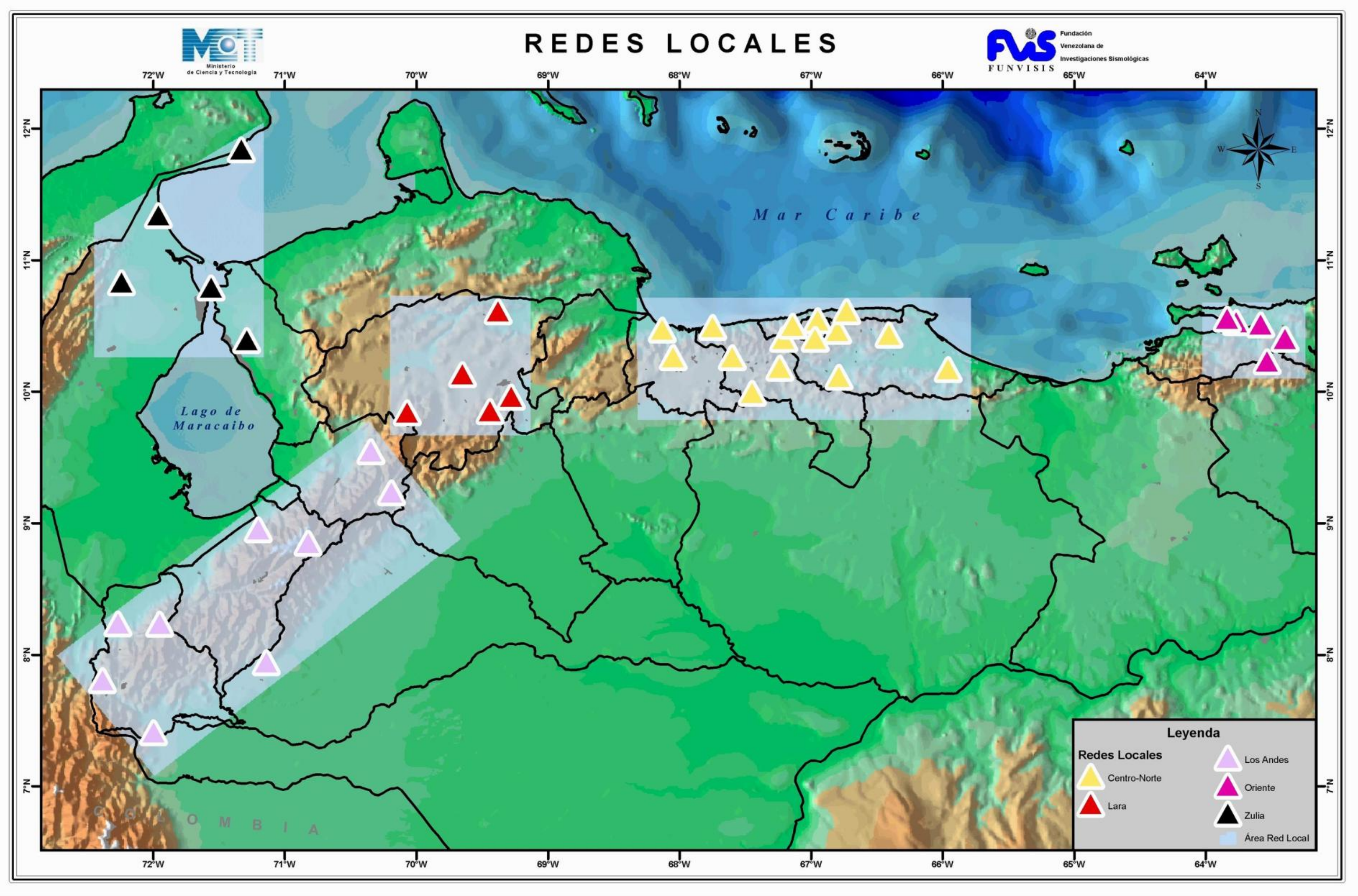
Funvisis

Fundación Venezolana de Investigaciones Sismológicas

Thanks very much

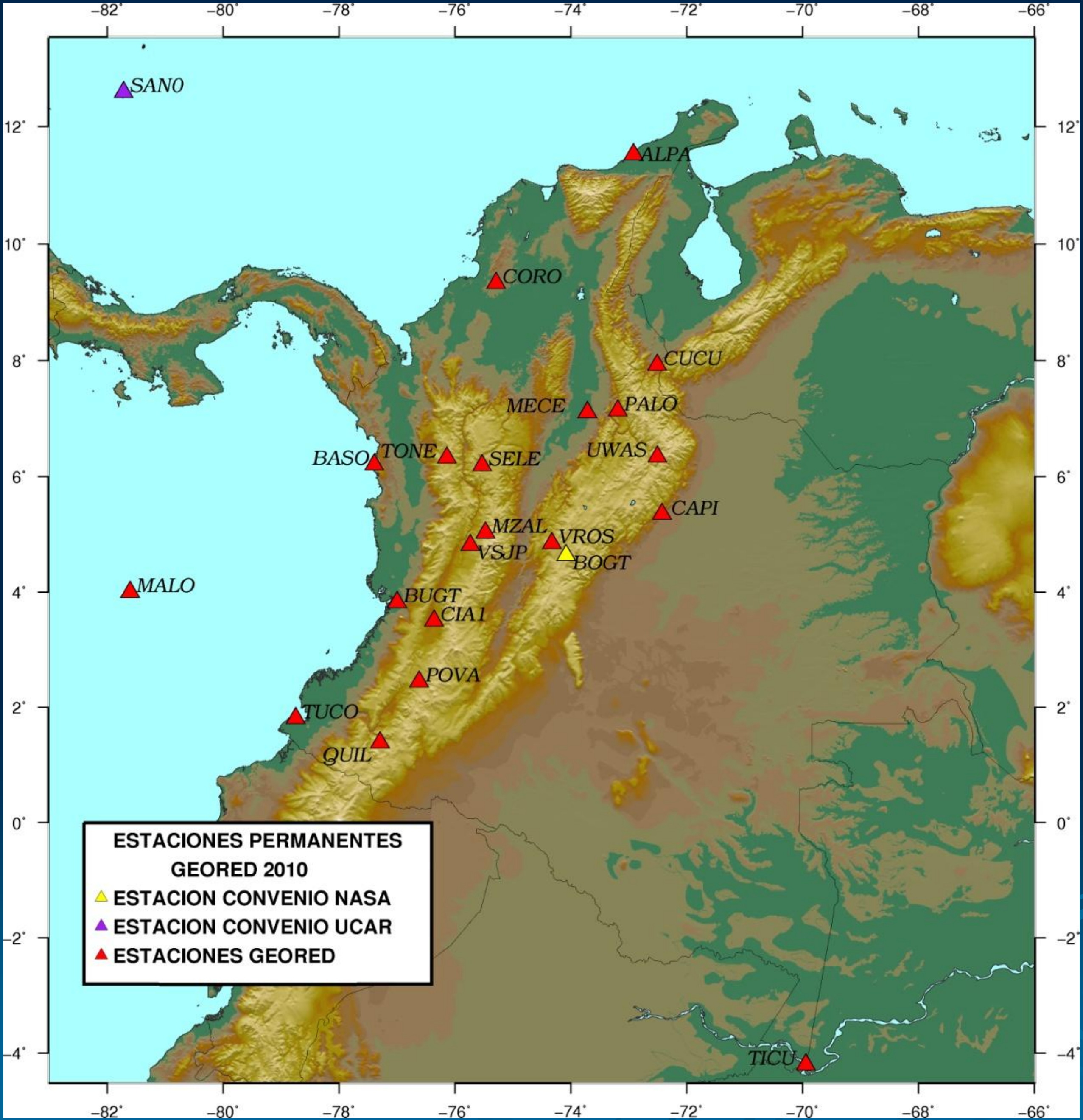
Mil gracias por su atención

0800-TEMBLOR (8362567)



REDES LOCALES
Ministerio de Ciencia y Tecnología
Fundación Venezolana de Investigaciones Sismológicas
FUNVISIS
Mar Caribe
Lago de Maracaibo
COLOMBIA
72°W
71°W
70°W
69°W
68°W
67°W
66°W
65°W
64°W
12°N
11°N
10°N
9°N
8°N
7°N
Leyenda
Redes Locales
Centro-Norte
Lara
Los Andes
Oriente
Zulia
Área Red Local

CARIVEN Stations 1988-1994


SAN0
ALPA
CORO
CUCU
MECE
PALO
UWAS
BASO
TONE
SELE
CAPI
MZAL
VROS
VSJP
BOGT
MALO
BUGT
CIA1
POVA
TUCO
QUIL
TICU
ESTACIONES PERMANENTES
GEORED 2010
ESTACION CONVENIO NASA
ESTACION CONVENIO UCAR
ESTACIONES GEORED

Las Bandas

- El espectro electromagnético usado por los satélites se identifica por Bandas. La Banda C, frecuencias de entre 3,7 y 4,2 GHz y desde 5,9 hasta 6,4 GHz, fue el primer rango de frecuencia usado por los satélites. Necesita antenas en tierra de gran tamaño. Es más confiable que la Banda Ku en condiciones climatológicas adversas, pero la Banda C es más congestionada y más susceptible a las interferencias terrestres.

- La Banda Ku es la porción del espectro electromagnético en el rango de las microondas que va de los 12 a los 18 GHz. Es usada sobre todo para señales de televisión. En comparación con la Banda C, tiene la ventaja de que no necesita antenas tan grandes, pero es más susceptible a las lluvias fuertes.

- La Banda Ka cubre un rango de frecuencias entre los 18 y los 31 GHz. Las longitudes de onda transportan grandes cantidades de datos. Inconvenientes: son necesarios transmisores muy potentes y las trasmisiones son sensibles a interferencias ambientales.