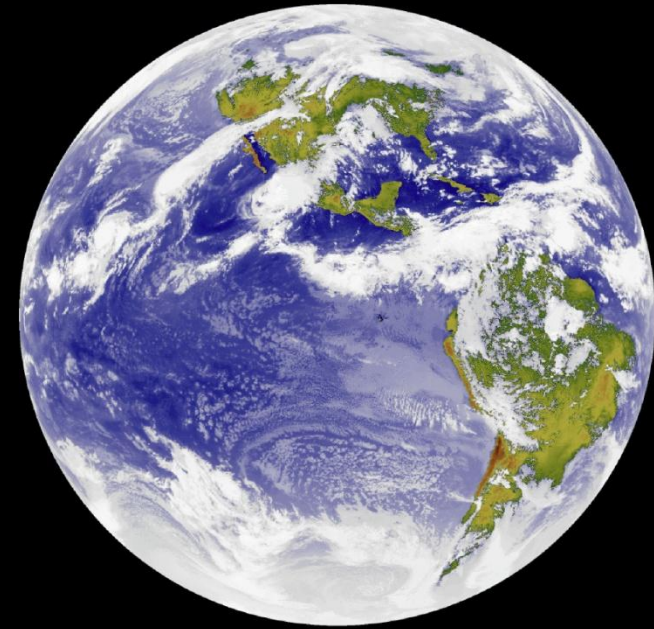


IAG - USP

G E O



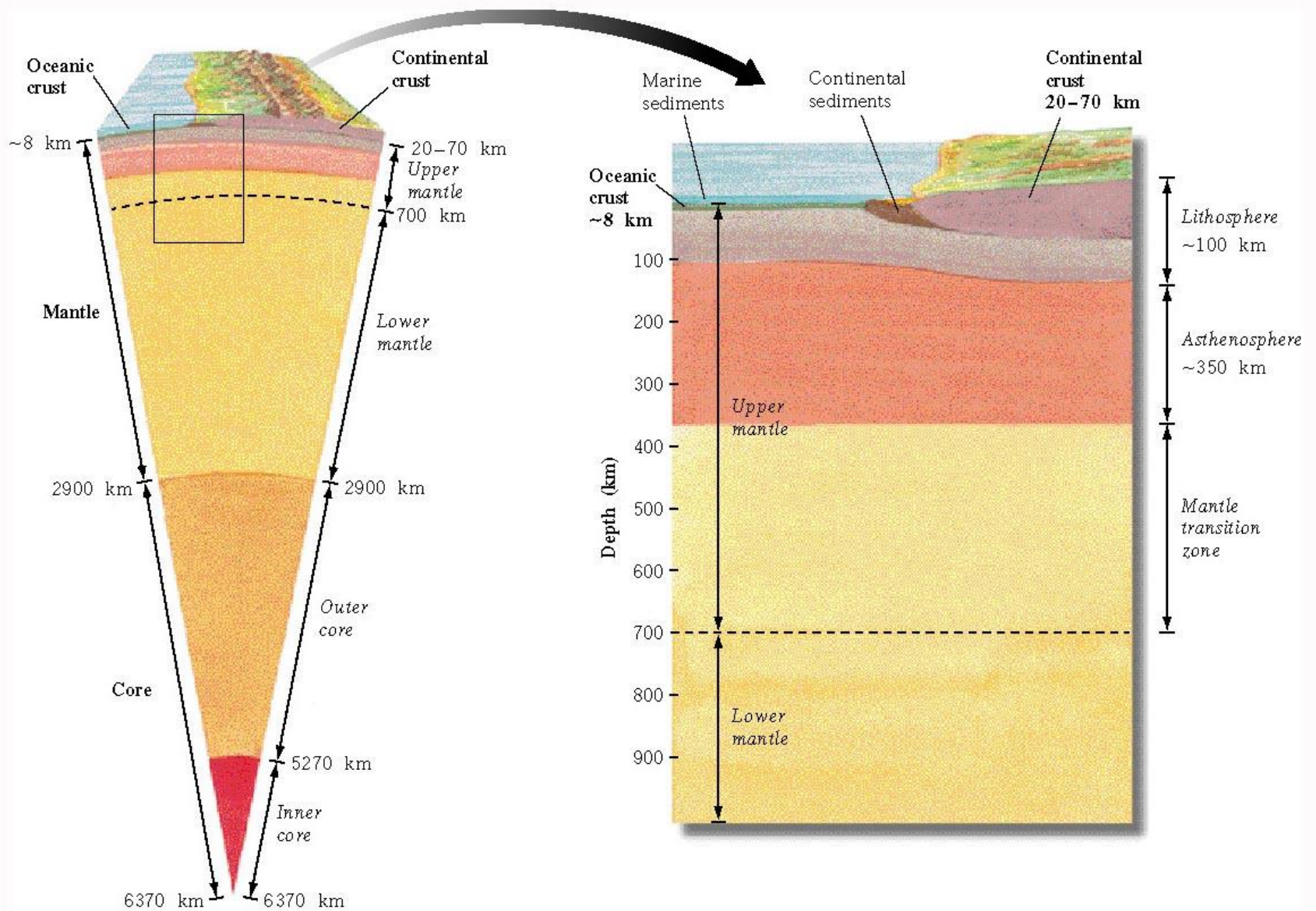
F Í S I C A



# MAPEAMENTO DA SUPERFÍCIE DOS CONTINENTES

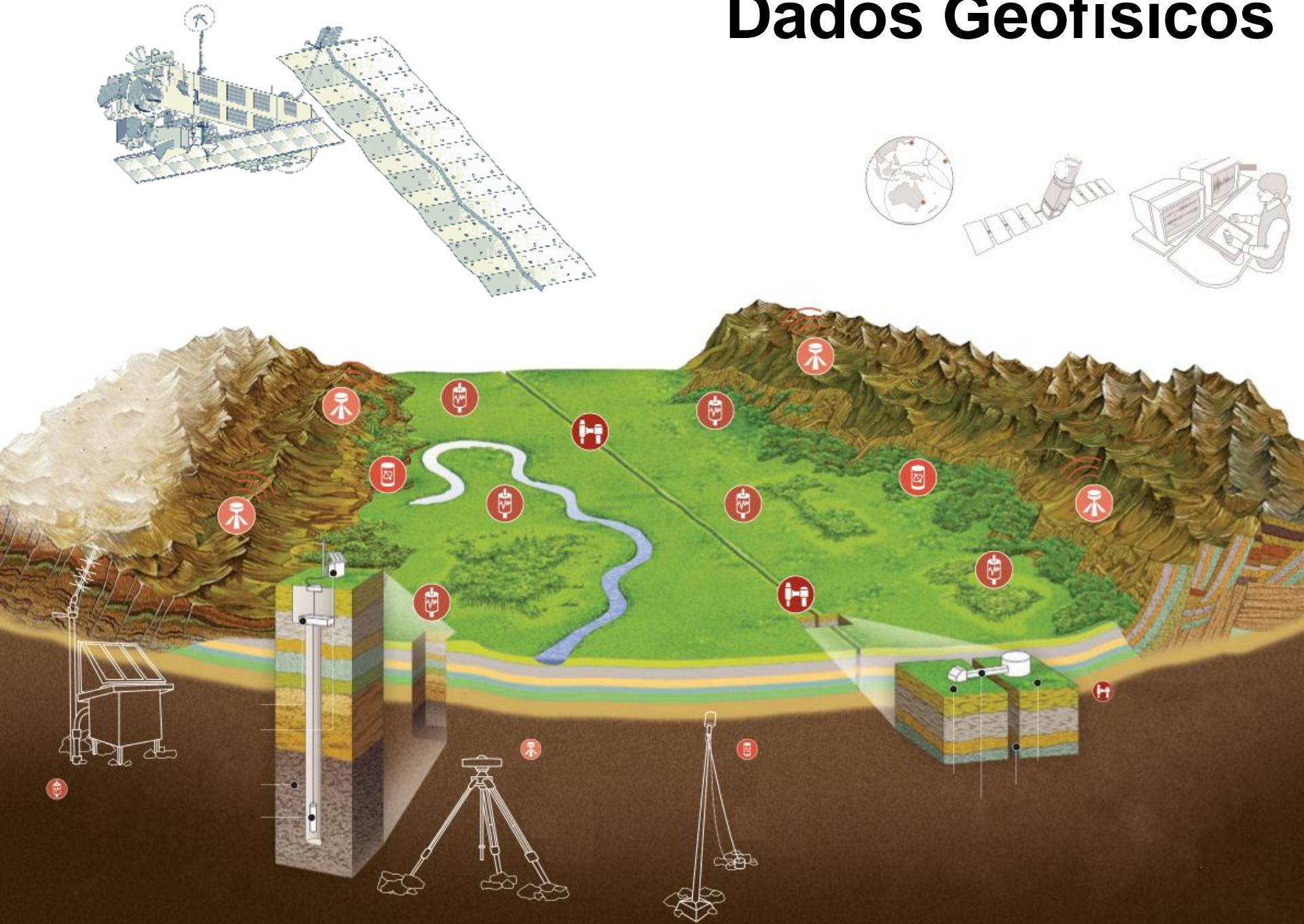
# Estrutura da terra



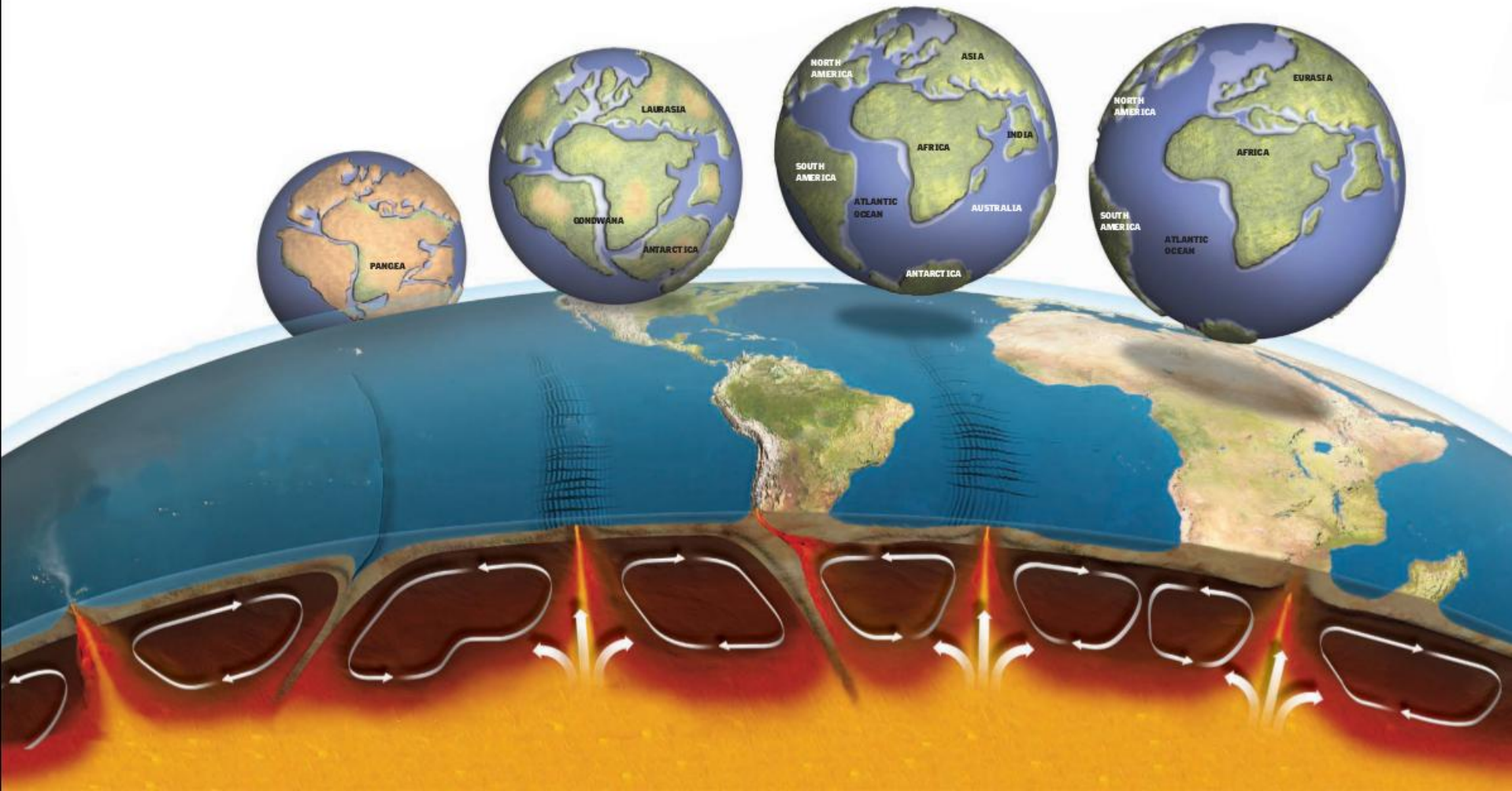




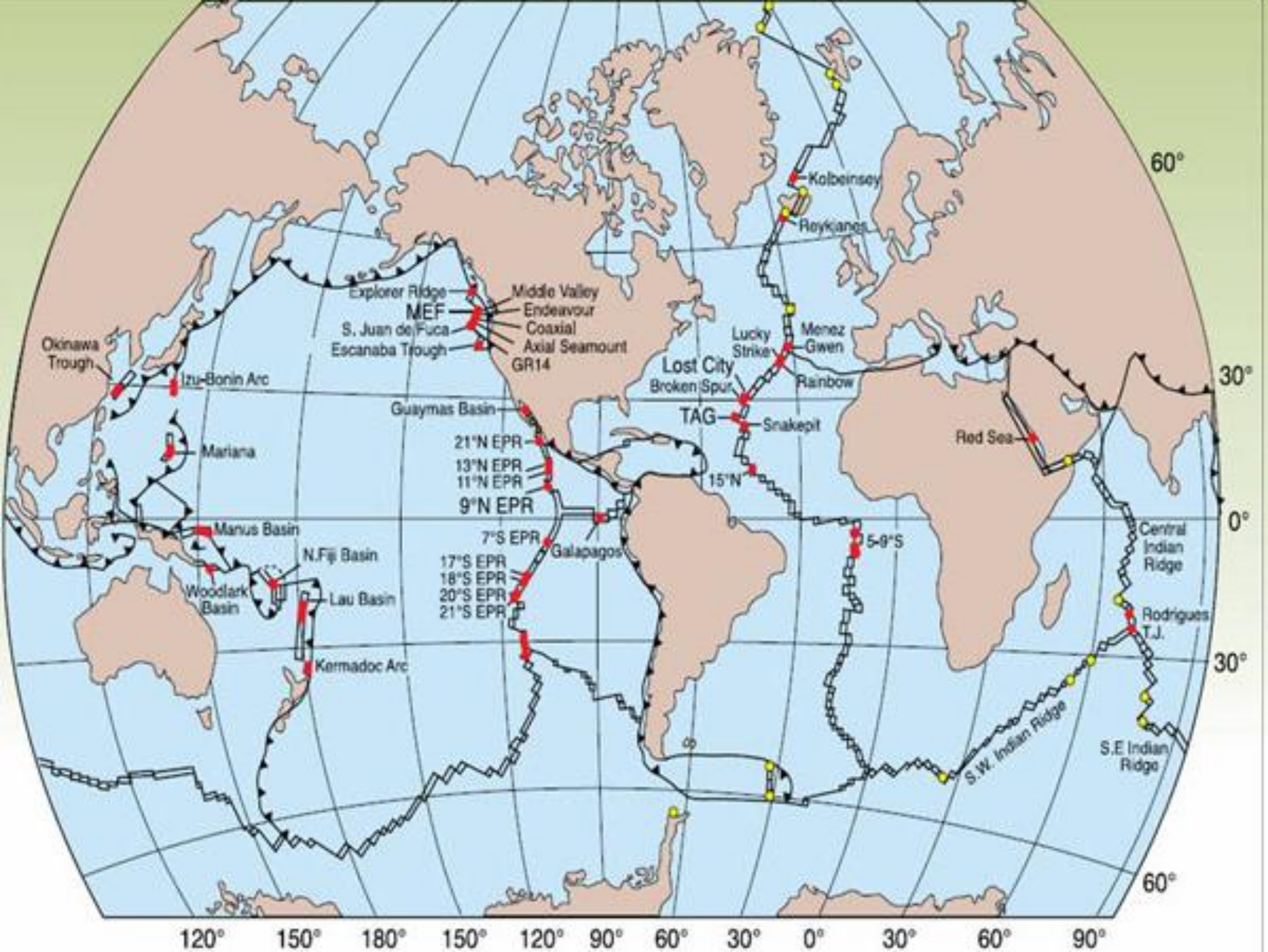
# Dados Geofísicos

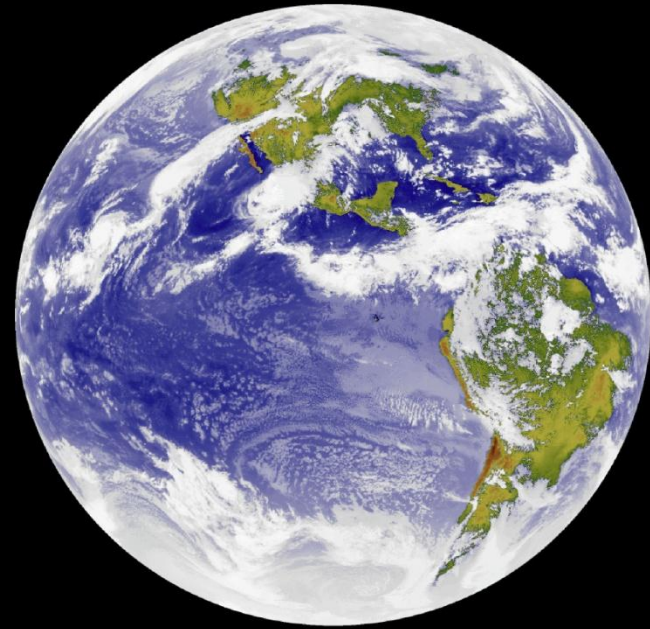


# Tectónica de placas





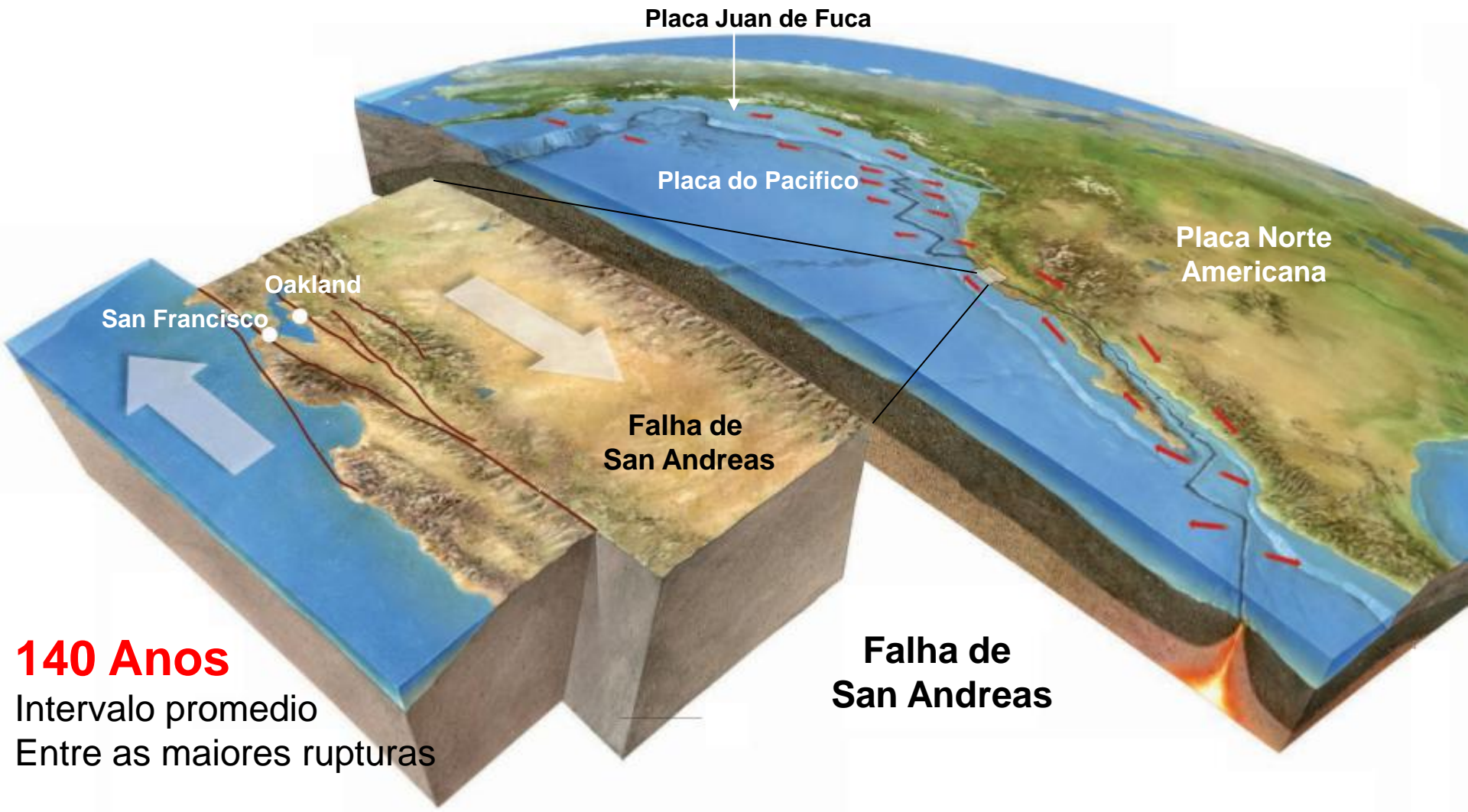




# SISMOLOGIA



# Terremotos e sismos



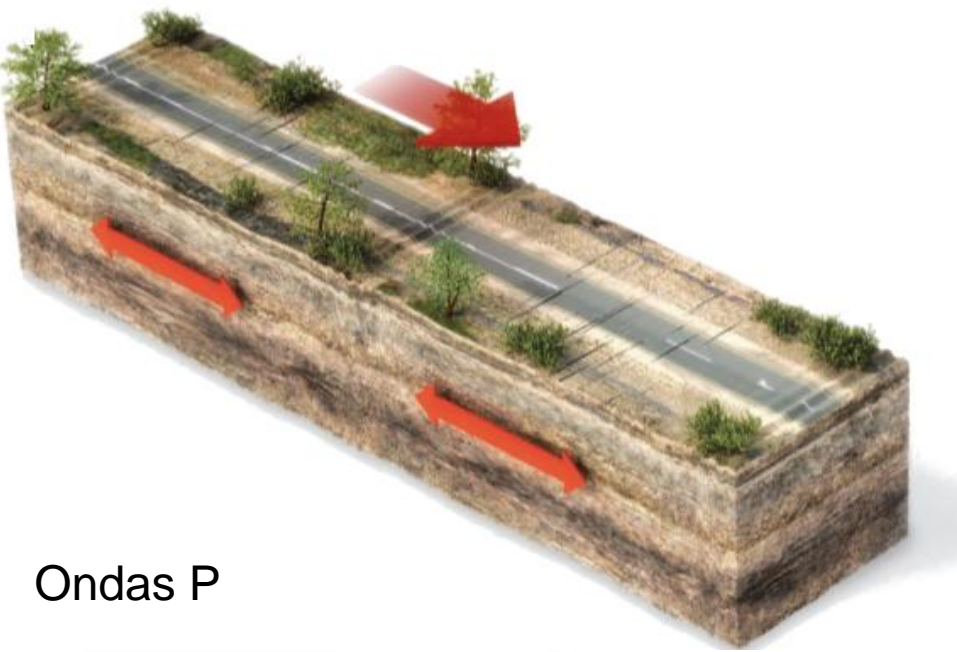
**140 Anos**

Intervalo promedio  
Entre as maiores rupturas



# Tipos de Ondas

Ondas P



Ondas Rayleigh



Ondas S



Ondas Love



# Tipos de Falhas



Falha Normal



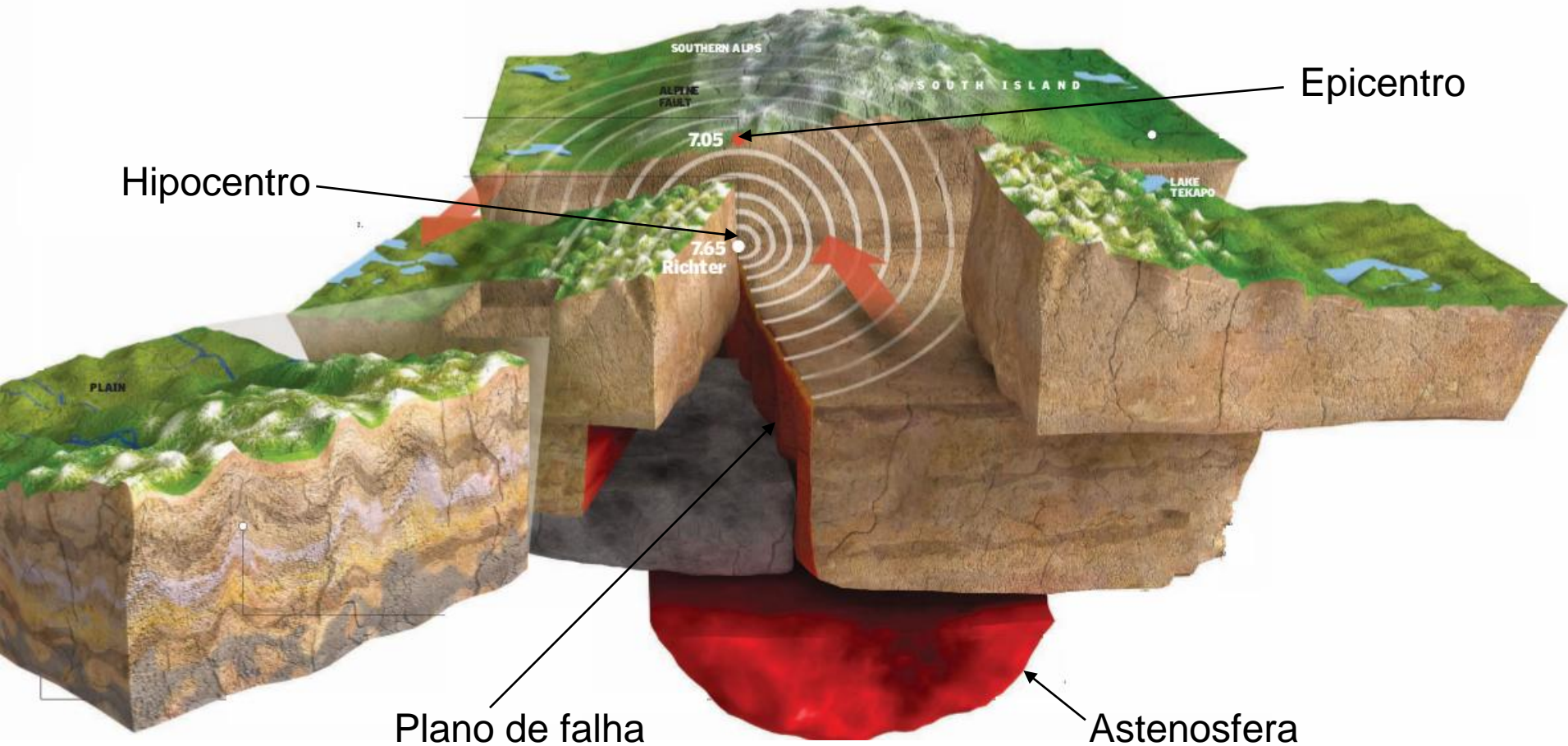
Falha Obliqua



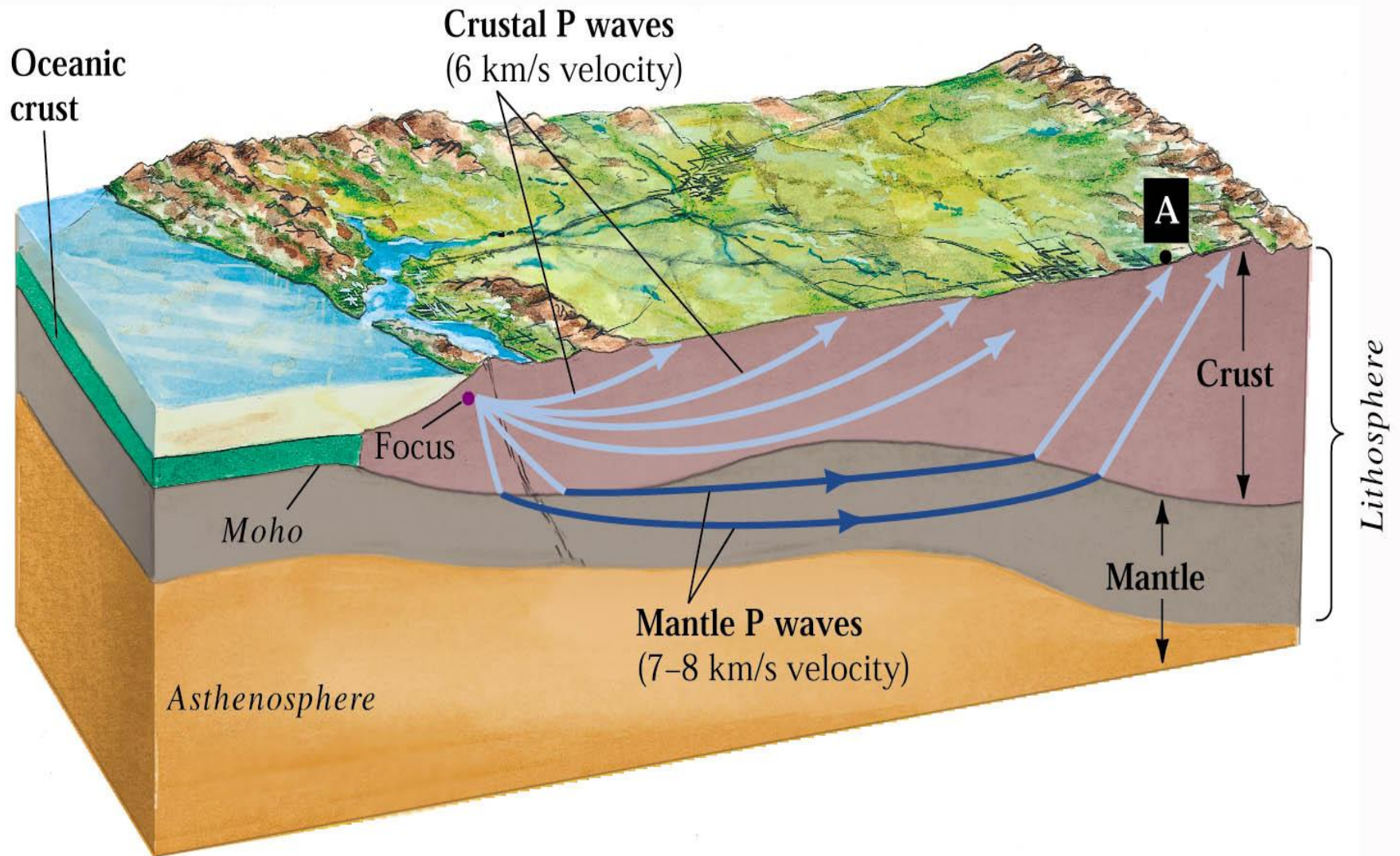
Falha Inversa



# Anatomia de um sismo



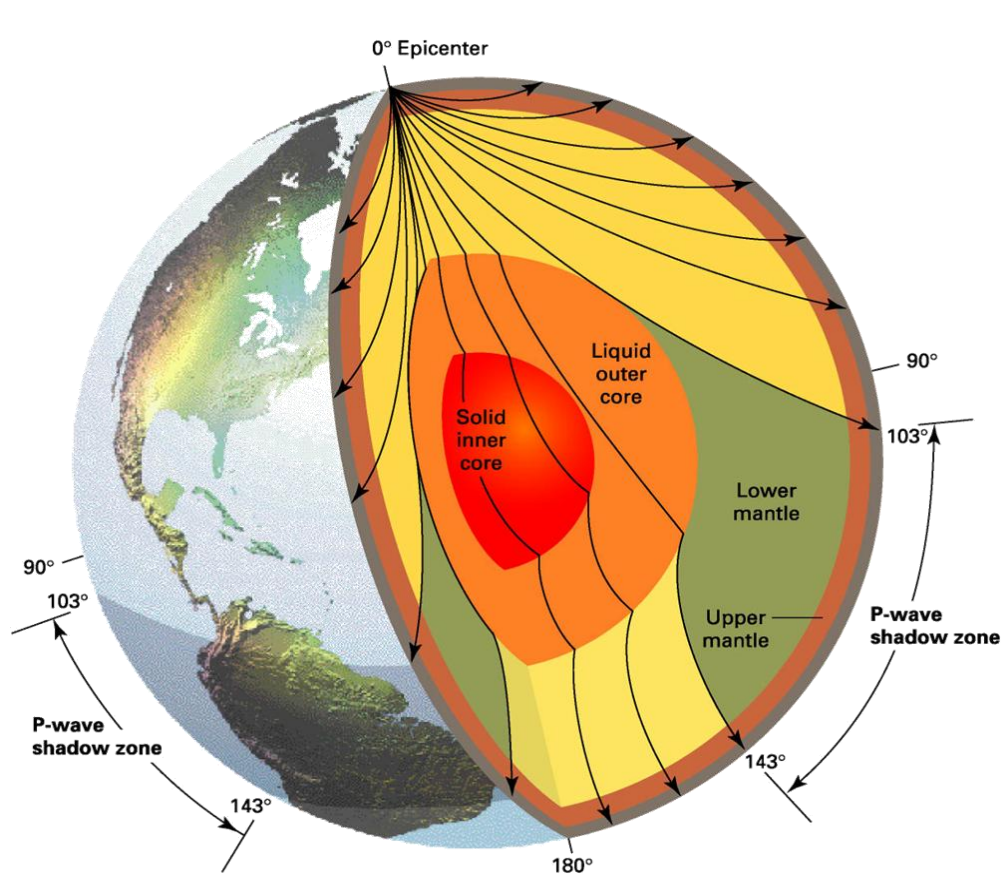
# Propagação de Ondas Sísmicas



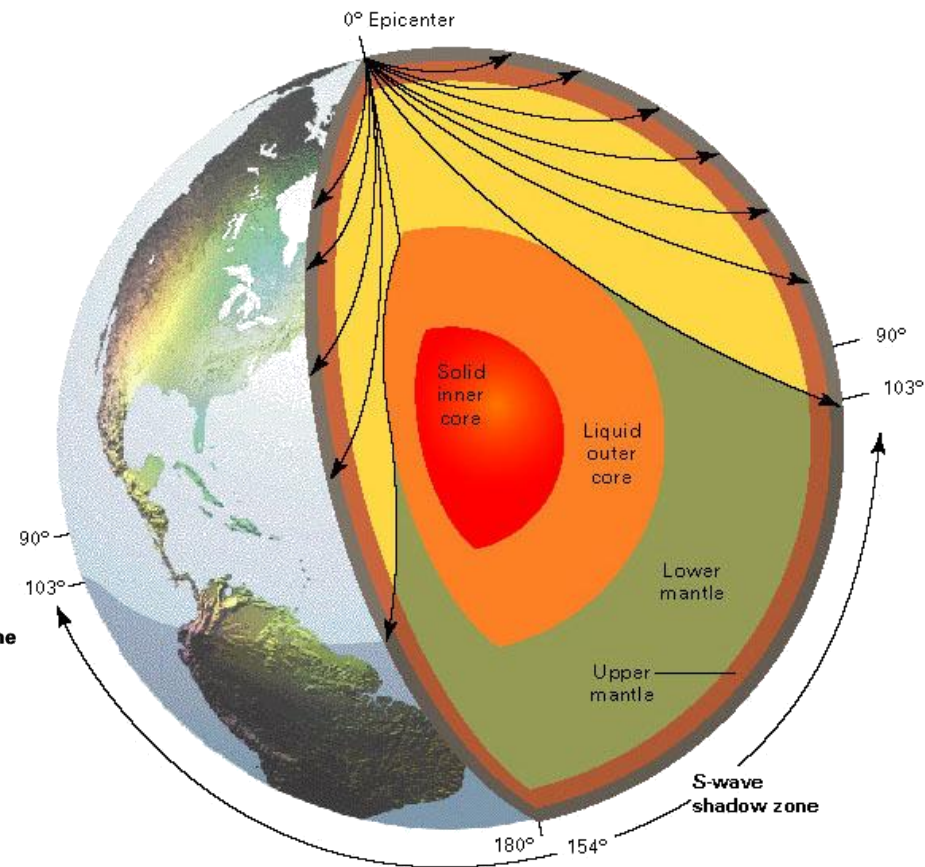


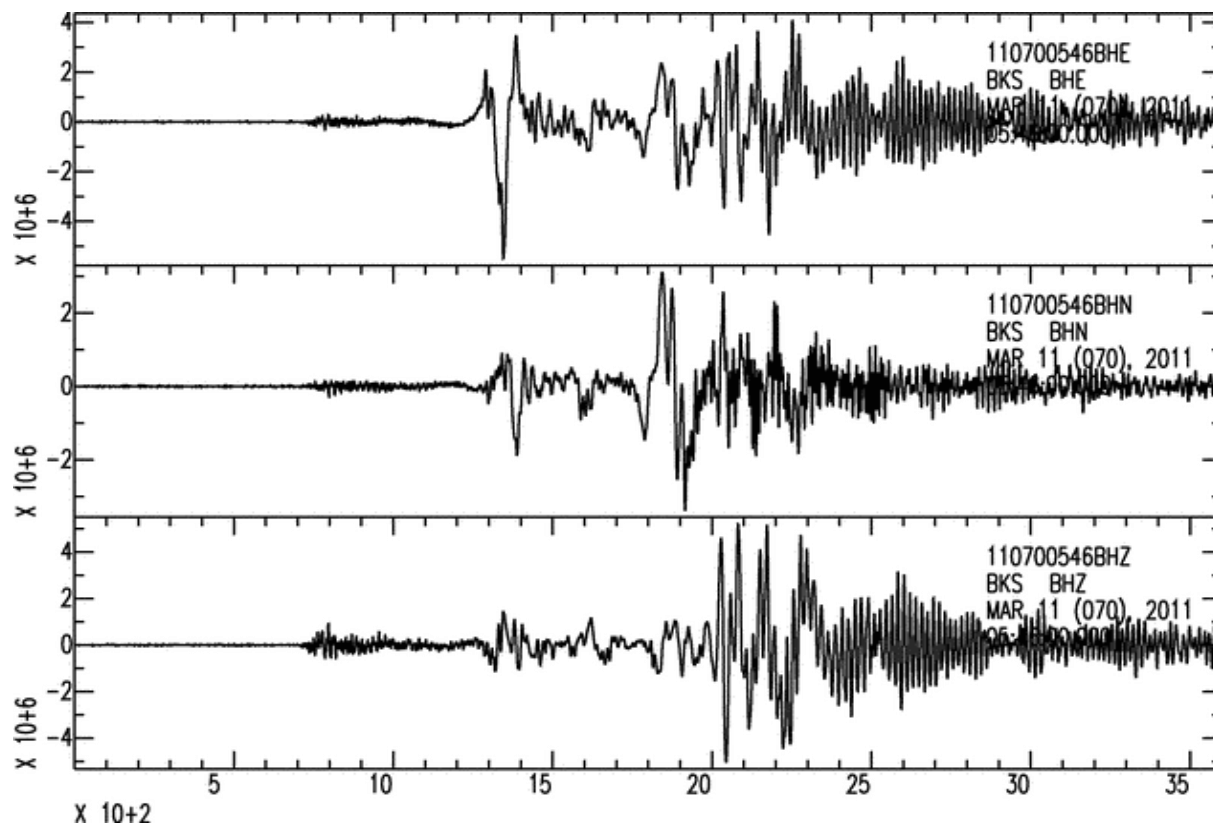
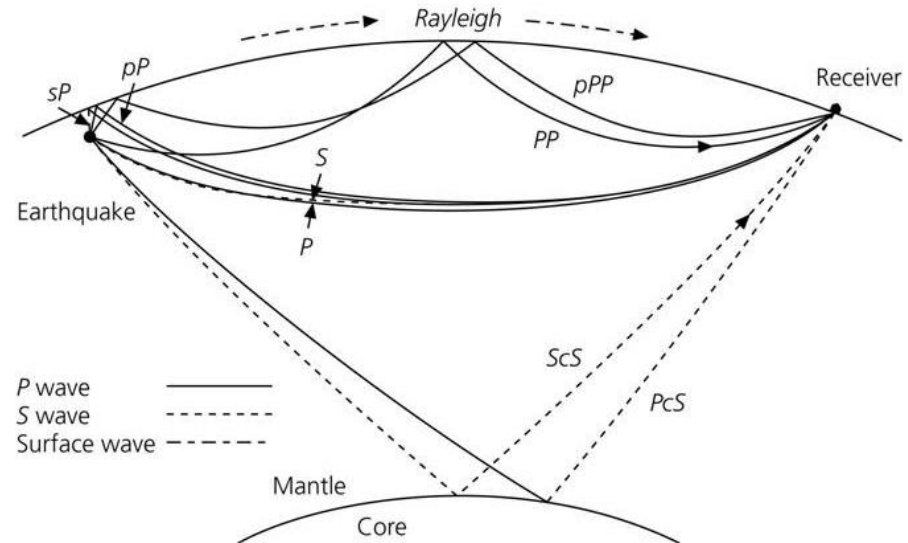
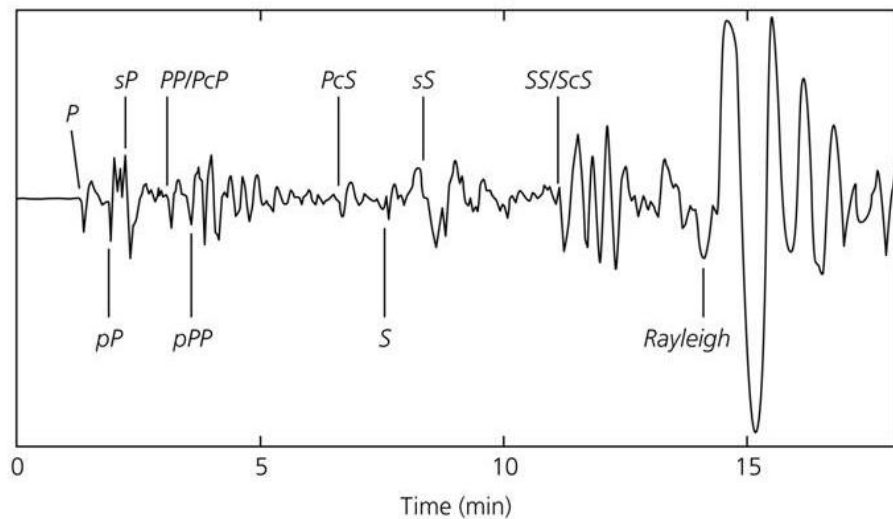
# Propagação de Ondas Sísmicas

## Ondas P



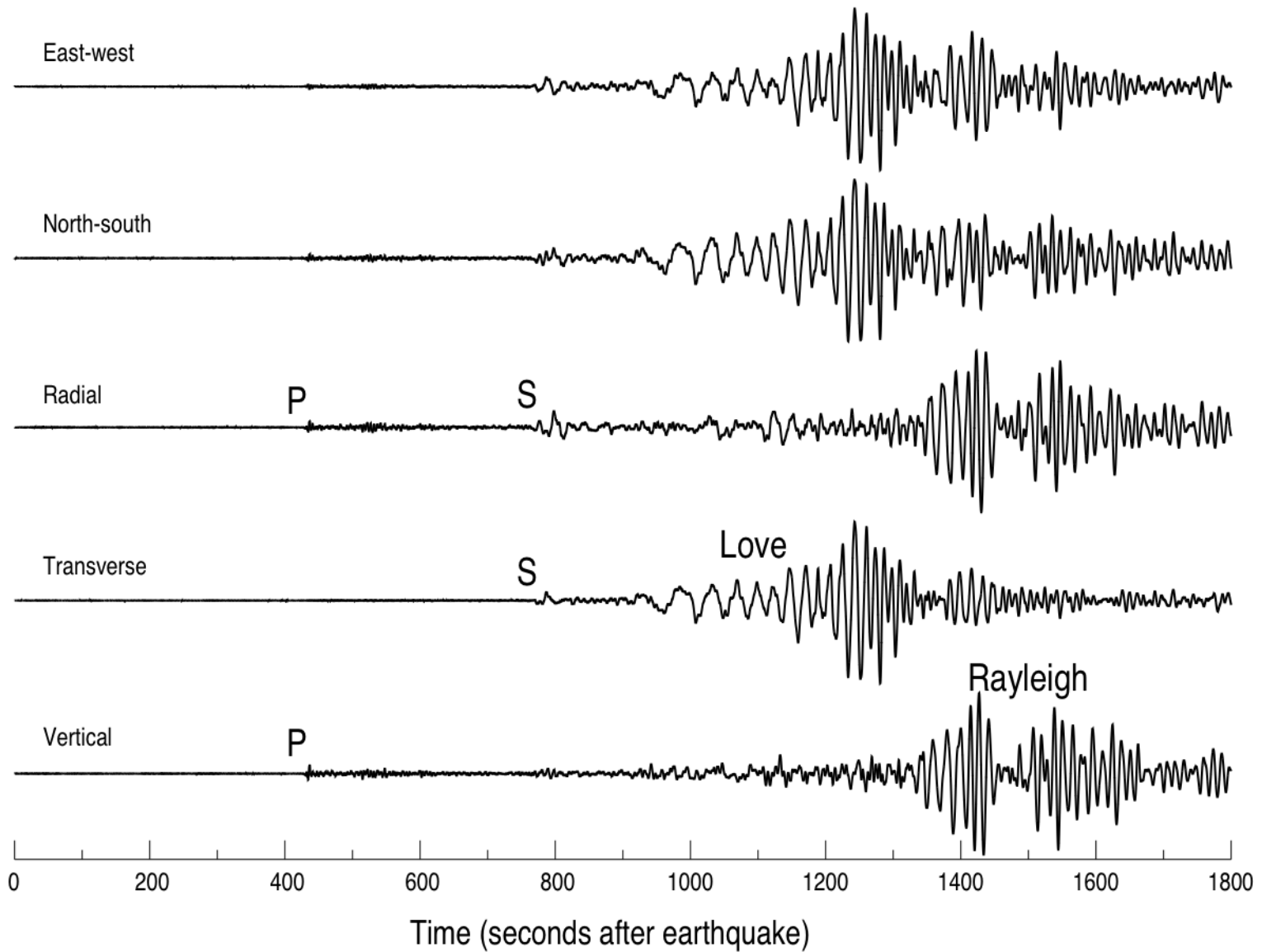
## Ondas S





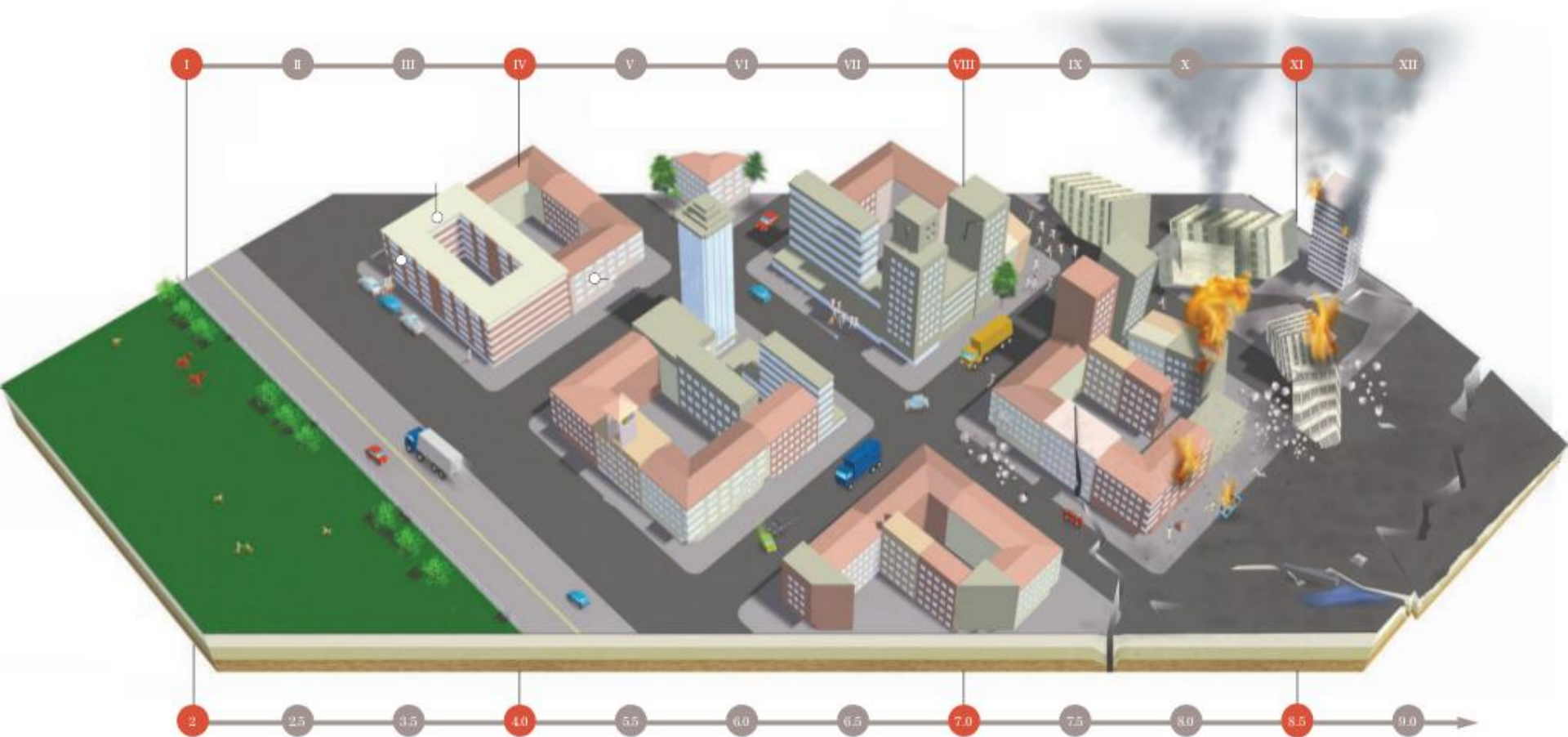


Haiti, Tuesday, January 12, 2010 at 21:53:09 UTC  
Recorded at Lac du Bonnet, Manitoba



# Intensidade e Magnitude

Intensidade



Magnitude

## 130°0'0"E 135°0'0"E 140°0'0"E 145°0'0"E



★ Epicenter

Academy of Disaster Reduction and Emergency Management,  
Beijing Normal University, P.R.China. 2011.3.17



# Frequencia dos Eventos

Magnitude	Número por ano	Energía Liberada (j/yr, aprox.)
>8	1	1,000
7 - 7.9	12	100
6 - 6.9	110	30
5 - 5.9	1400	5
4 - 4.9	13,500	1
3 - 3.9	>130,000	0.2
2 - 2.9	> 1,300,000	< 0.05
Stein & Wyssession, 2003		



## IAG-USP 2010 & Future BRASIS Project:

- 55 BB permanent real-time stations to be installed by four institutions



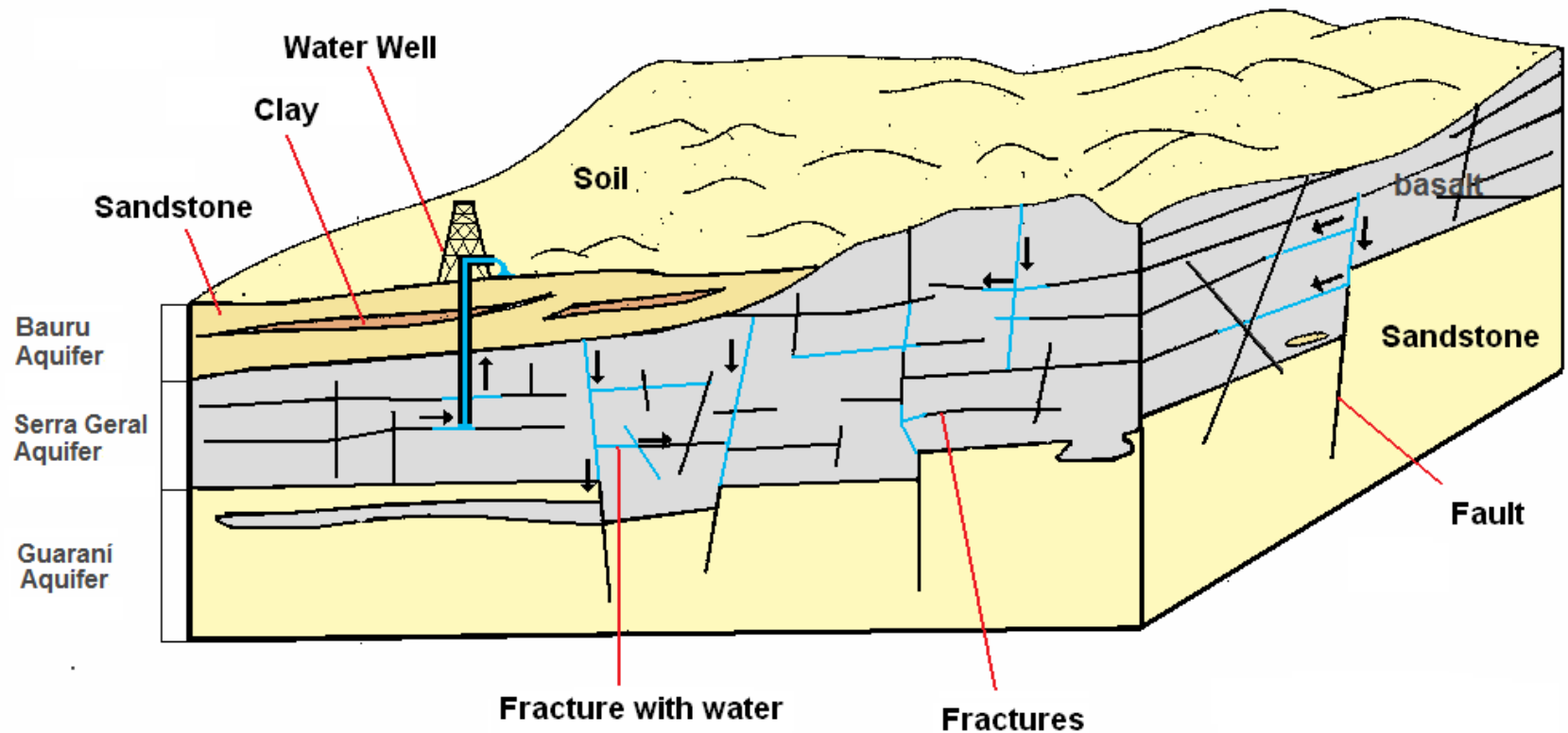
-Study Brazilian seismicity, locating all magnitudes 3+

-Studies of crust and upper mantle structure.

## Stations



# Ex: Modelo Geológico Bebedouro, SP



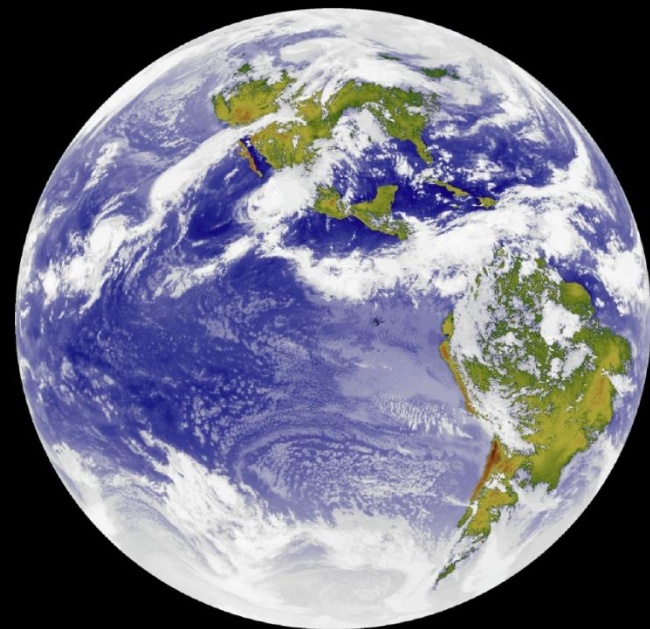


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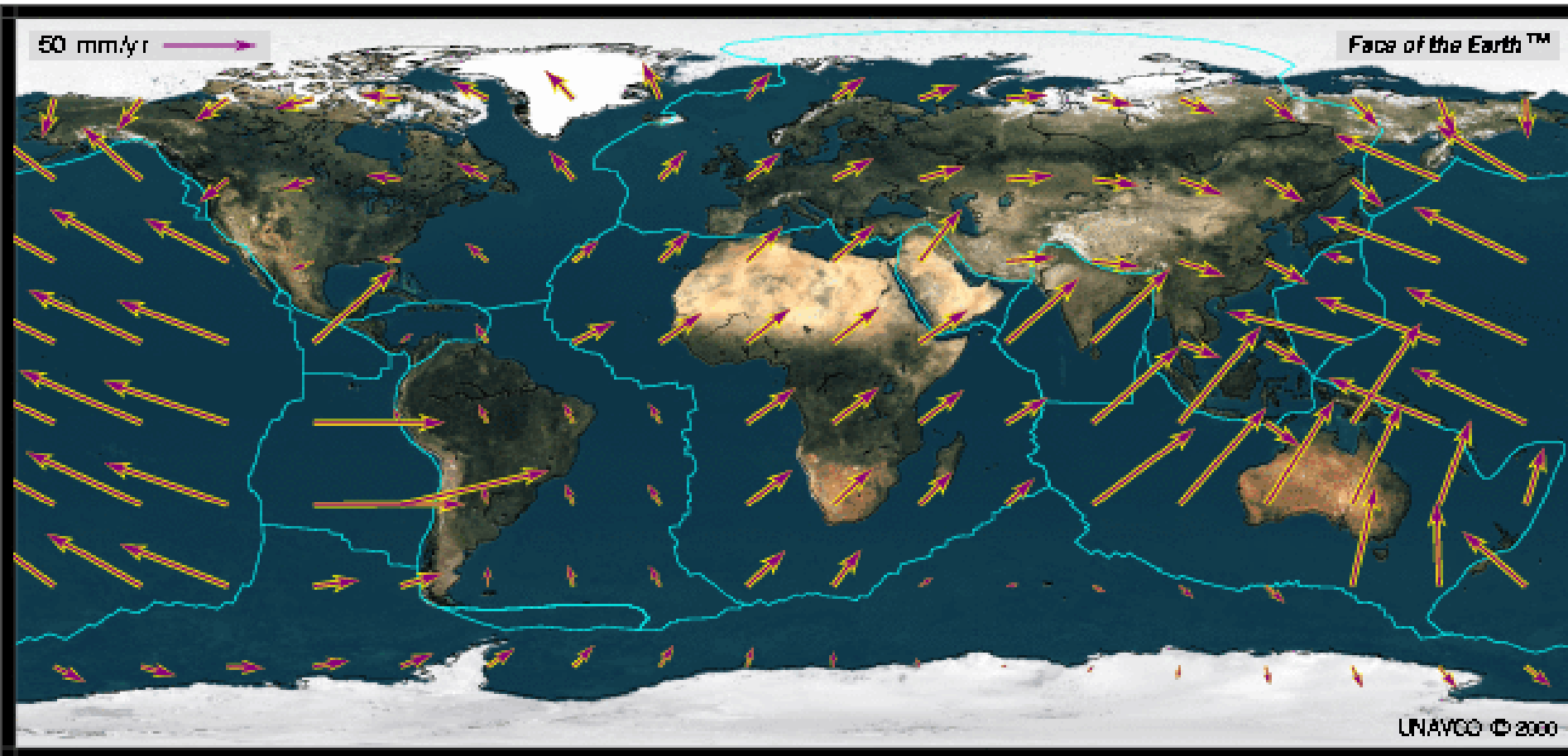
F Í S I C A

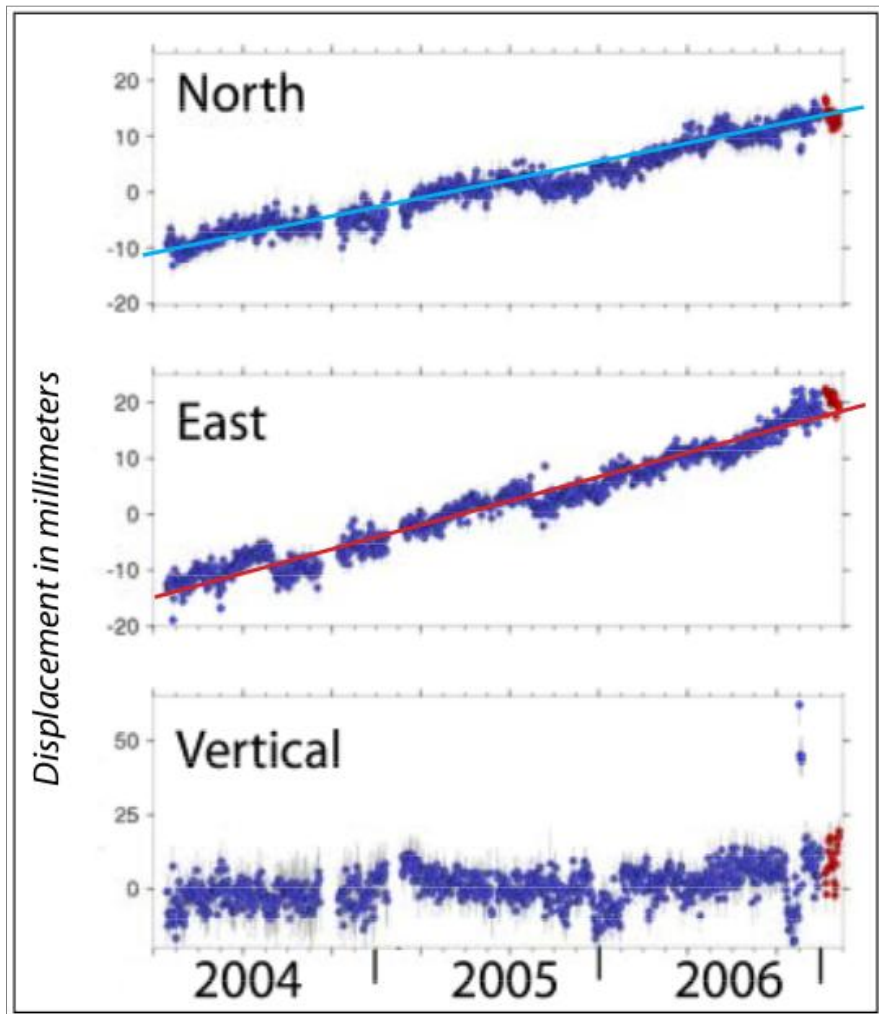


# GEODESIA

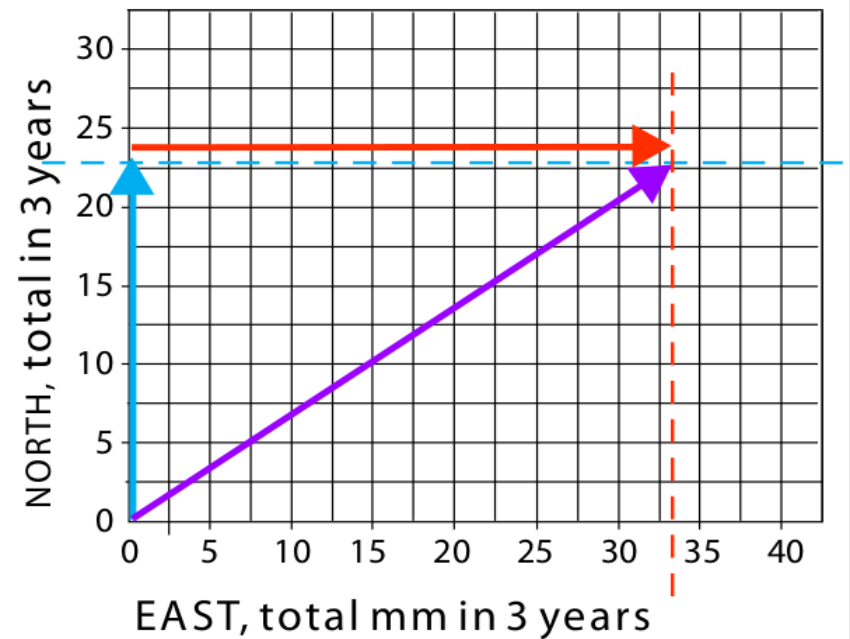
## GPS - INSAR

# Uso do GPS no monitoramento do deslocamento das placas tectônicas.





**NORTH:** 23 mm  
**EAST:** 33 mm  
**ACTUAL:** 37 mm to East-northeast



O movimento registrado numa estação de GPS no estado de Washington, USA. Mostrando que esta area esta sendo empurrada de volta para o nordeste pela subducção da placa de Juan de Fuca

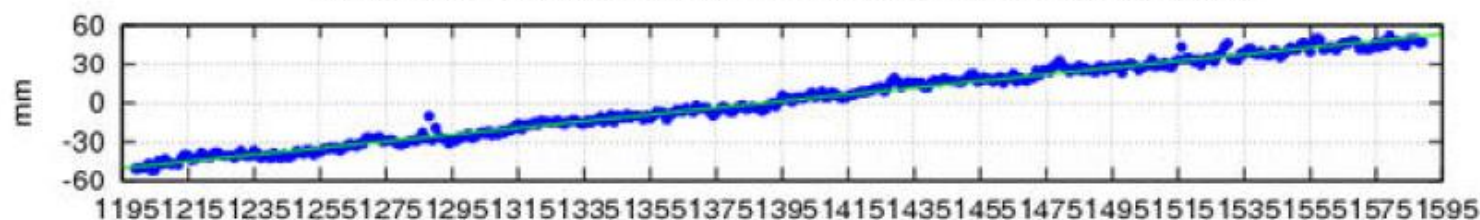


# SÉRIE TEMPORAL – BRAZ (BRASÍLIA)

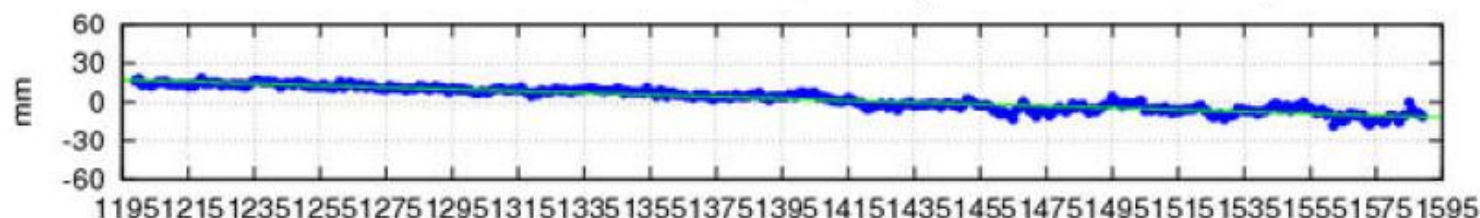


BRAZ - Velocidade Planimetrica  $0.01399 \pm 1e-04$  m/ano

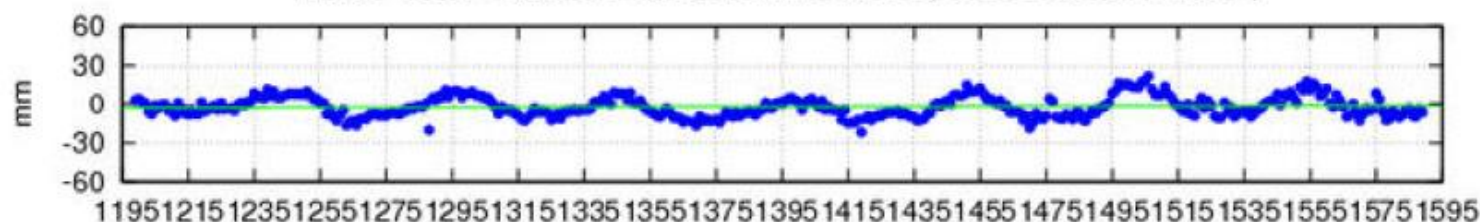
Norte - Coef =  $0.25841 \pm 0.0014$  mm/semana ( $0.01347 \pm 7e-05$  m/ano )



Leste - Coef =  $-0.07243 \pm 0.00132$  mm/semana ( $-0.00378 \pm 7e-05$  m/ano )



Altura - Coef =  $0.00382 \pm 0.00328$  mm/semana ( $2e-04 \pm 0.00017$  m/ano )



Semana GPS



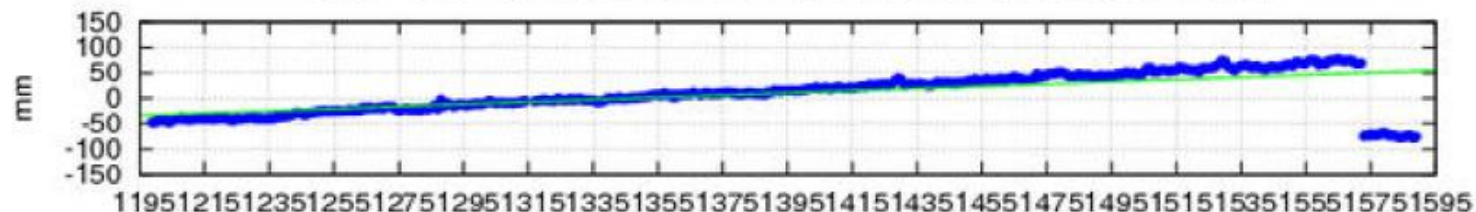


# SÉRIE TEMPORAL: SANT (SANTIAGO)

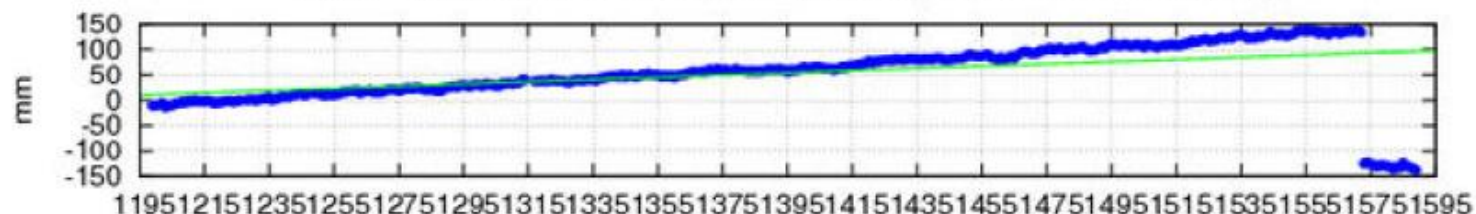


SANT - Velocidade Planimetrica  $0.01626 \pm 0.0022$  m/ano

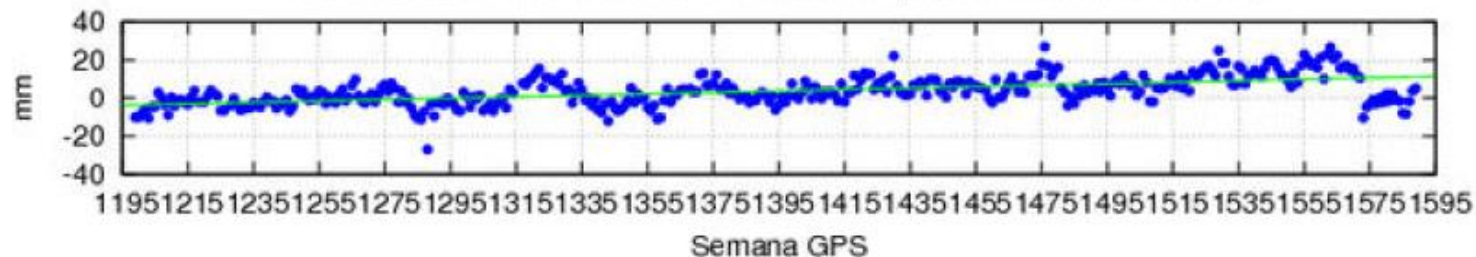
Norte - Coef =  $0.22217 \pm 0.02103$  mm/semana ( $0.01158 \pm 0.0011$  m/ano )



Leste - Coef =  $0.21876 \pm 0.03666$  mm/semana ( $0.01141 \pm 0.00191$  m/ano )



Altura - Coef =  $0.03808 \pm 0.0031$  mm/semana ( $0.00199 \pm 0.00016$  m/ano )



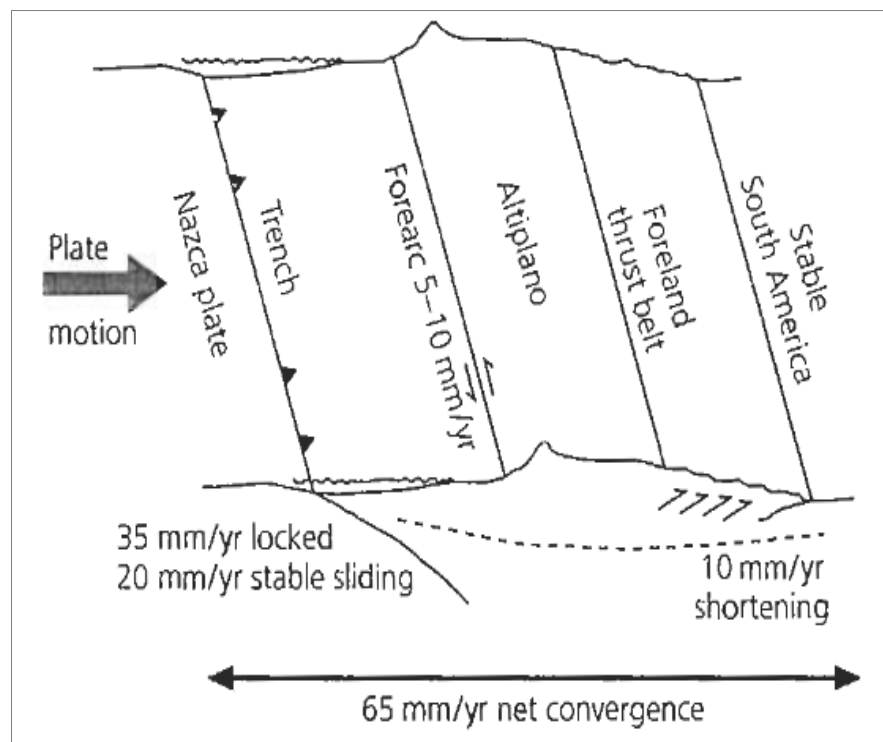
**Deslocamento Planimétrico: 28,4 cm (325 km)**



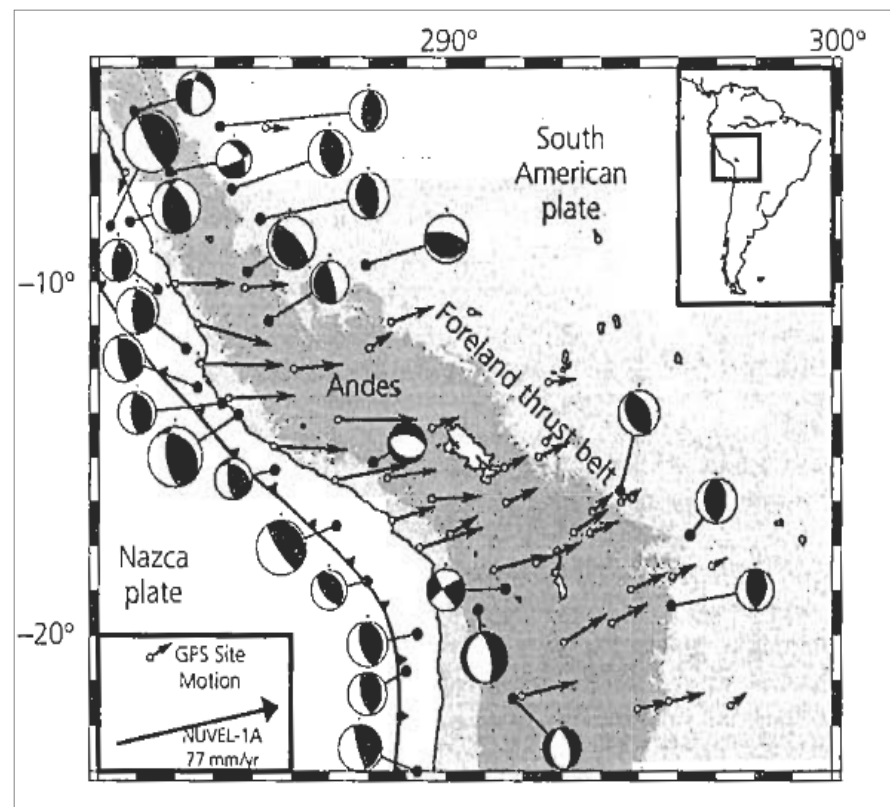
# PRINCIPAIS DESLOCAMENTOS PLANIMÉTRICOS

Estação	Local	Dist. ~ (km)	Desloc. (cm)
CONZ	Concepción – Chile	115	297,8
SANT	Santiago – Chile	325	28,4
MZAS	San Rafael – Arg.	415	20,5
MZAC	Mendoza – Arg.	460	11,6
MZAE	Santa Rosa – Arg.	490	11,0
VALP	Valparaíso – Chile	290	7,7
LHCL	Lihuel Calel – Arg.	700	7,4
SL01	La Punta – Arg.	650	6,7
SRLP	Santa Rosa – Arg.	780	6,2
CSLO	Leoncito – Arg.	520	4,4
CFAG	Caucete – Arg.	610	4,0
VBCA	Bahia Blanca – Arg.	1000	3,6
UNSJ	Salta – Arg.	600	3,3
BRASIL	0,5 a 1,5 cm		





Velocidades de deslocamento em relação ao estável placa Sulamericana (Norrabuena et al, 1998. Science 279, 358-62, 1998), model Nuvel 1A (DeMets et al., 1994)

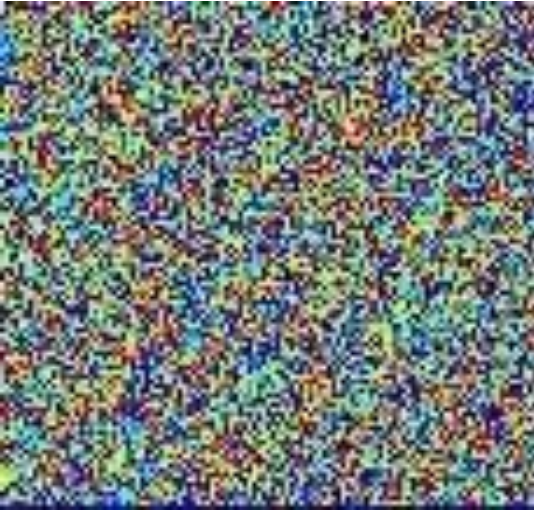


Seção cruzada mostrando a distribuição das velocidades inferidas de dados GPS. Figuras adaptadas de Stein e Wyssession, (2003)

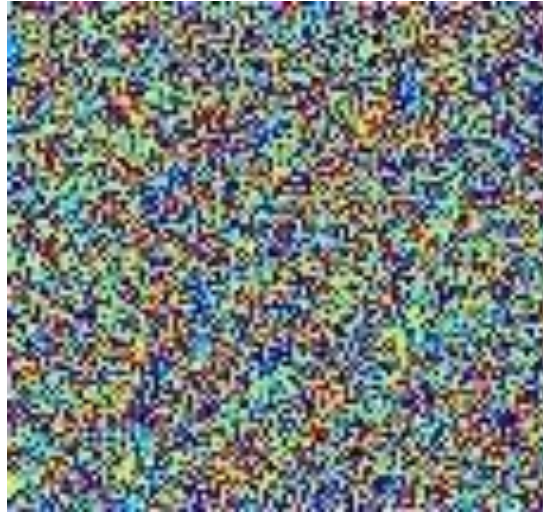
# Interferometria InSAR

Processo para obter um interferograma

fase “master”



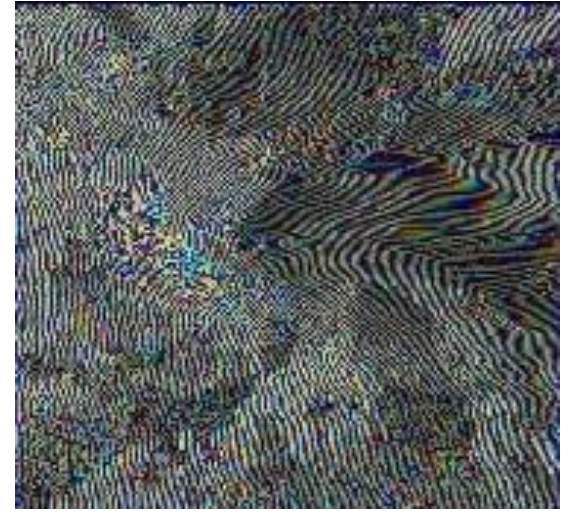
fase “slave”



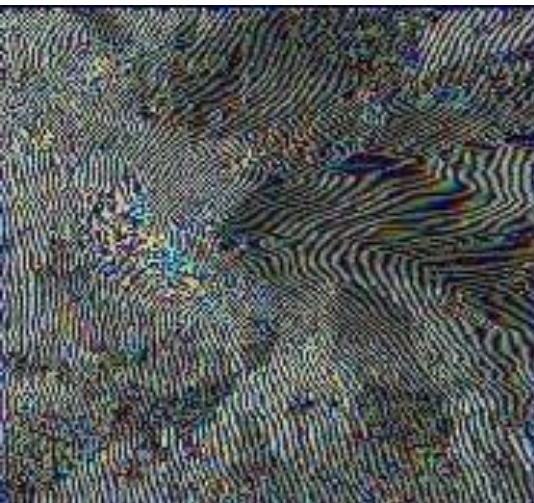
-

=

Interferograma de fase

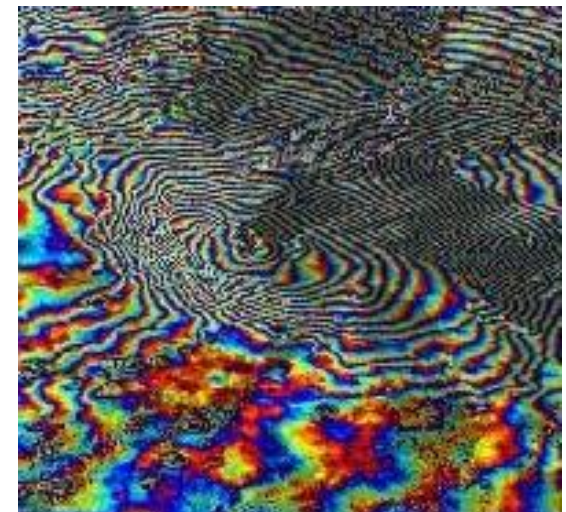
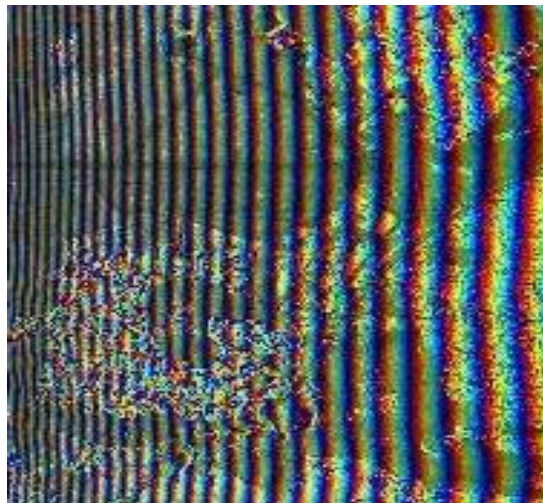


Próximo remover o efeito de terra plana ao interferograma e fase.



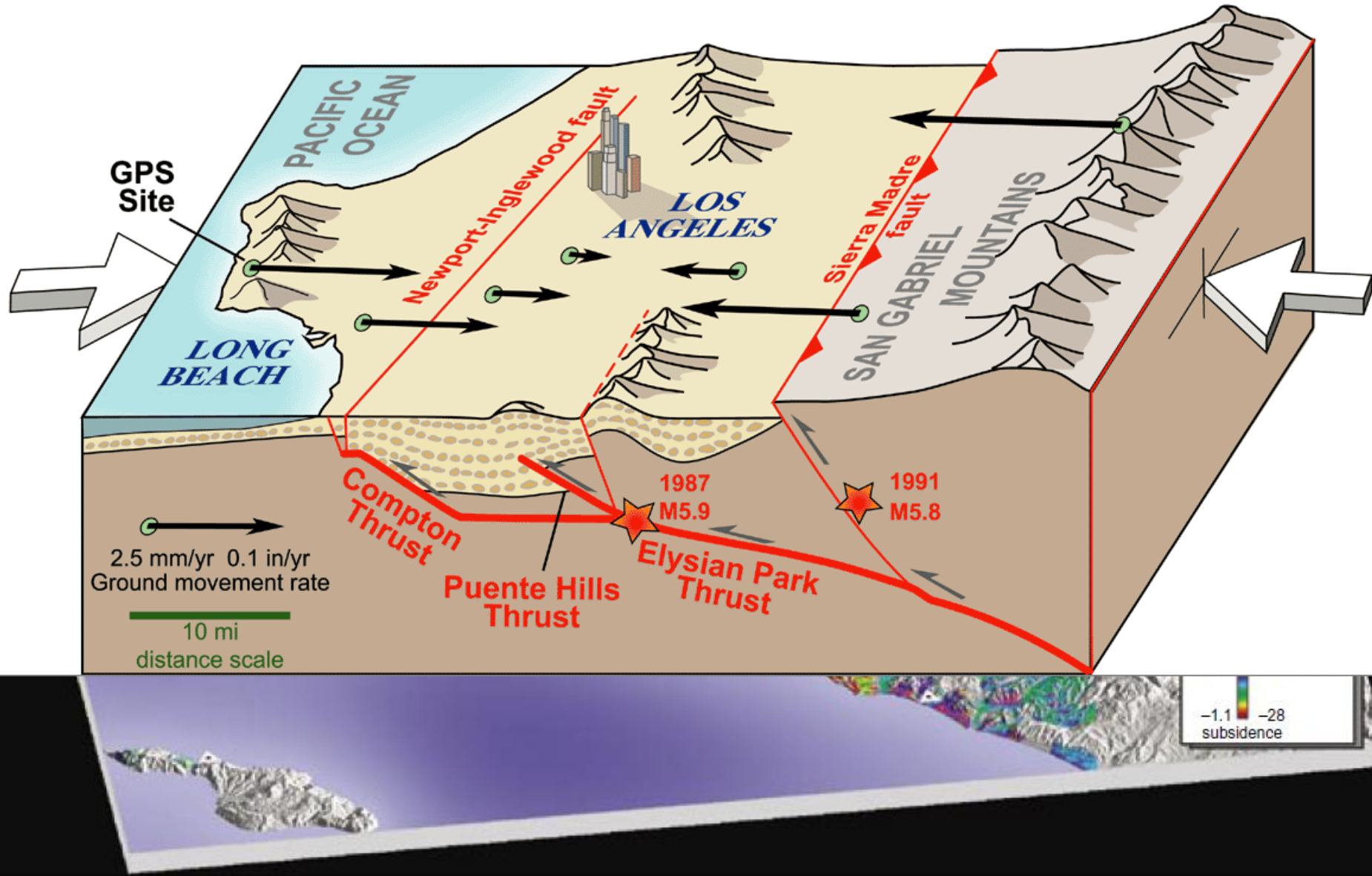
-

=



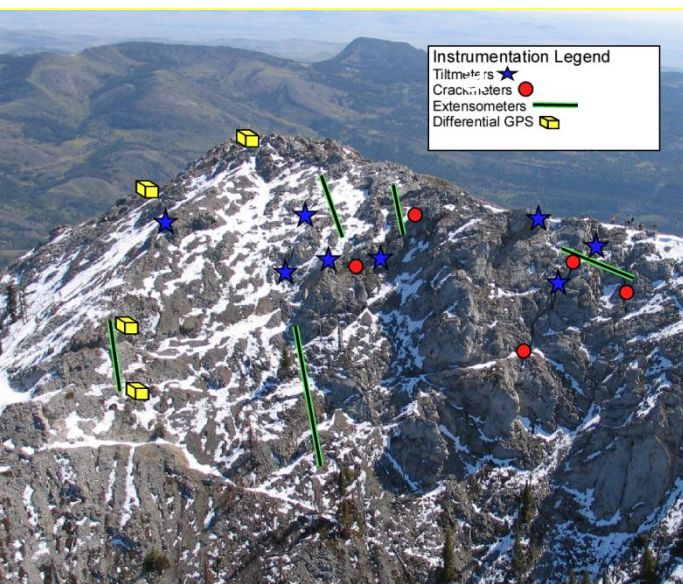


# Exemplo de Interferometria InSAR

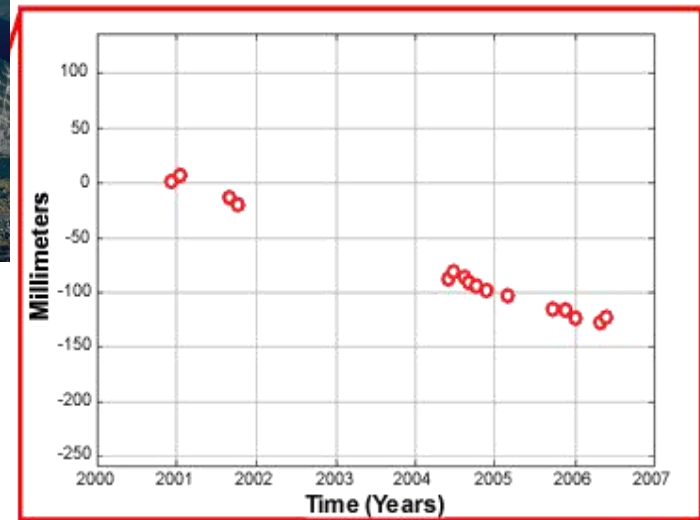




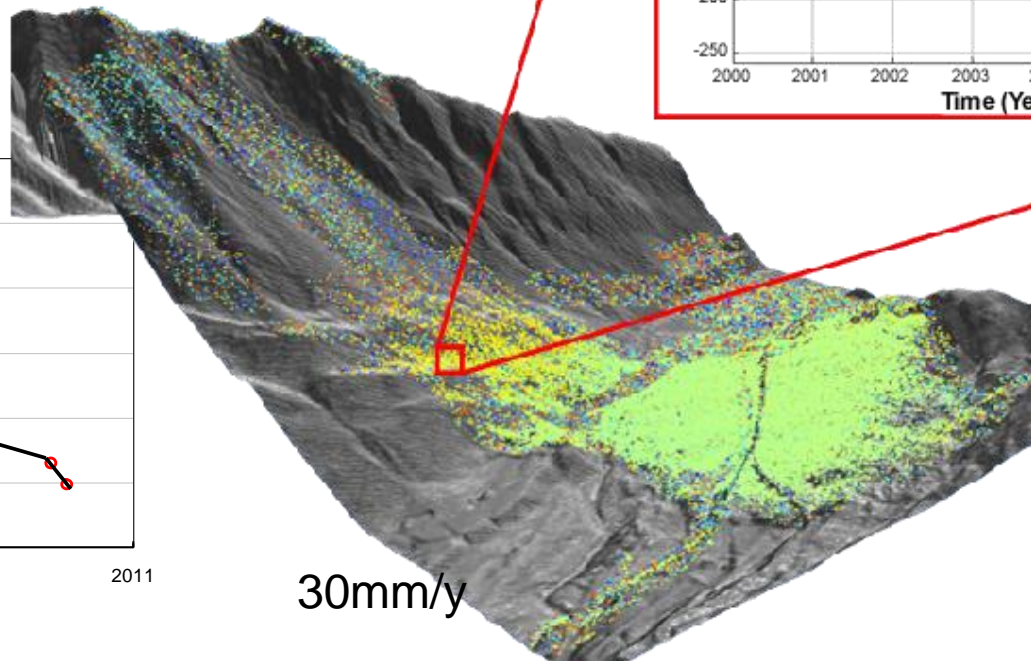
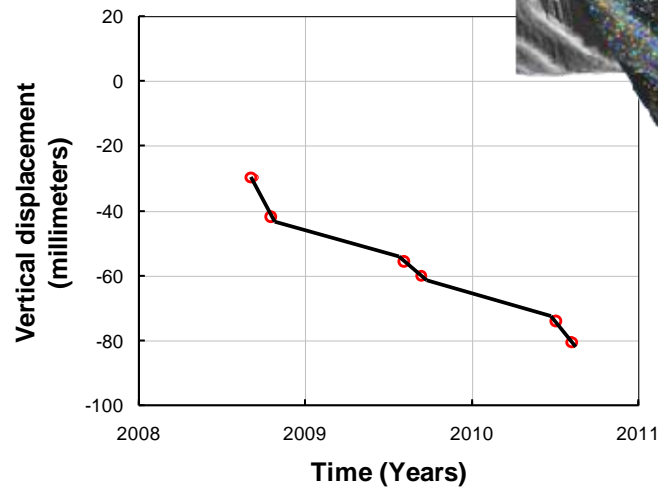
# Monitorando subsidencia com InSAR



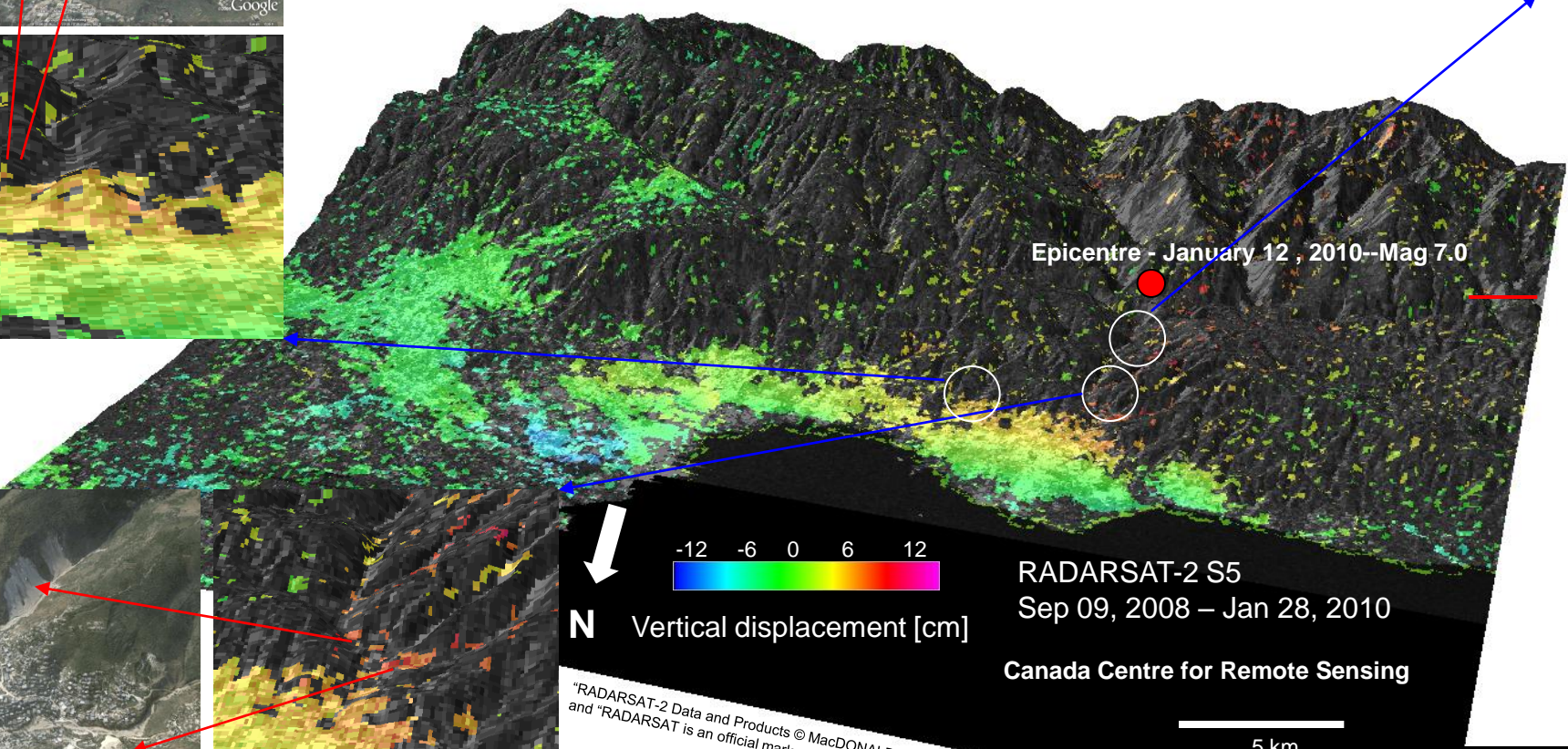
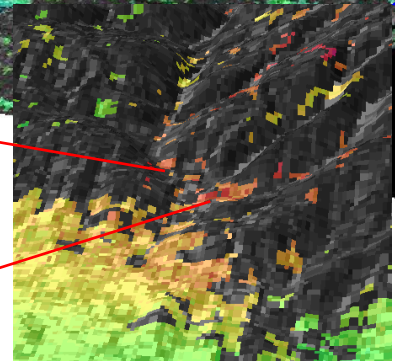
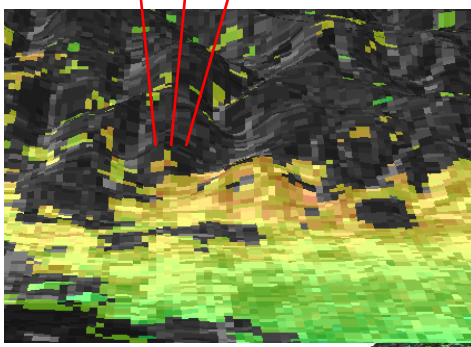
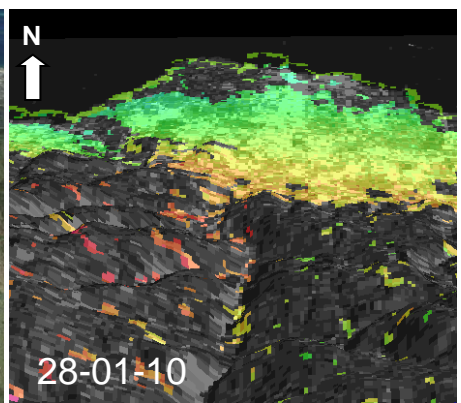
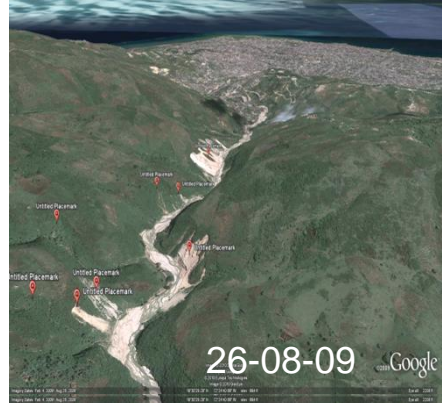
## RADARSAT-1



## RADARSAT 2







"RADARSAT-2 Data and Products © MacDONALD, DETTWILER AND ASSOCIATES LTD. (2010) – All Rights Reserved"  
and "RADARSAT is an official mark of the Canadian Space Agency"

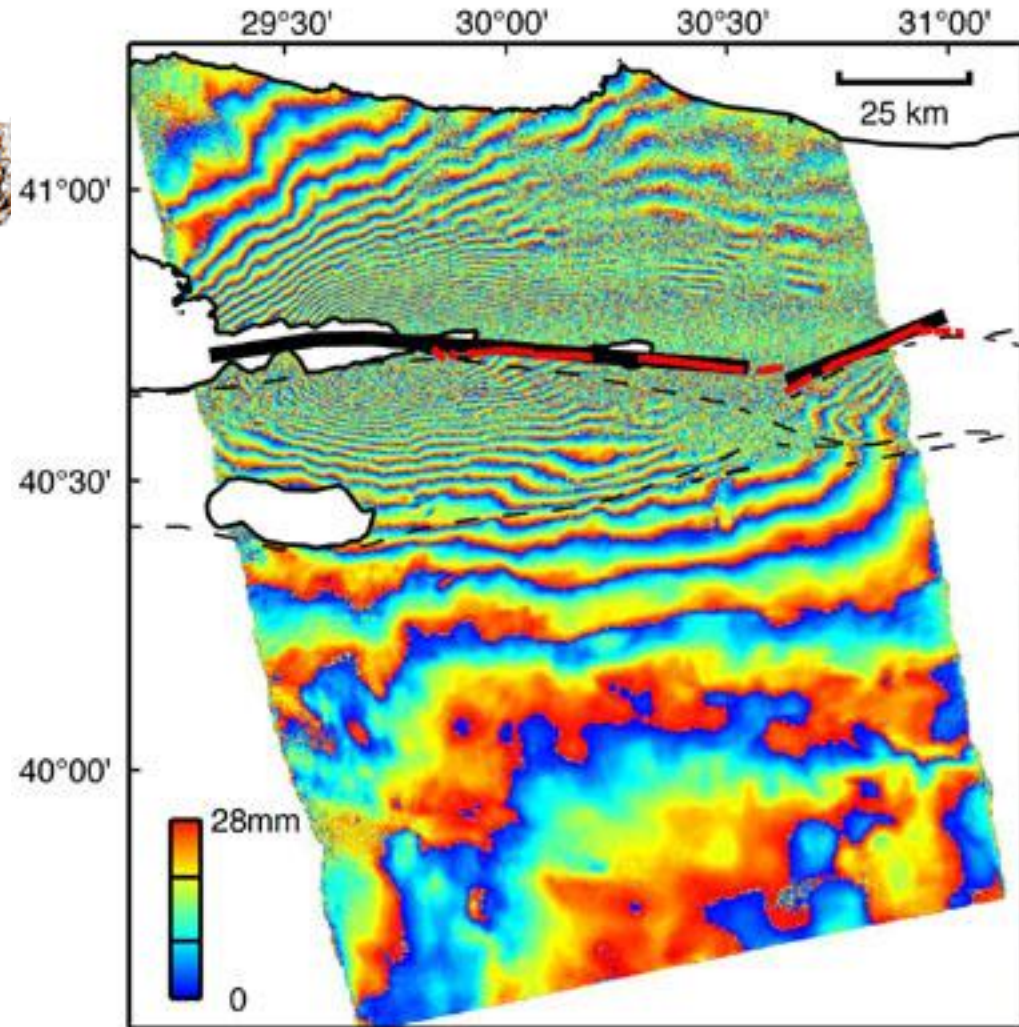
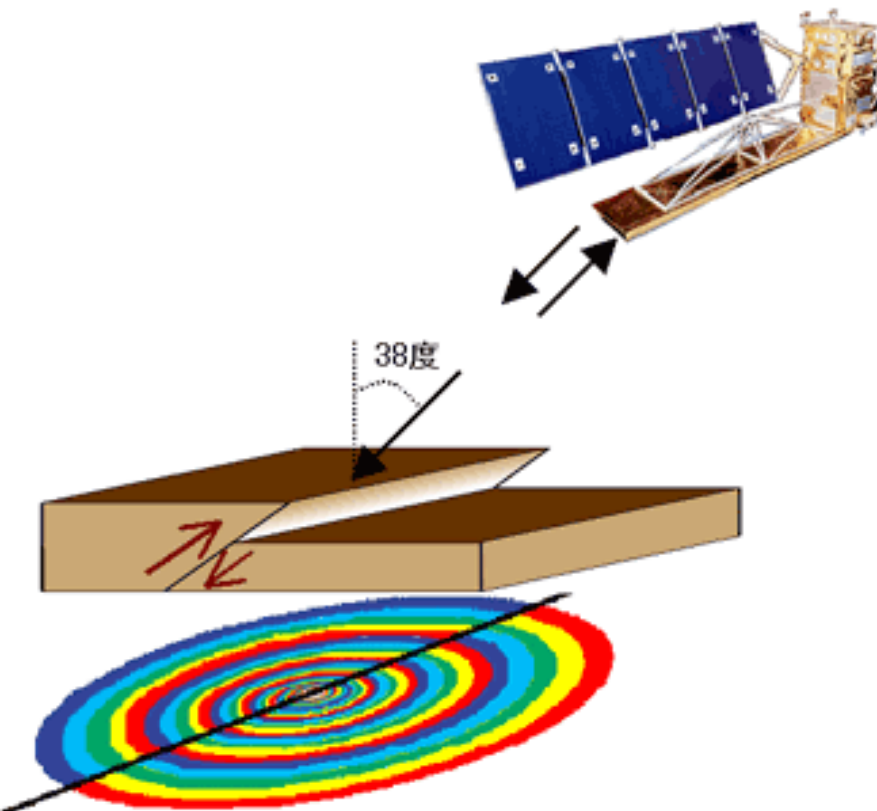
# RADARSAT-2 Vertical Displacement Map – Port-au-Prince - Haiti

Singhroy and Pavlic, CCRS, Feb 2010





# Izmit – Turkey, 1999





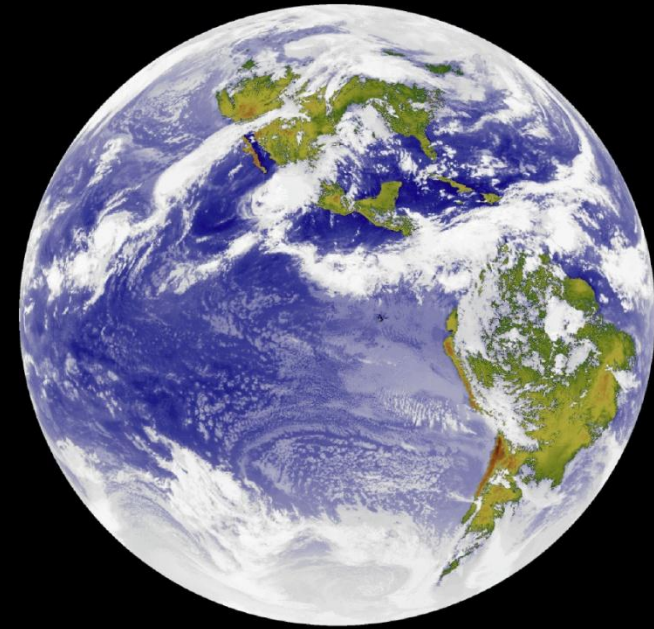


IAG - USP

G E O

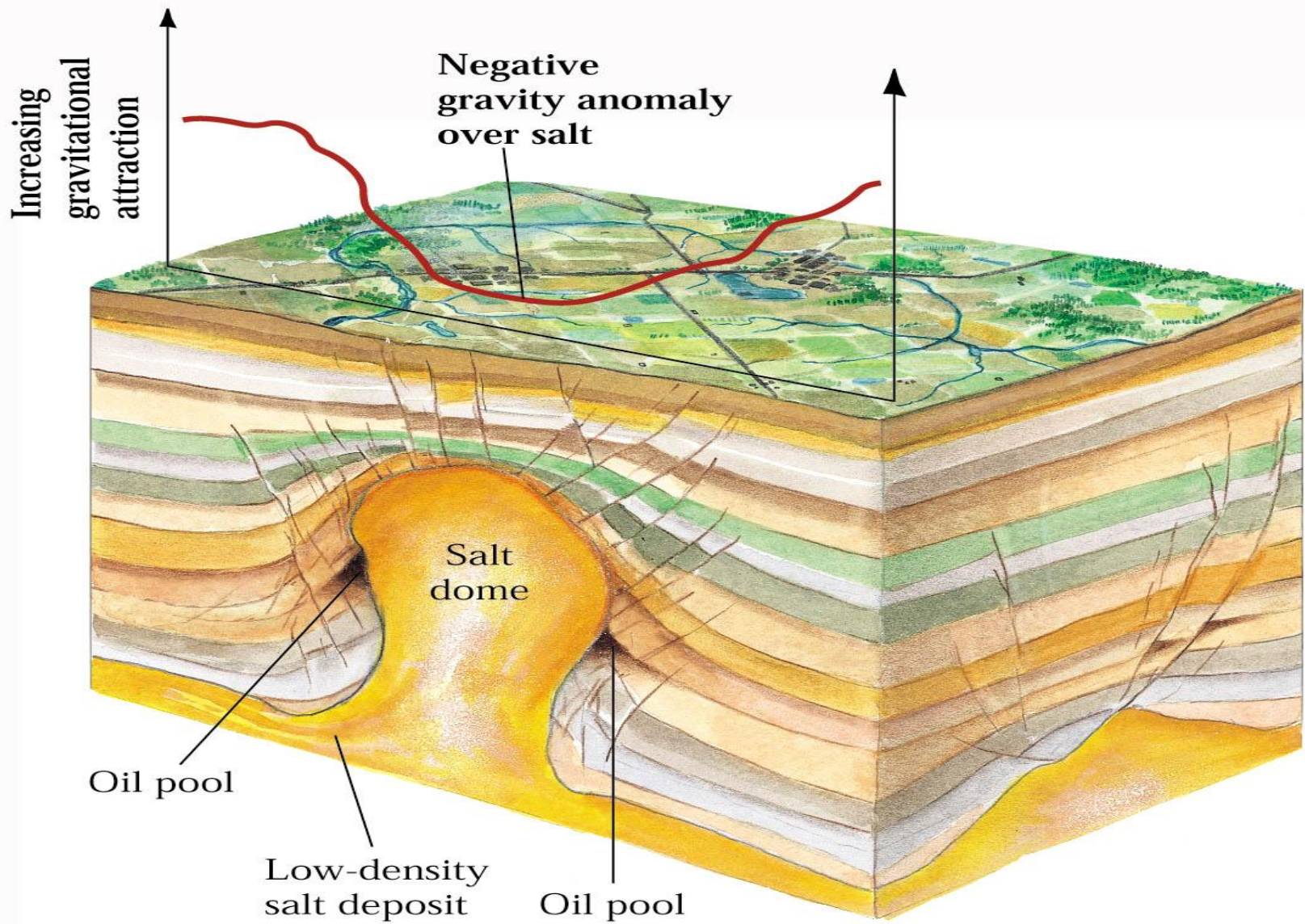


F Í S I C A



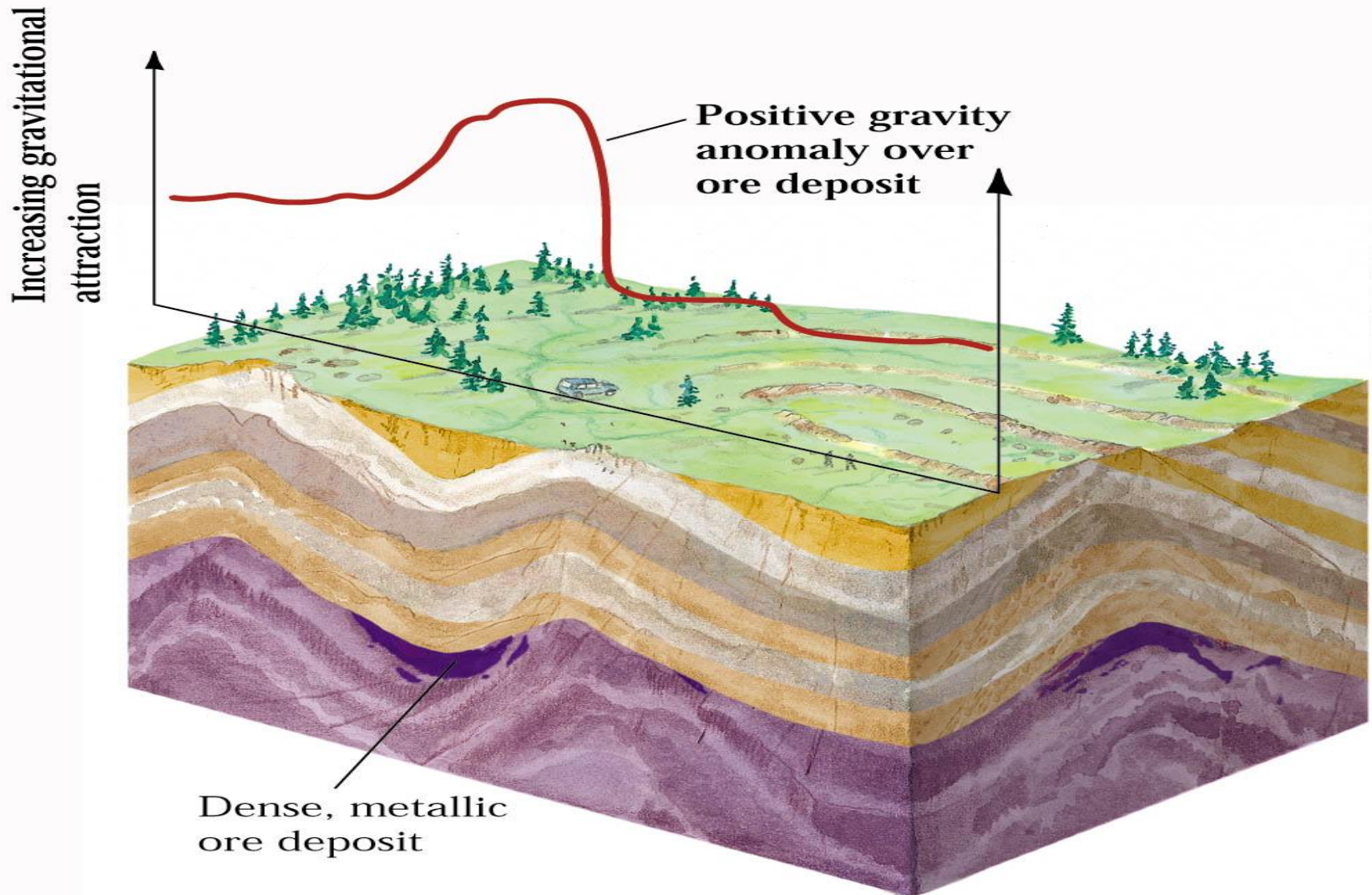
# GRAVIMETRIA

# Anomalia de Gravidade

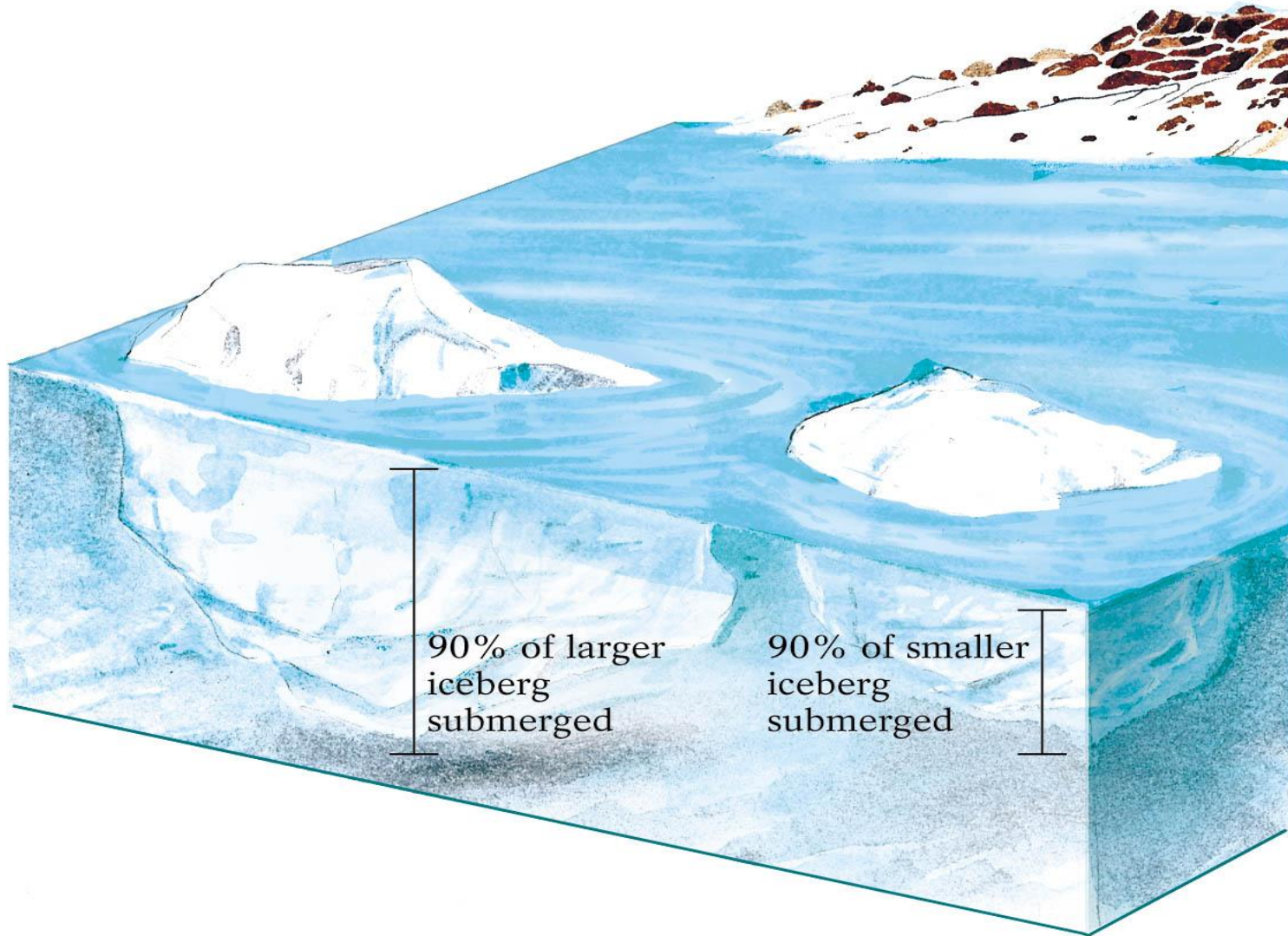




# Anomalia de Gravidade

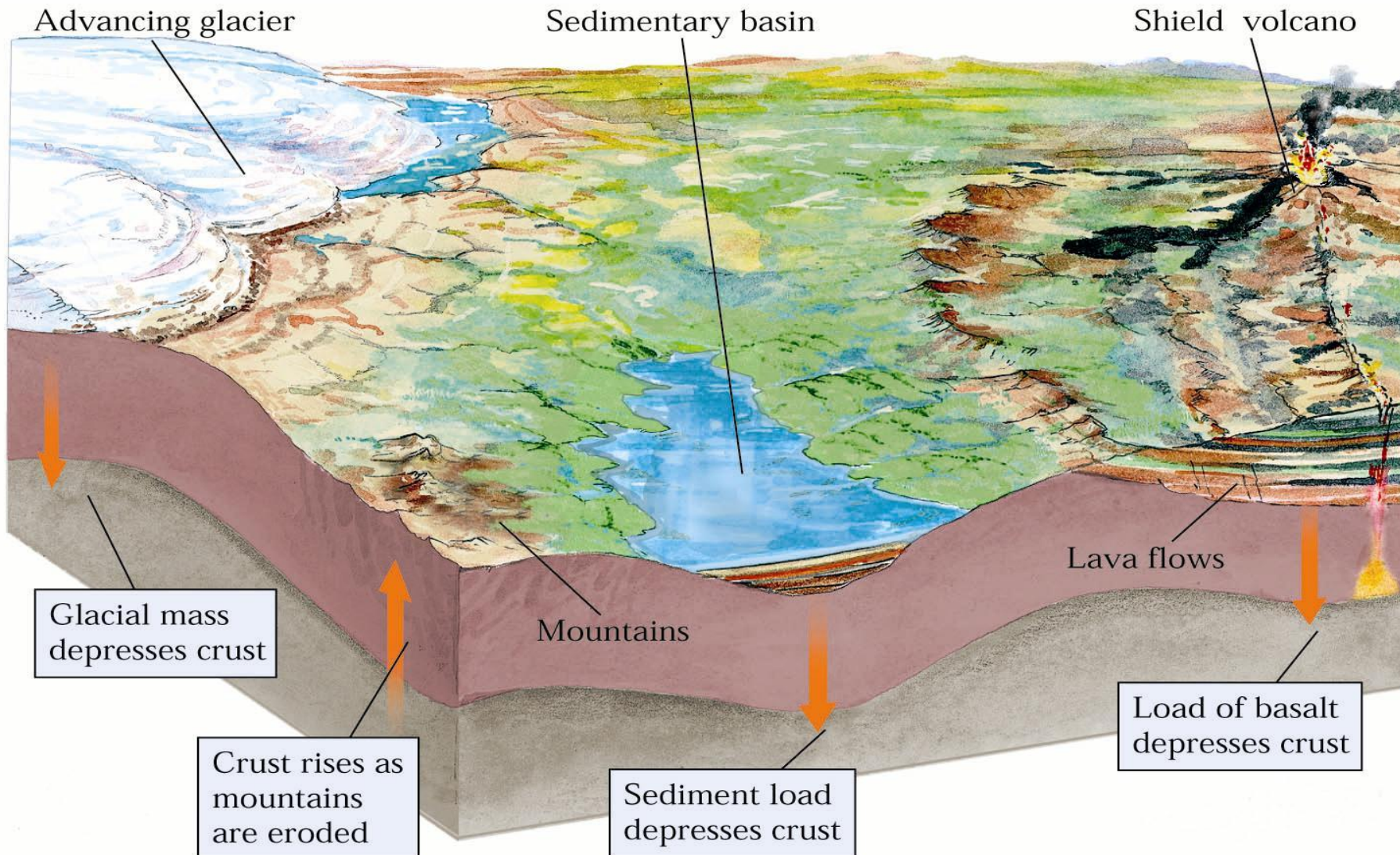


# Isostasia



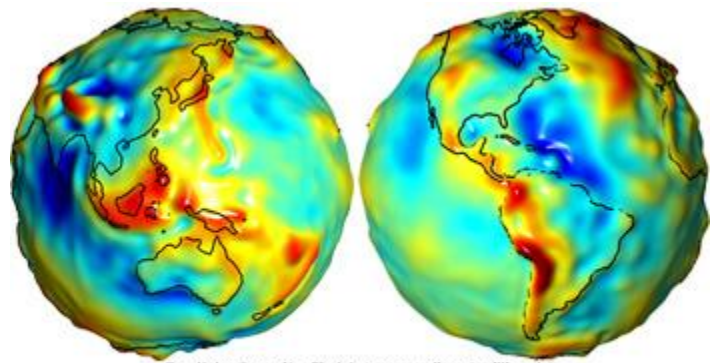


# Isostasia





# Forma da terra



<- Geoide

