

I “cambiamenti climatici ” e la vulnerabilità

Il caso del Vietnam e del Benin

Pierre OZER

**Department of Environmental Sciences and Management
University of Liege, Arlon, Belgium
pozer@ulg.ac.be**

***Accademia Ligure di Scienze e Lettere
Palazzo Ducale, Genova, Italia, 3 December 2013***

Vulnerabilità ?

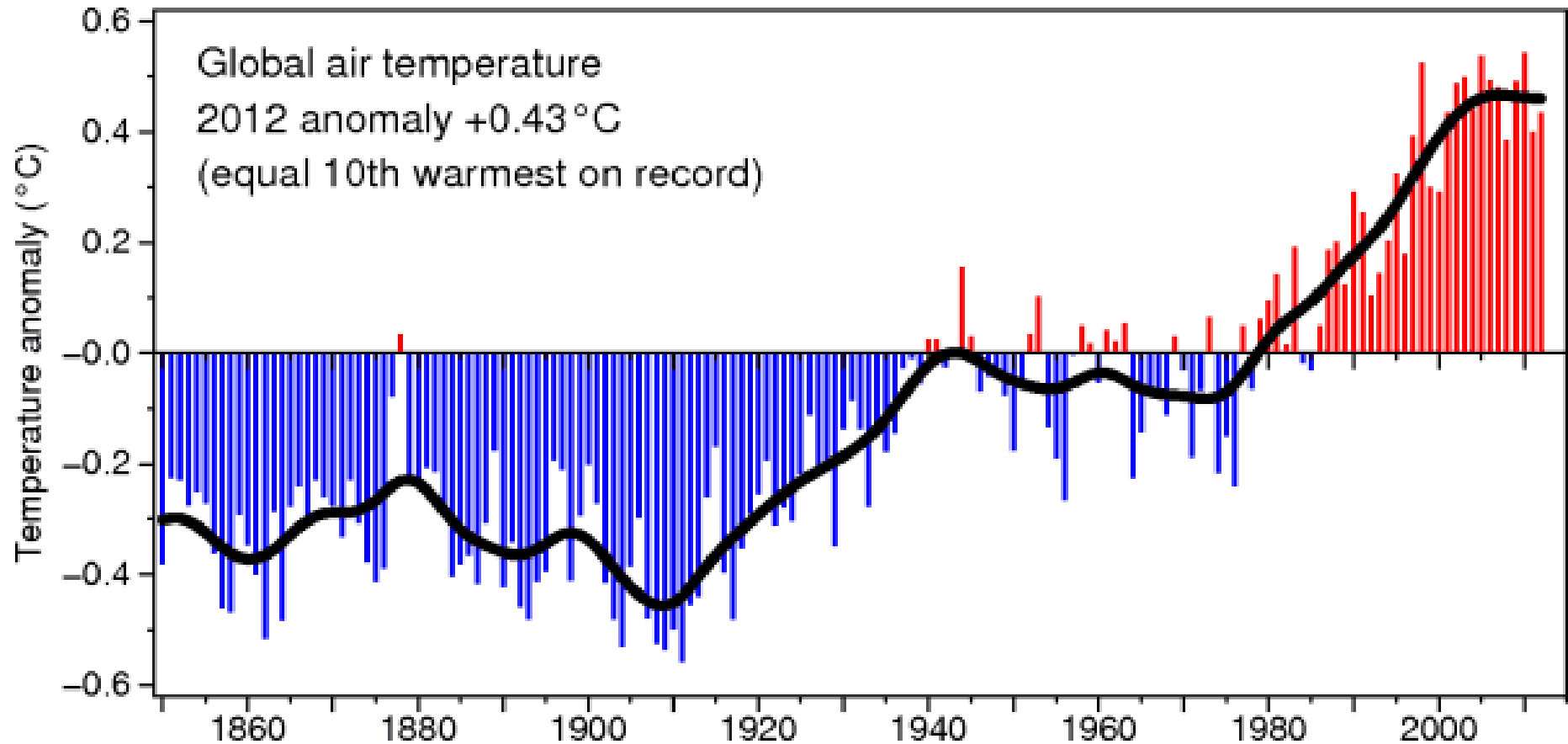
La vulnerabilità è l'esposizione, la conoscenza del rischio e la capacità di adattamento degli individui e / o gruppi collettivi e / o autorità (di sistema) allo stress sostenuto a causa degli effetti dei cambiamenti climatici e dei cambiamenti socio-economici e ambientali consecutivi.

- ❑ *Esposizione*: la natura e il grado in cui un sistema sperimenta impatti dei cambiamenti climatici;
- ❑ *La conoscenza del rischio*: il grado di conoscenza / comprensione di come un sistema potrebbe essere influenzata da impatti dei cambiamenti climatici;
- ❑ *Capacità di adattamento*: la capacità del sistema di far fronte alle sollecitazioni indotte da impatti dei cambiamenti climatici.

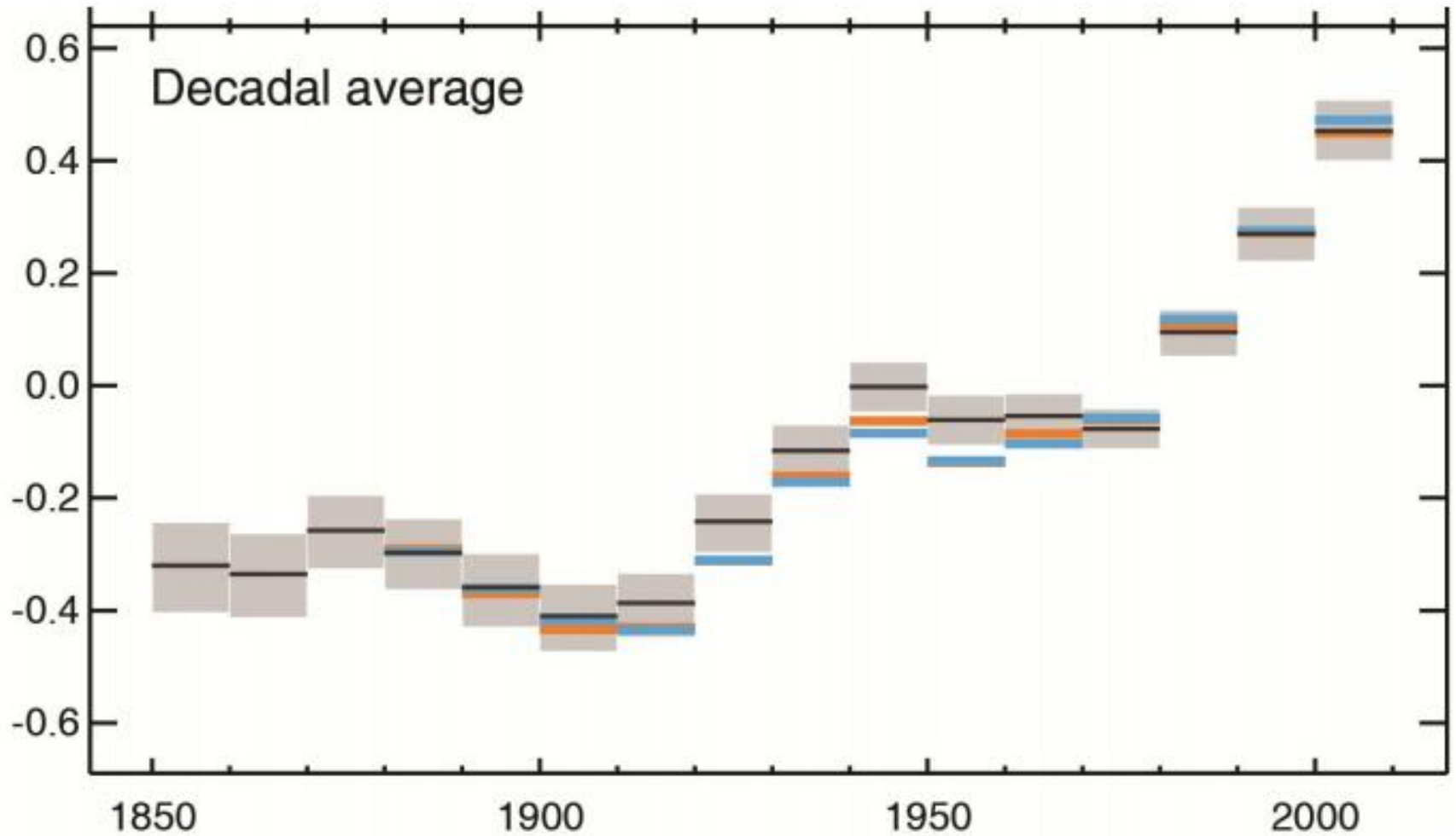
Cambiamenti climatici or « cambiamenti climatici » ?

1. Cambiamenti climatici : introduzione
 2. « Cambiamenti climatici » : 3 casi di studio
- **SEMPRE**: Poveri diventano più poveri

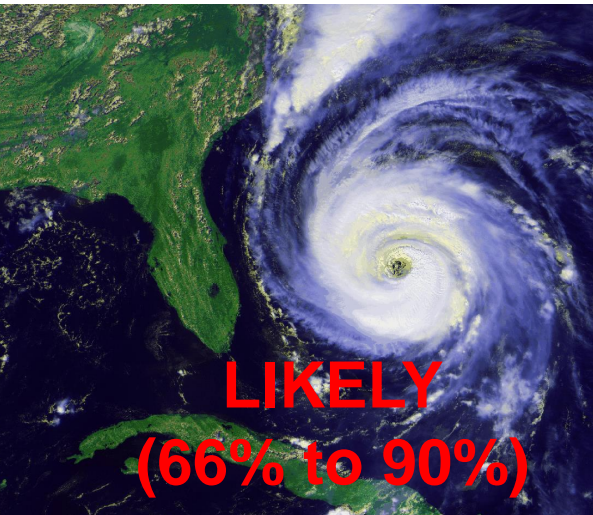
Global air temperature from 1850 to 2012



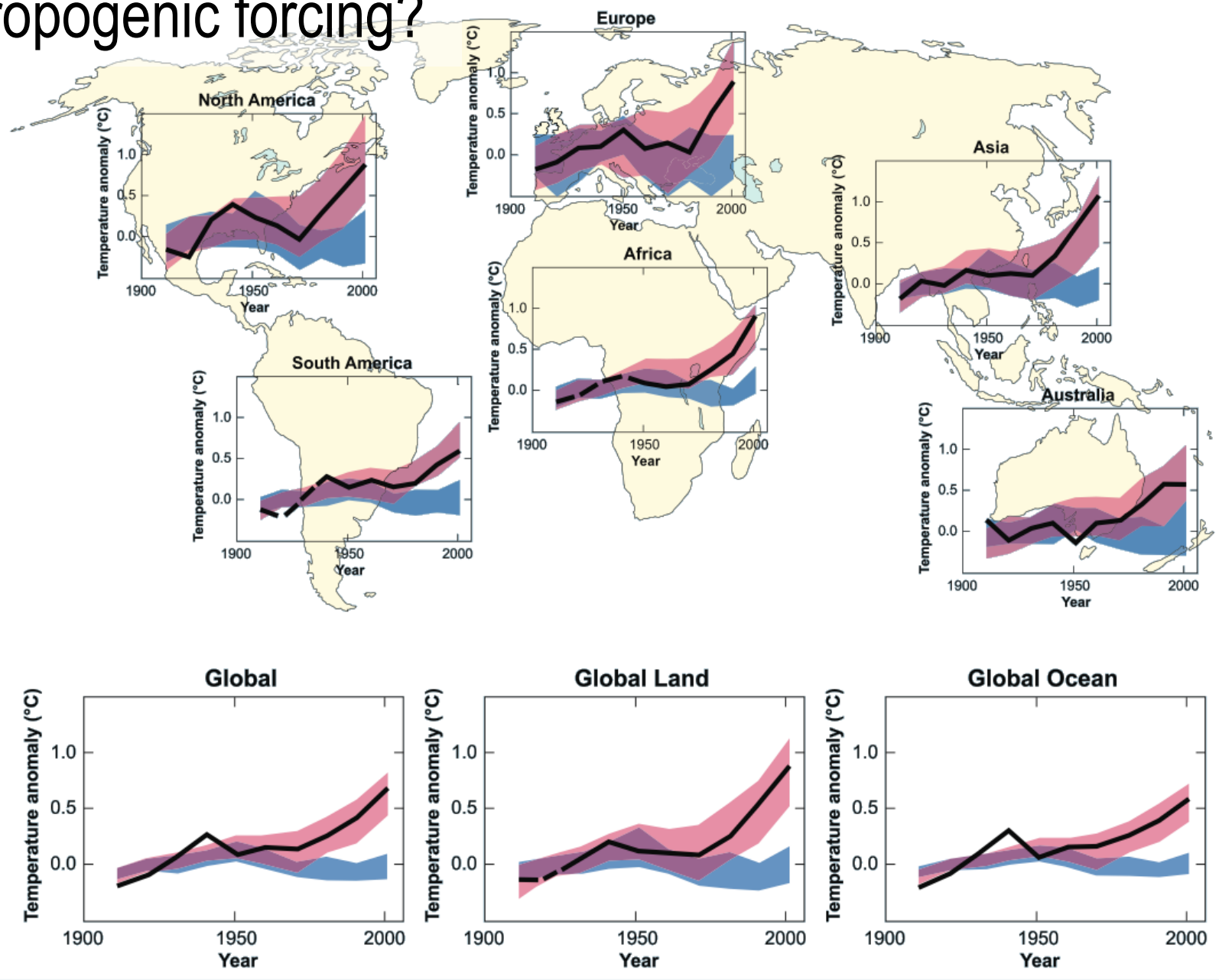
Global air temperature per decade from 1850 to 2010



Past and future consequences of global warming

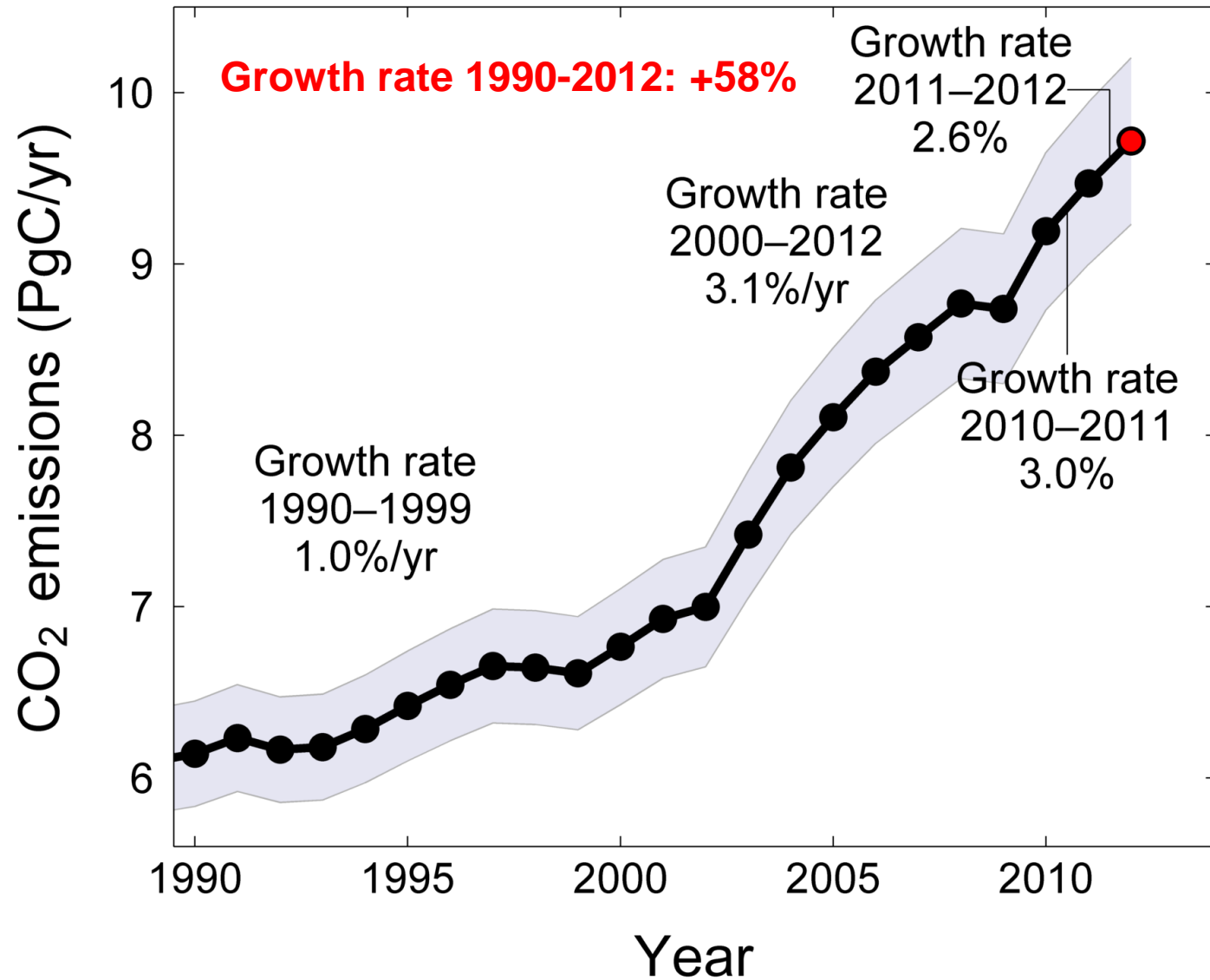


Anthropogenic forcing?



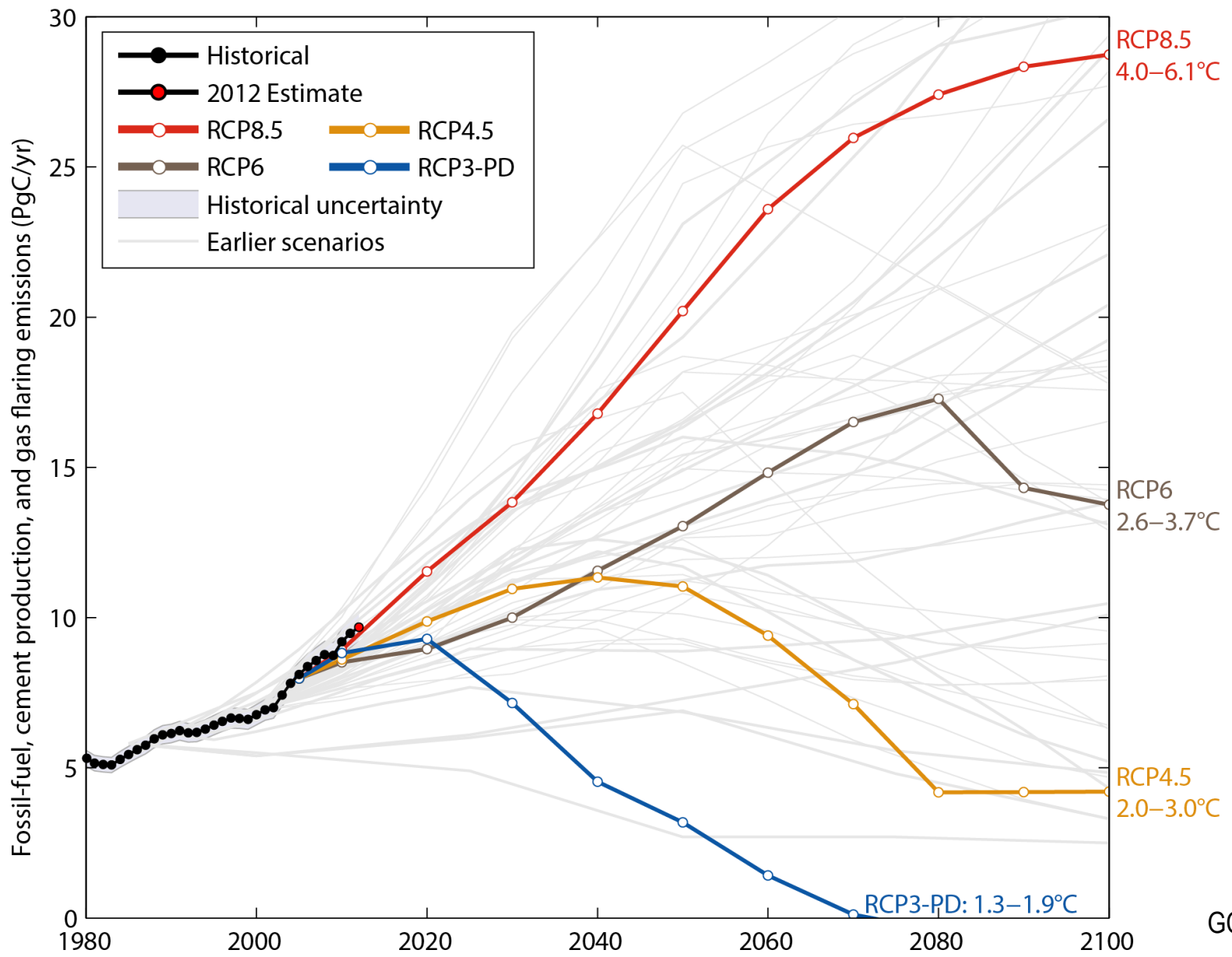
models using only natural forcings
 models using both natural and anthropogenic forcings
 observations

Global fossil fuel CO₂ emissions

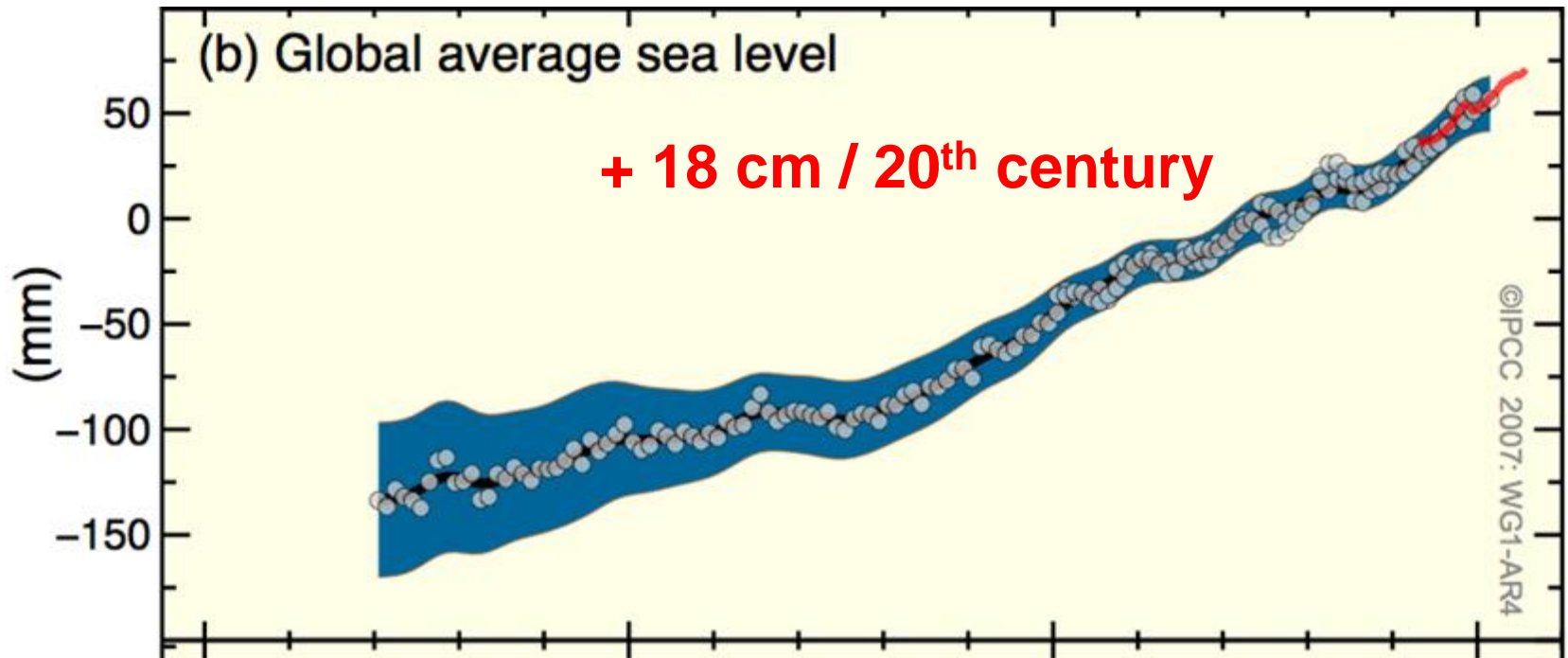


Fossil fuel CO₂ emissions vs IPCC scenarios

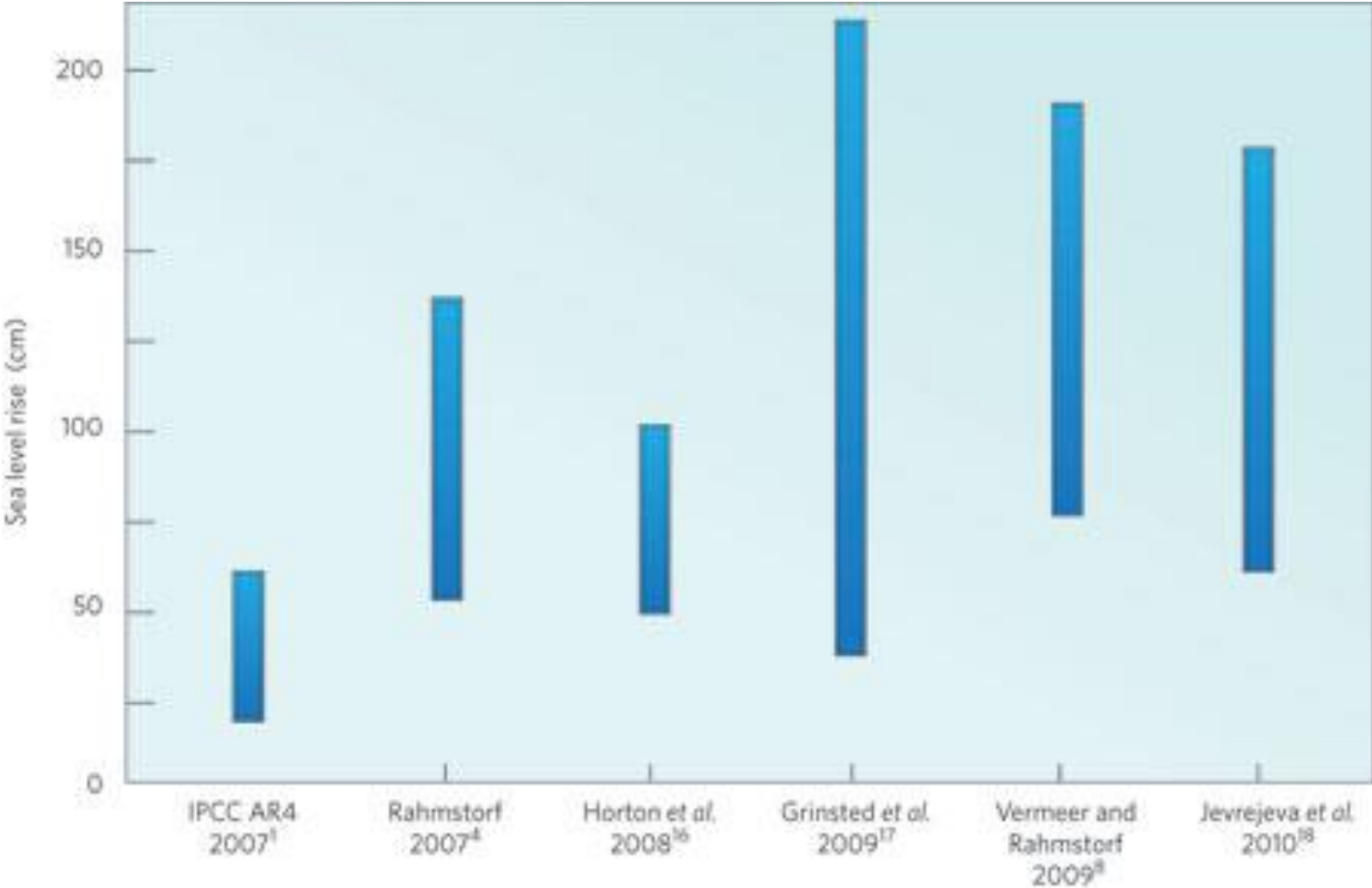
Emissions are heading to a 4.0-6.1°C “likely” increase in temperature



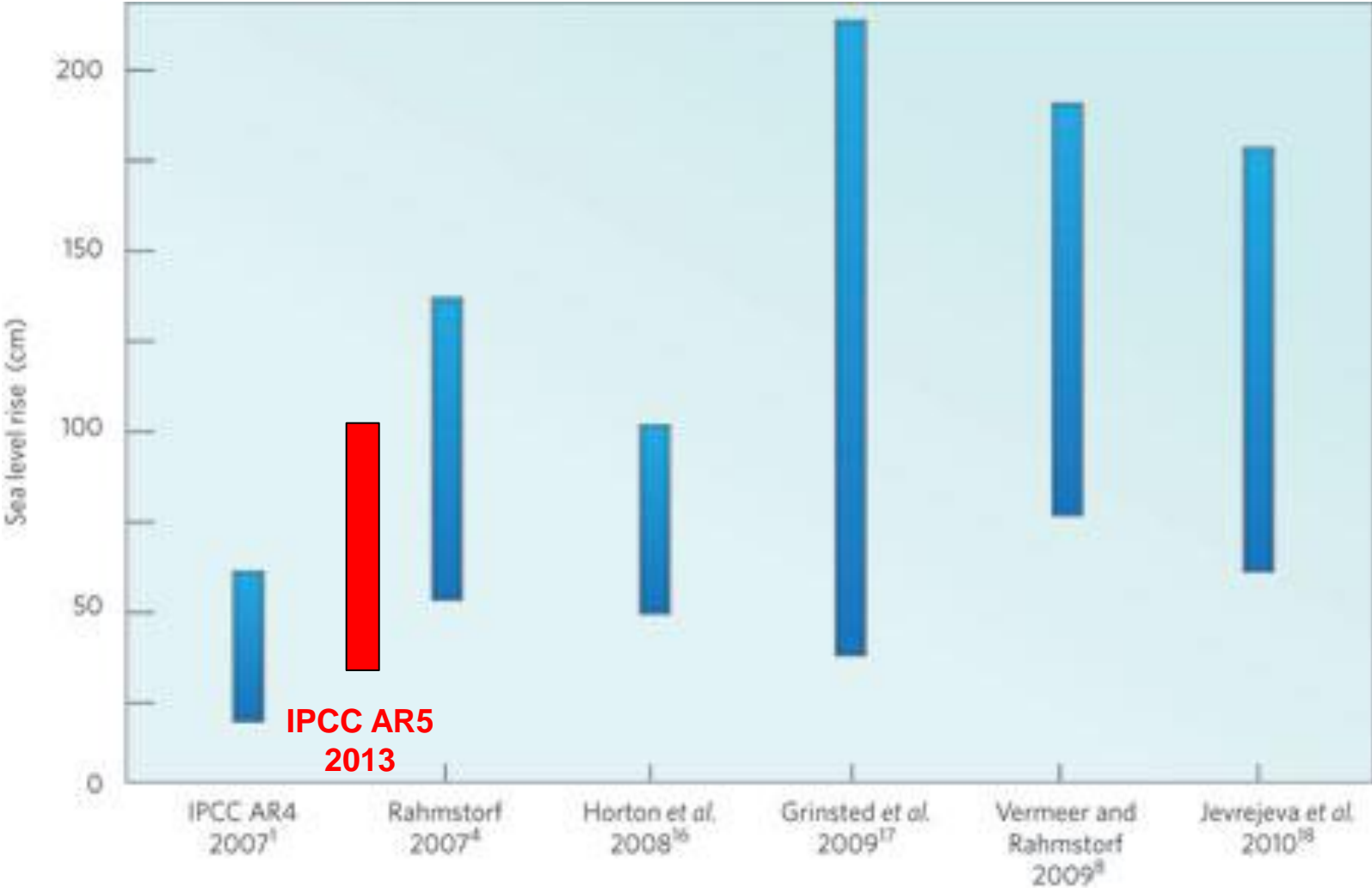
Sea level rise during the 20th century



Estimates for 21st century sea level rise from semi-empirical models vs IPCC Fourth Assessment Report



Estimates for 21st century sea level rise from semi-empirical models vs IPCC Fourth Assessment Report



Potential impact of sea level rise: Nile Delta

Population: 3 800 000
Cropland (Km²): 1 800



Population: 6 100 000
Cropland (Km²): 4 500

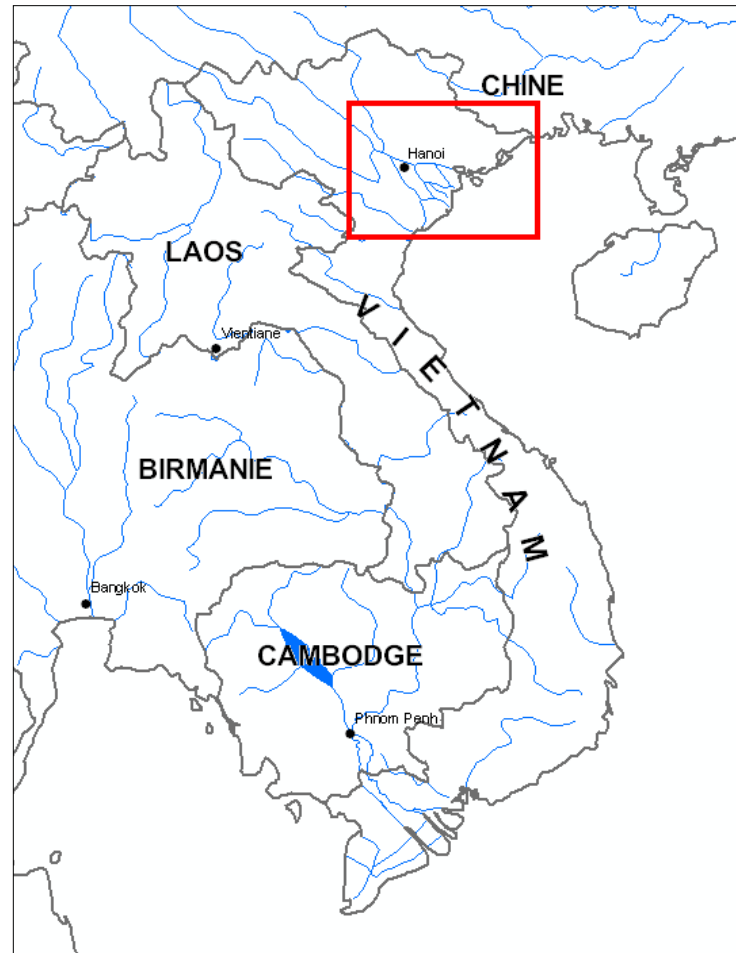


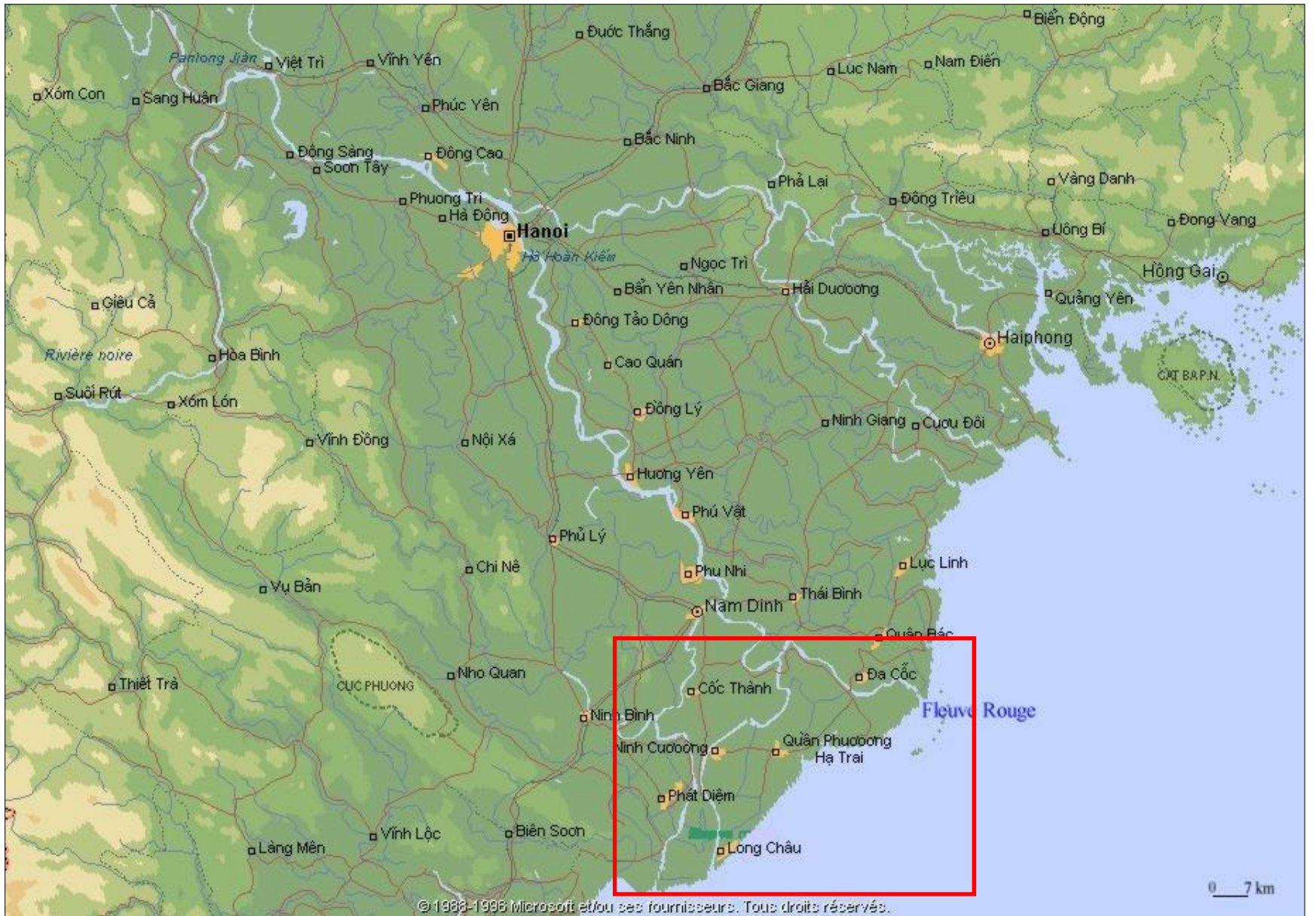
GRID
Arendal

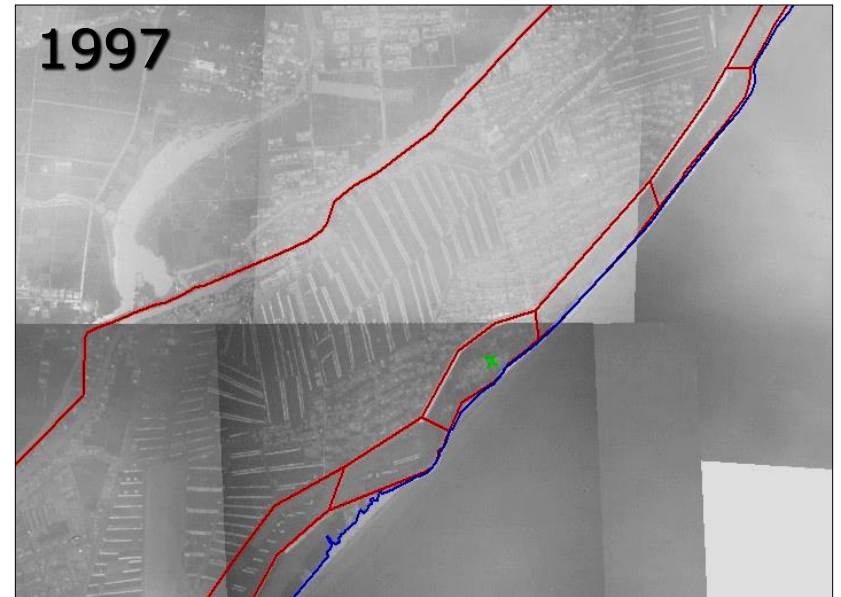


0 50 km

Vietnam – Red River Delta







12-2002



02-2003



12-2003



12-2002



02-2003



12-2003

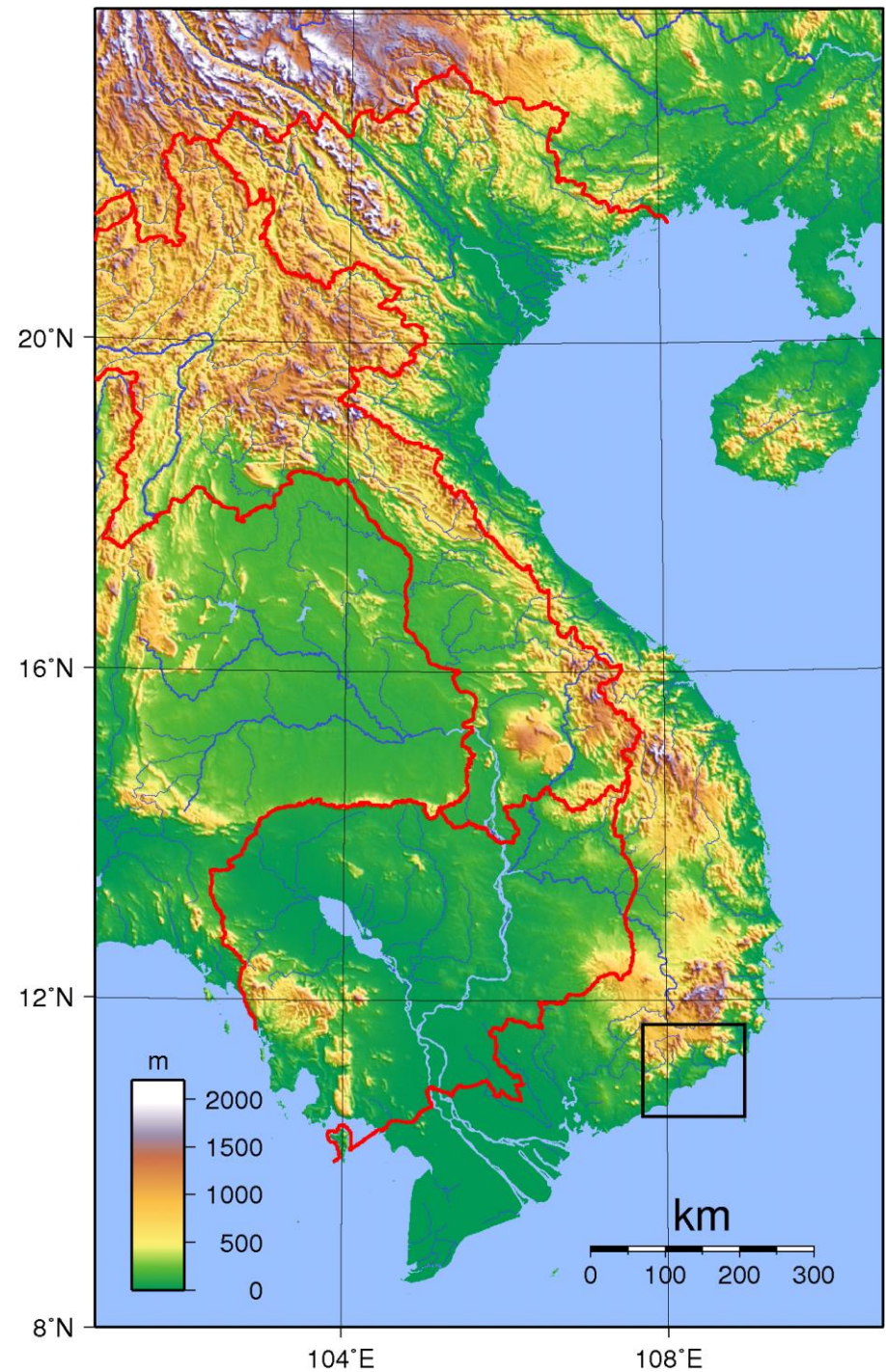


Case study # [1]

VIETNAM

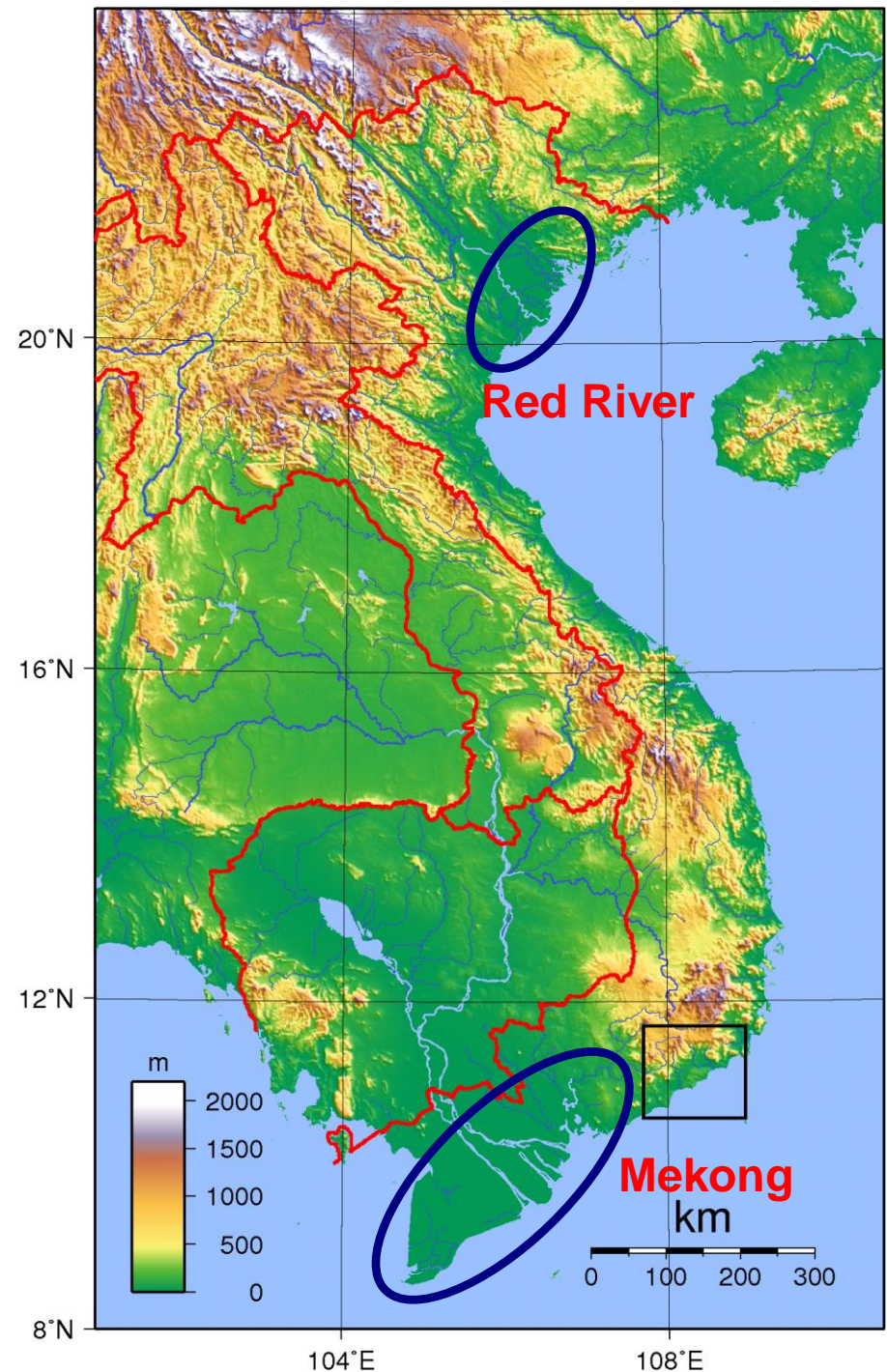
VIETNAM

- 3,200 km of shorelines



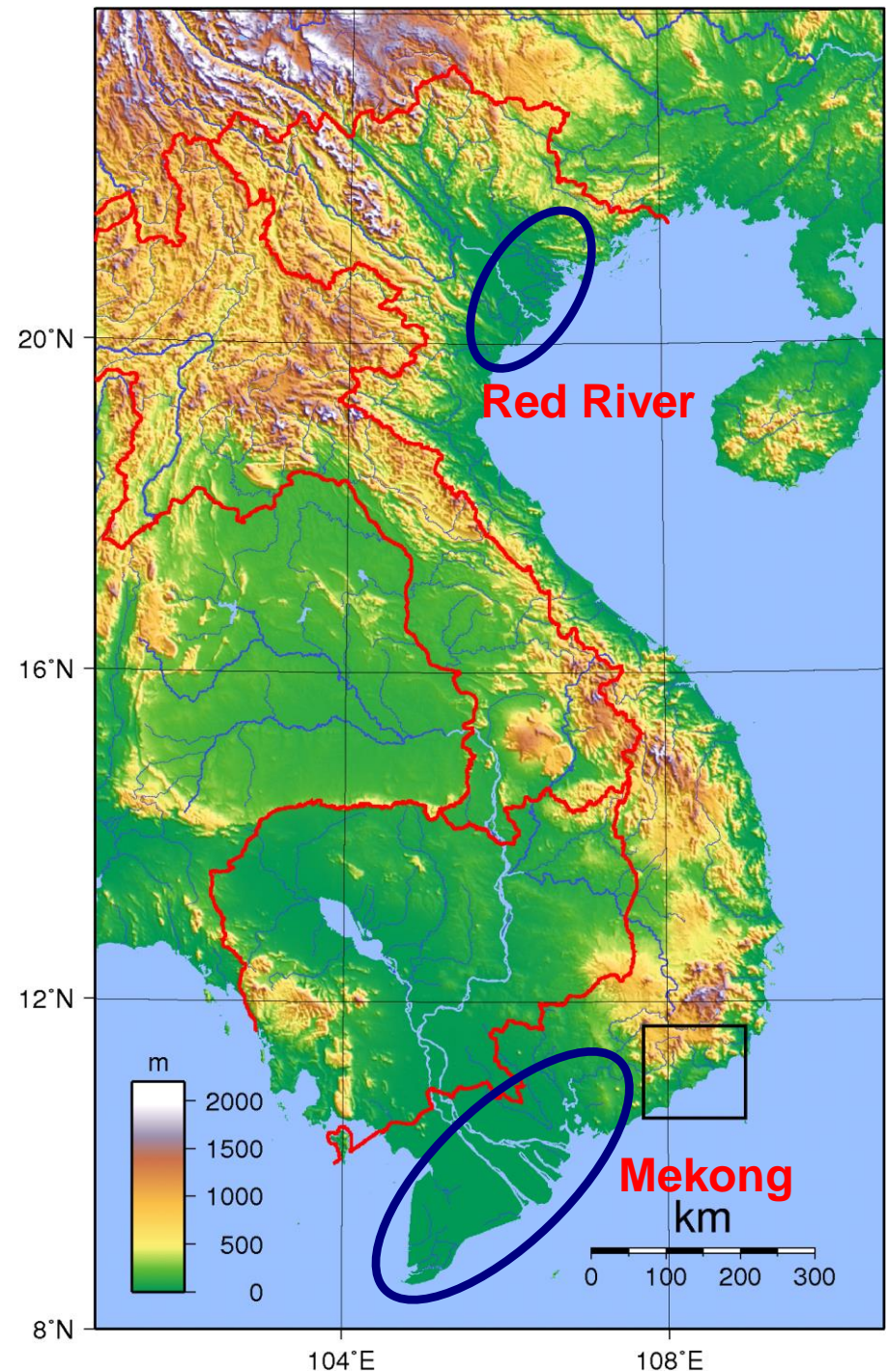
VIETNAM

- 3,200 km of shorelines
- 2 deltas with extremely high vulnerability to sea level rise



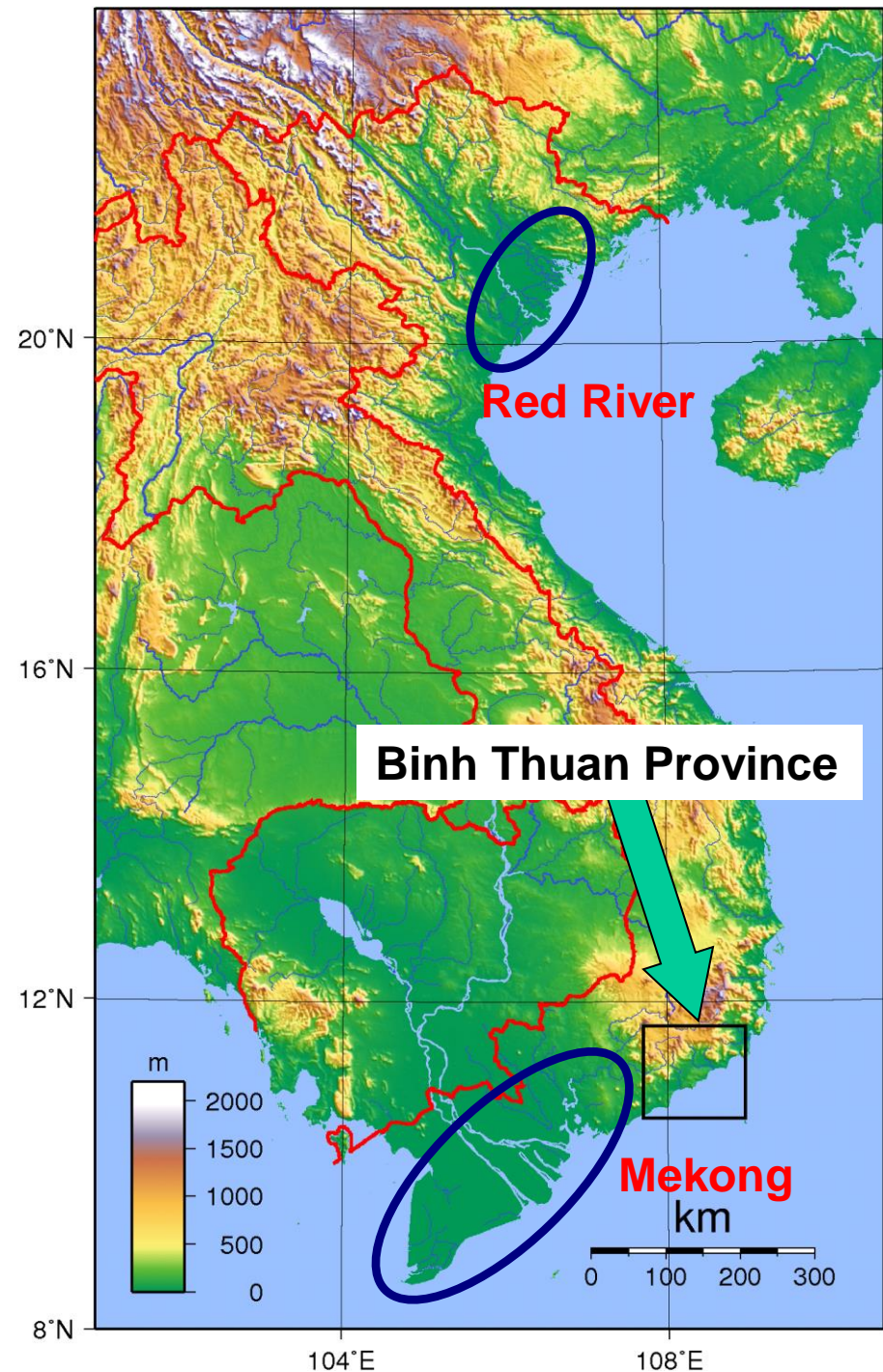
VIETNAM

- 3,200 km of shorelines
- 2 deltas with extremely high vulnerability to sea level rise
- Located on the highway of tropical cyclones



VIETNAM

- 3,200 km of shorelines
- 2 deltas with extremely high vulnerability to sea level rise
- Located on the highway of tropical cyclones



THE STORY



RTL info > Monde > International > Vietnam: des maisons du littoral s'effondrent, victimes de l'érosion

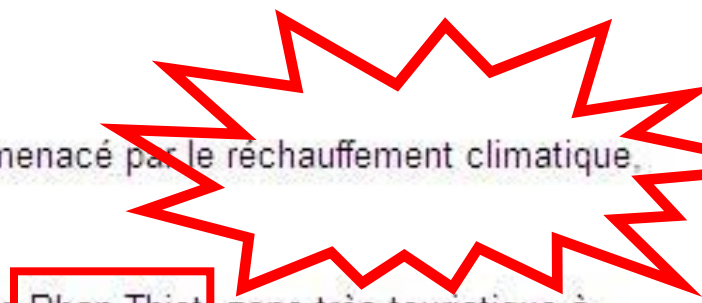
Vietnam: des maisons du littoral s'effondrent, victimes de l'érosion

12 Janvier 2009 13h19

A+ A- Imprimer

Des maisons du littoral sud du Vietnam, pays à vastes côtes fortement menacé par le réchauffement climatique, se sont effondrées pendant le week-end, rongées par de fortes vagues.

Les autorités ne faisaient état d'aucune victime lundi matin dans la ville de Phan Thiet, zone très touristique à quelque 200 kilomètres à l'est de Ho Chi Minh-Ville, l'ex- Saïgon et capitale économique du Vietnam.



THE STORY

**THE FISHING VILLAGE
OF PHAN THIET
« DISAPPEARS »**

**““VICTIM OF CLIMATE
CHANGE””**



Phan Thiết

Phú Hải

Hàm Tiến

FISHING VILLAGE



Phan Thiet

FISHING VILLAGE

Phú Hải

PHU HAI RESORT

MUI NE RESORTS
6 km

Hàm Tiên



Phan Thiet

FISHING VILLAGE

PHU HAI RESORT

MUI NE RESORTS
6 km

GUEST HOUSES

Phu Hai

Ham Tien



Phan Thiet

FISHING VILLAGE

PHU HAI RESORT

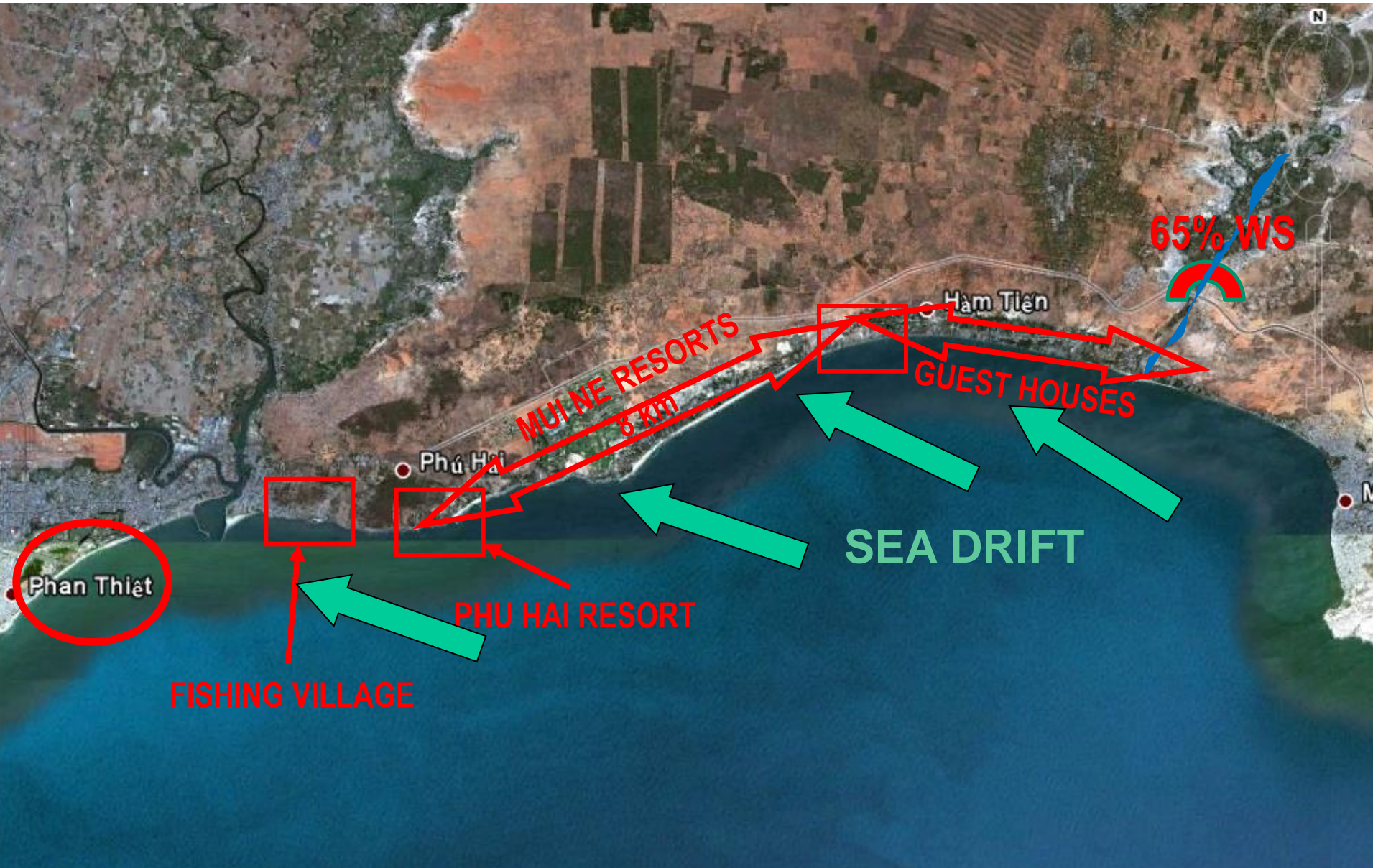
MUI NE RESORTS
6 km

GUEST HOUSES

65% WS

Phu Hai

Ham Tien



Phan Thiet

FISHING VILLAGE

Phú Hải

PHU HAI RESORT

MUI NE RESORTS
6 KM

Hàm Tiên

GUEST HOUSES

SEA DRIFT

65% WS

N

FISHING VILLAGE OF PHAN THIET



FISHING VILLAGE OF PHAN THIET

27 March 2006



FISHING VILLAGE OF PHAN THIET

10 May 2009



FISHING VILLAGE OF PHAN THIET

February 2011



PHU HAI RESORT



PHU HAI RESORT



PHU HAI RESORT



PHU HAI RESORT

27 March 2006

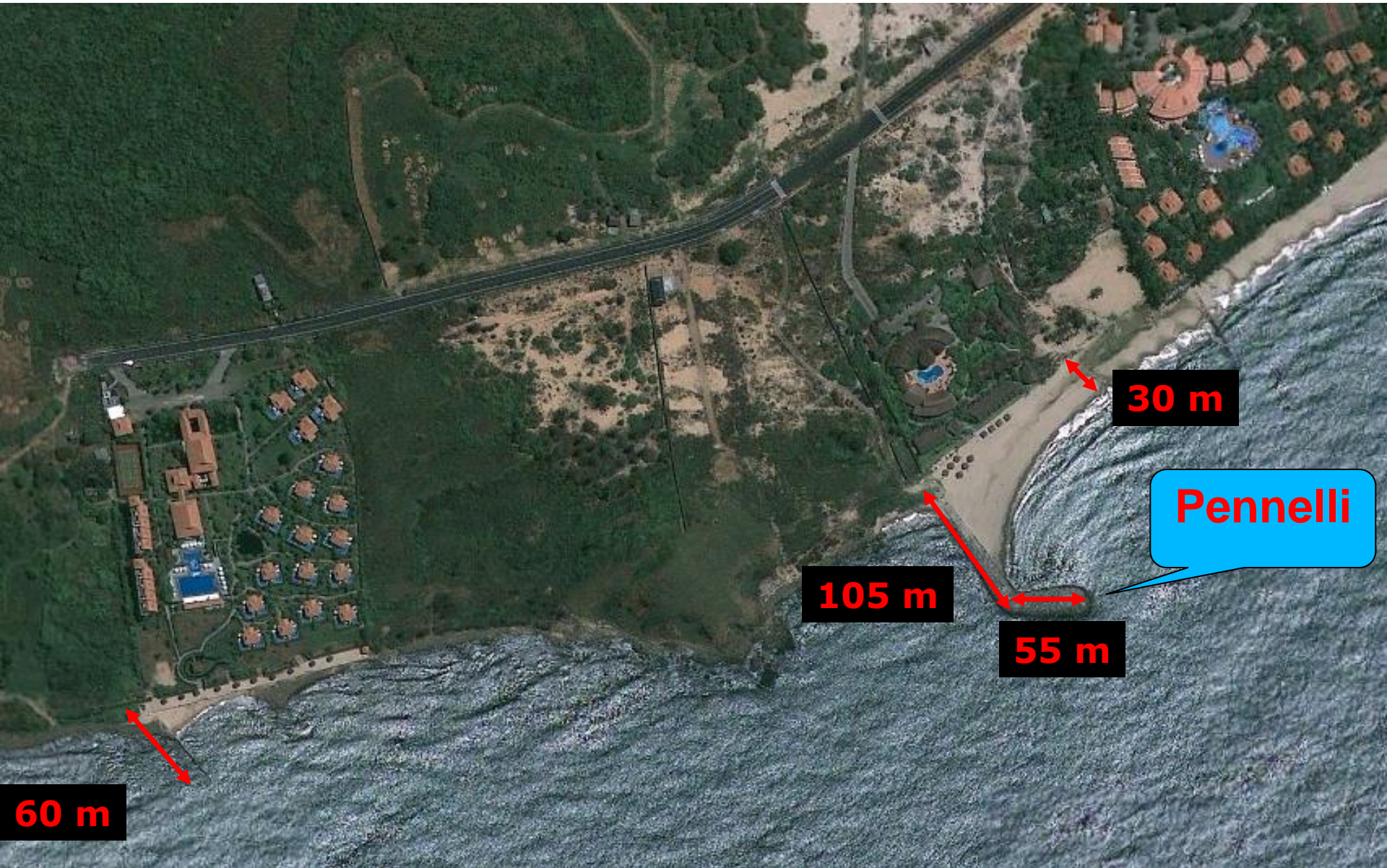


30 m

25 m

PHU HAI RESORT

10 May 2009



30 m

Pennelli

105 m

55 m

60 m

PHU HAI RESORT

26 April 2010



PHU HAI RESORT

20 May 2012



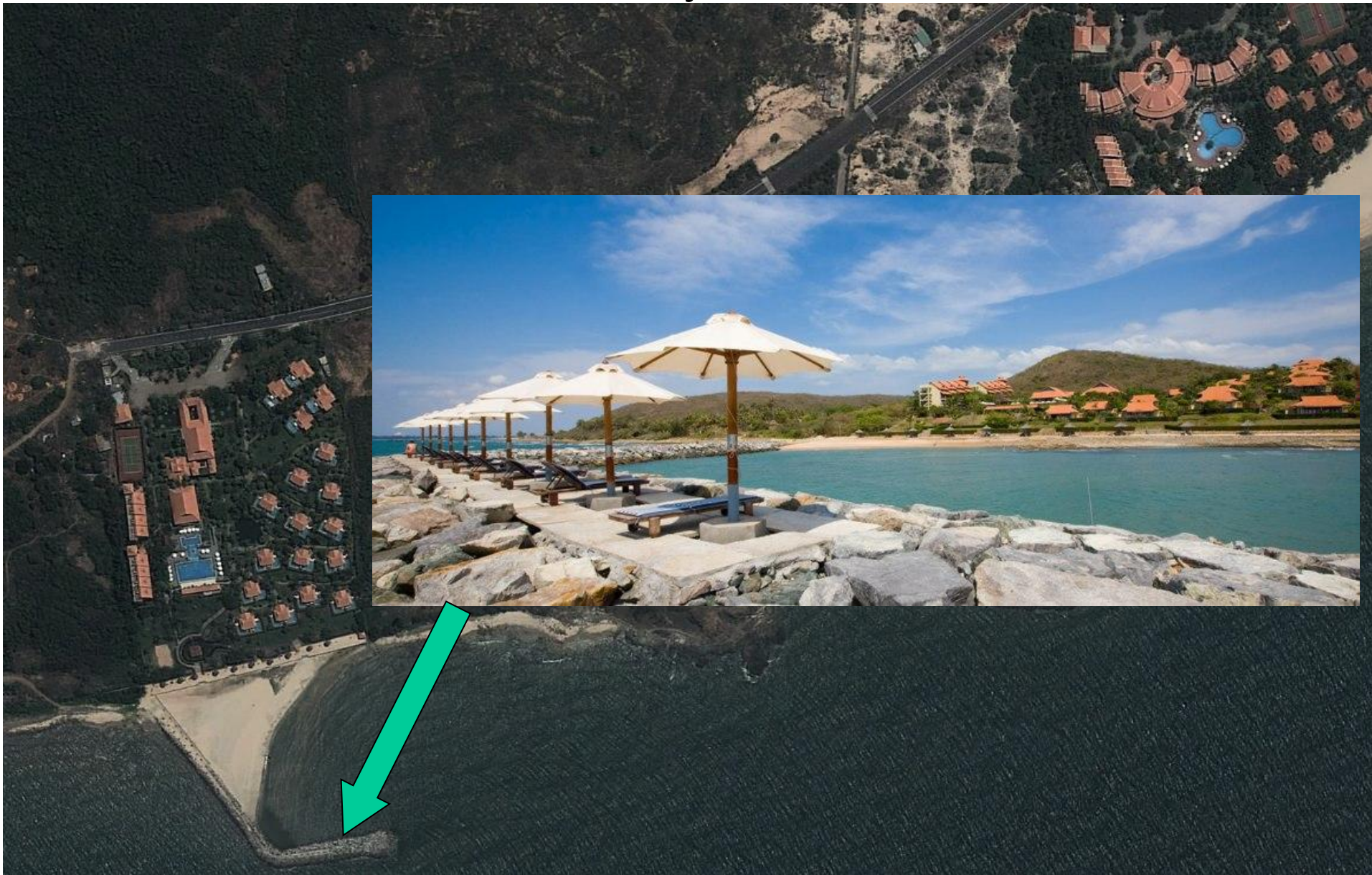
140 m

85 m

65 m

PHU HAI RESORT

20 May 2012





Phan Thiết

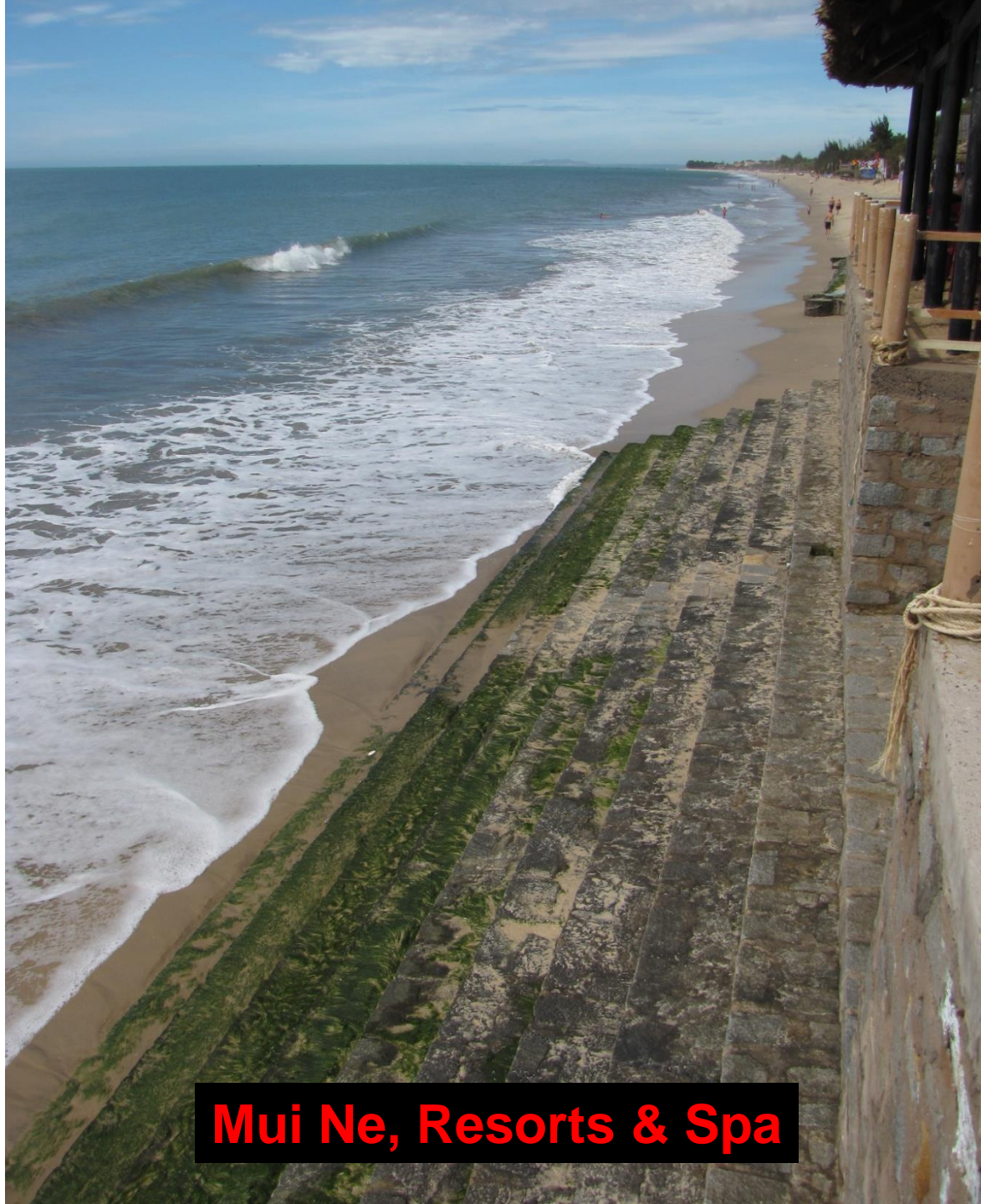
Phú Hải

Hàm Tiến

N



Mui Ne, Resorts & Spa



Mui Ne, Resorts & Spa



Mui Ne, Resorts & Spa



Mui Ne, Resorts & Spa



Mui Ne, Resorts & Spa



Mui Ne, Resorts & Spa

DISCUSSION

&

CONCLUSION

CLIMATE CHANGE ?

- First hotel, *Coco beach*, 1994
- Second hotel, *Novotel*, 1995
- Third hotel, *Victoria*, 1997
- ...
- 2012, everything is constructed

ALL

are western hotels

FOR Western tourists...

STORY TELLING

[A] TO PROTECT THE TOURISM BUSINESS

[B] TO RECEIVE MORE ATTENTION FROM THE
INTERNATIONAL COMMUNITY ABOUT THE THREAT OF
GLOBAL WARMING IN VIETNAM

BUT:

Increasing CO₂ emissions:

2009 → 1,8 million Western tourists → traveling by air, from
Europe (40%), Northern America (40%), Russia (10%) and
Australia (10%) → emissions of about $8.2 \cdot 10^6$ tons of CO₂-eq.

That represents the CO₂ emissions from fuel combustion of Benin
+ DR Congo + Togo for 2009 !!! (IEA, 2012).

2006

9 Janv. 2006



500 m

2012



26 oct 2012

500 m

NO

**THE FISHING VILLAGE
OF PHAN THIET
WAS NOT VICTIM OF
CLIMATE CHANGE**

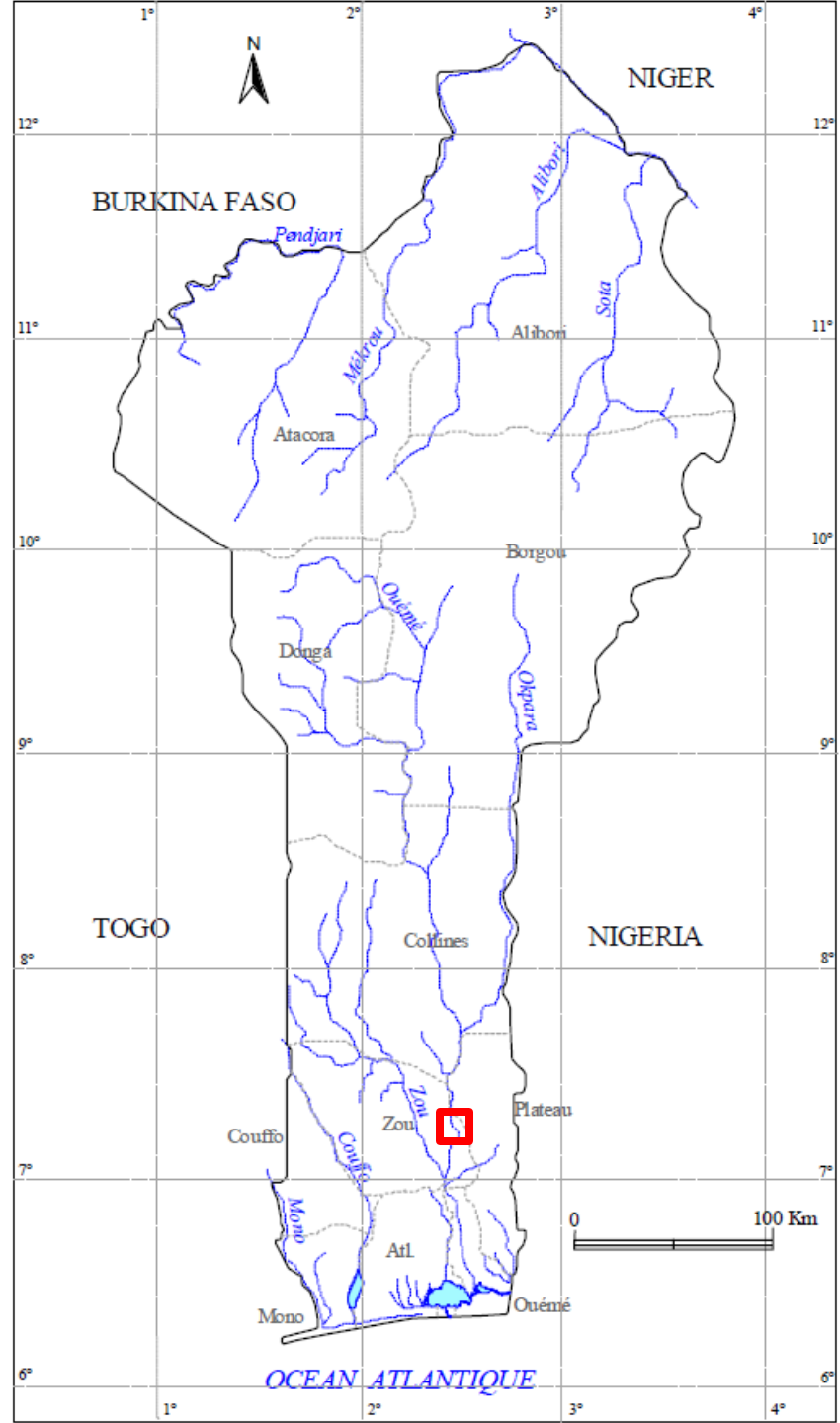
YES

THE FISHING VILLAGE
OF PHAN THIET
WAS VICTIM OF
« CLIMATE CHANGE »:
POOR BECAME POORER

Case study # [2]

BENIN

Watershed: 37850 km²



In September 2010, Benin has been affected by **exceptional** floods, «**the most disastrous of its history**», due to **climate change**.

In September 2010, Benin has been affected by **exceptional** floods, «**the most disastrous of its history**», due to **climate change**.

IMPACTS

680 000 people affected

150 000 homeless

455 schools affected

92 health centres destroyed

In September 2010, Benin has been affected by **exceptional** floods, «**the most disastrous of its history**», due to **climate change**.

WHO SAYS THAT ?

Medias

NGOs

United Nations

...

In September 2010, Benin has been affected by **exceptional** floods, «**the most disastrous of its history**», due to **climate change**.

WHO PROVIDES THE DATA ?

The President (Yayi Boni)

The government

A special « commission »

1st October 2010

The Government of the Republic of Benin declares a state of emergency in the country and appeals for international support

3 October 2010

OCHA's team arrives in Cotonou

7 October 2010

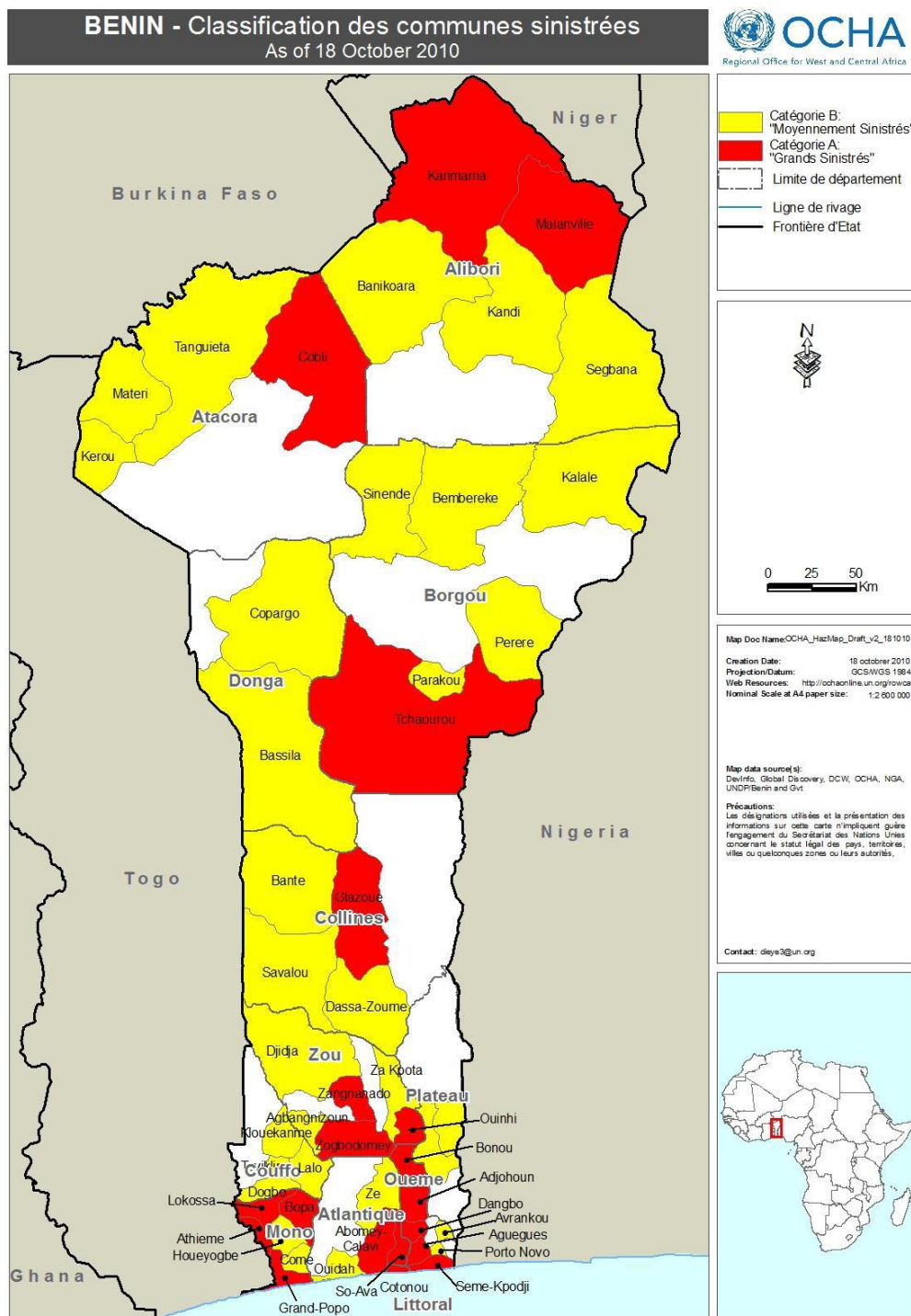
« **Rapport de situation OCHA #1** »
300 000 people affected.

16 October 2010

« **Rapport de situation OCHA #5** »
358 621 people affected.

25 October 2010

« **Rapport de situation OCHA #7** »
680 000 people affected, that is
10% of the last population census
(6,769,914 inhabitants in 2002)



Secrétariat du Comité national de Crise, Cotonou - Benin

Tél. : +229 66 62 25 68 / +229 66 62 25 69 ; courriel : benin.floods2010@gmail.com

I. Evénements clés

- Grande ampleur des inondations au Benin, 42 communes sur 77 sont affectées par les inondations
- 358 621 personnes affectées, 43 morts, 97 815 sans-abri, 55 575 maisons détruites / inondées et 276 écoles inondées/ détruites.
- Epidémie de cholera à Cotonou : 800 cas pour l'ensemble du pays et 07 cas de décès.
- Finalisation de la requête CERF pour un montant de US\$ 8 094 596

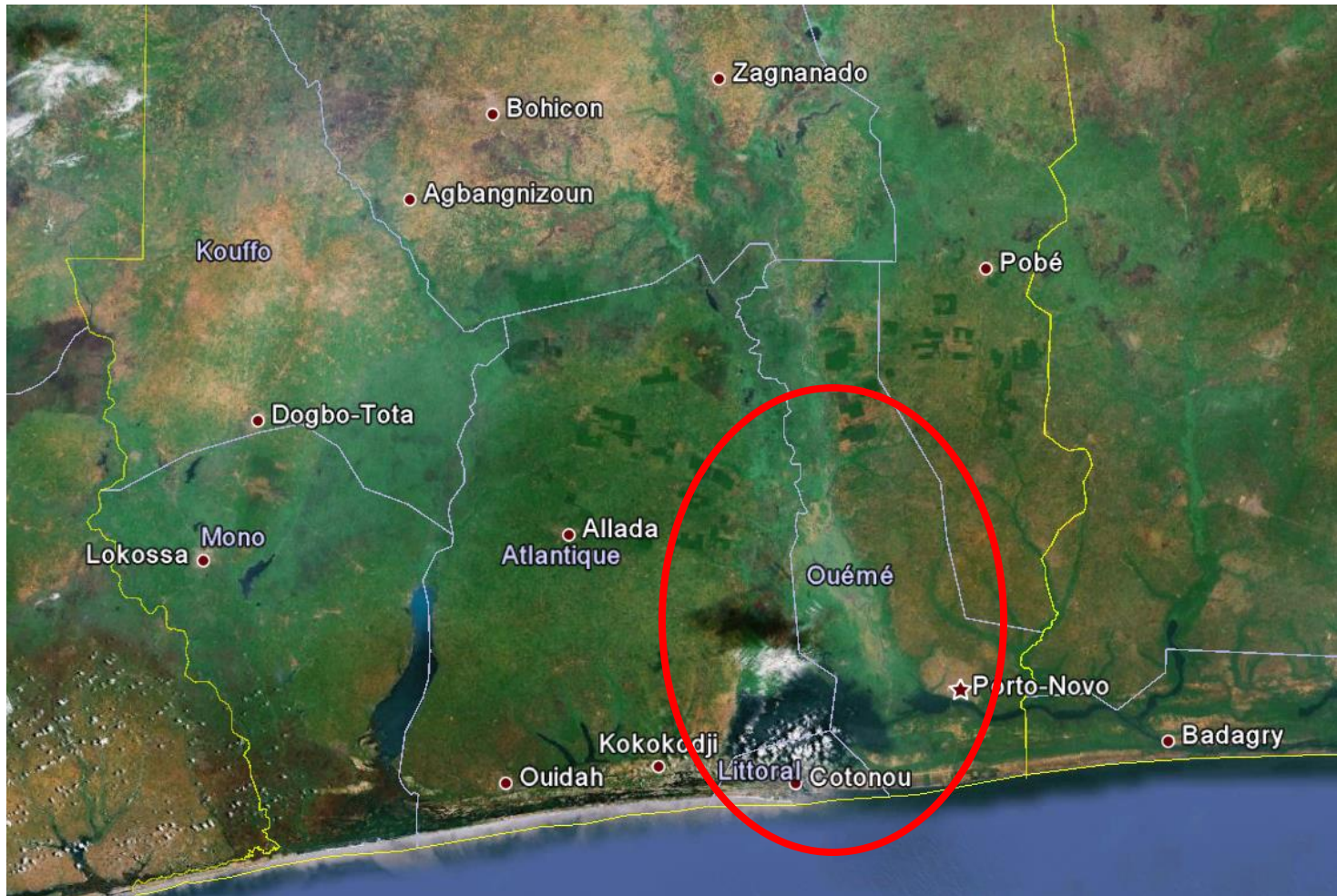
II. Contexte

- Survol de la ville de Cotonou et du Sud du pays par hélicoptère pour l'appréciation des sinistres. Il ressort de cette vue aérienne que la crise a été sous-estimée. En substance, le pays est atteint par des inondations à près des 2/3 en termes de superficie, soit plus 76500 km²
- Finalisation de la requête CERF, Réponse rapide et transmission de la requête au secrétariat du CERF à OCHA- New York ;
- Le processus d'élaboration du Flash Appeal pour la réponse aux inondations a été initié ;
- La situation humanitaire dans le pays devient de plus en plus inquiétante.
- Plus de 360 000 personnes affectées et 43 morts à cause de la persistance des pluies
- Augmentation des cas de cholera à Cotonou. Avec les inondations, il est à craindre une

16 October 2010

Rapport de situation OCHA #5:

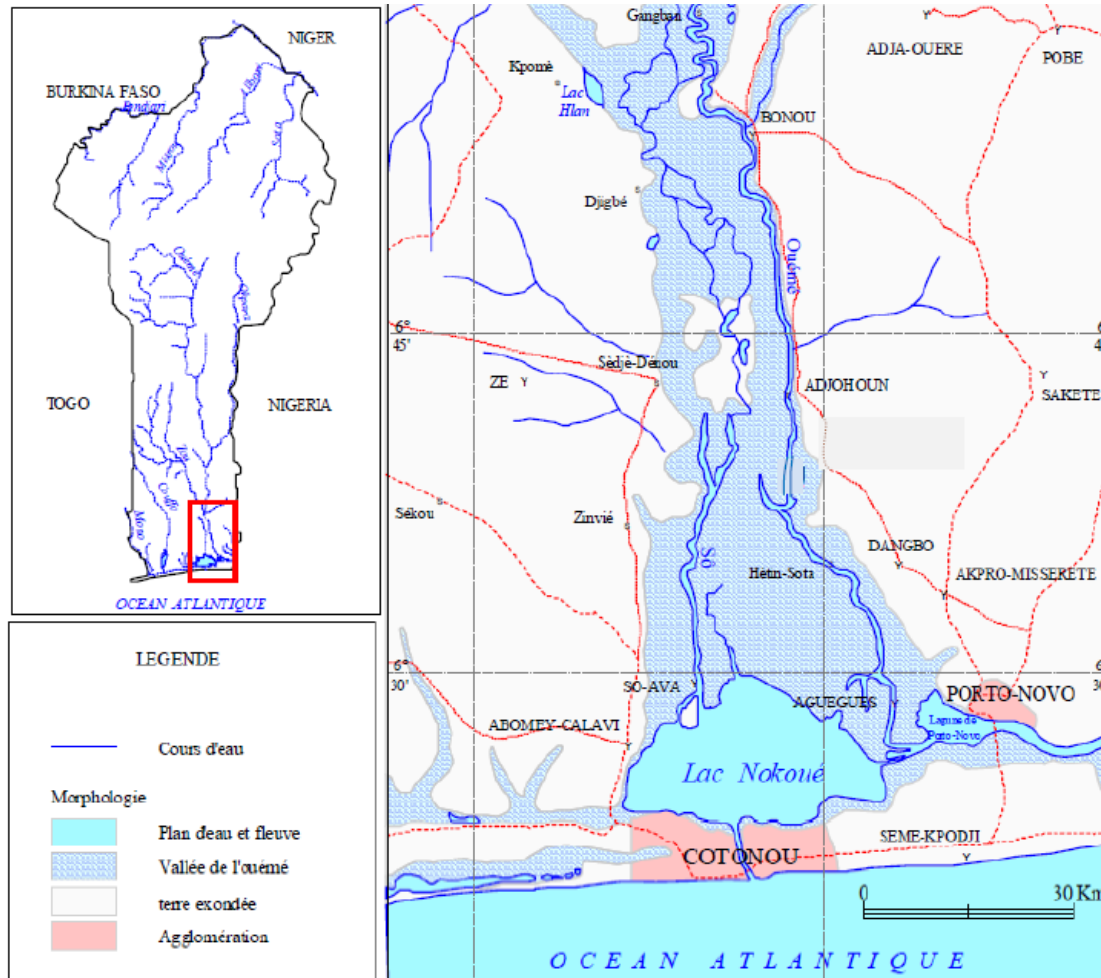
« Overview of the city of Cotonou and South of the country by helicopter for the assessment of claims. It appears from this aerial view that the crisis was underestimated. In essence, the country is hit by flooding in nearly 2/3 in terms of area, over 76 500 km² » .



16 October 2010

Rapport de situation OCHA #5:

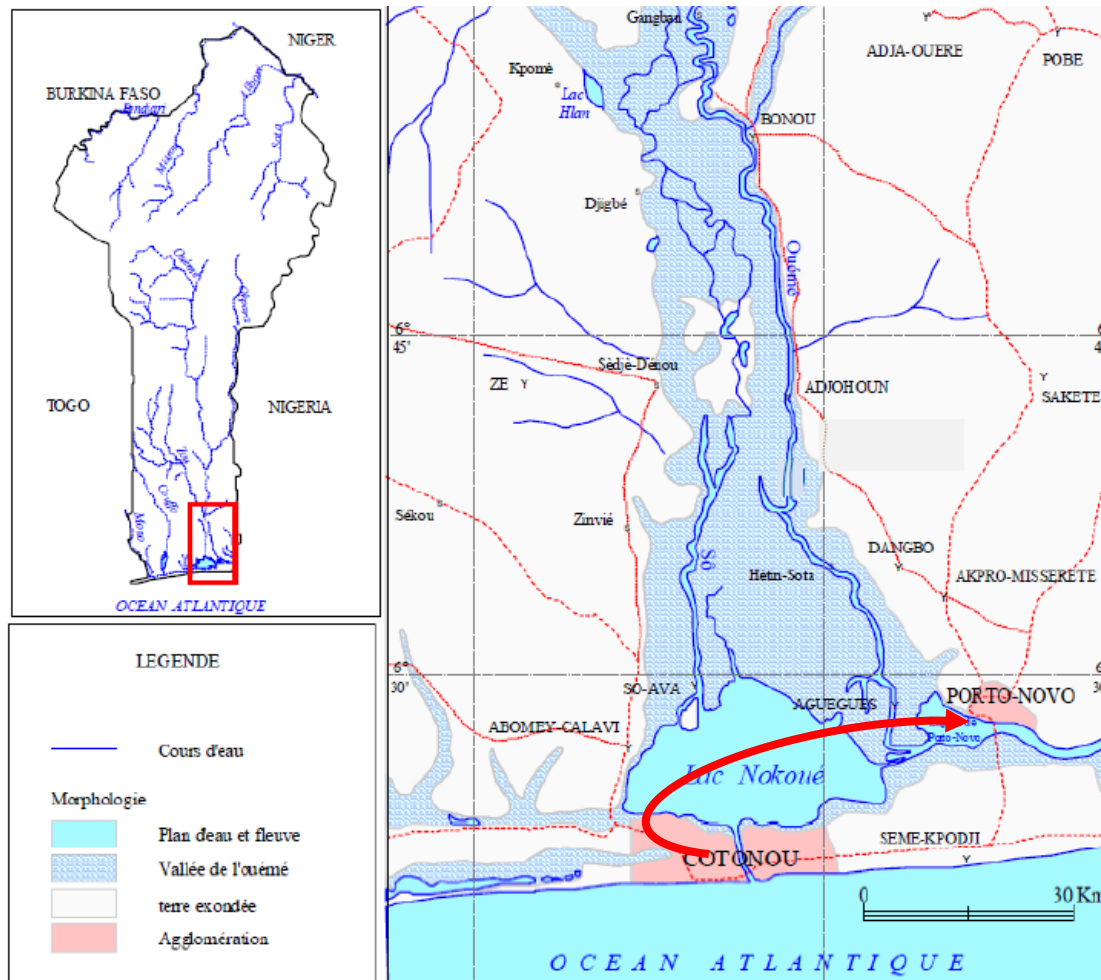
« Overview of the city of Cotonou and South of the country by helicopter for the assessment of claims. It appears from this aerial view that the crisis was underestimated. In essence, the country is hit by flooding in nearly 2/3 in terms of area, over 76 500 km² » .



16 October 2010

Rapport de situation OCHA #5:

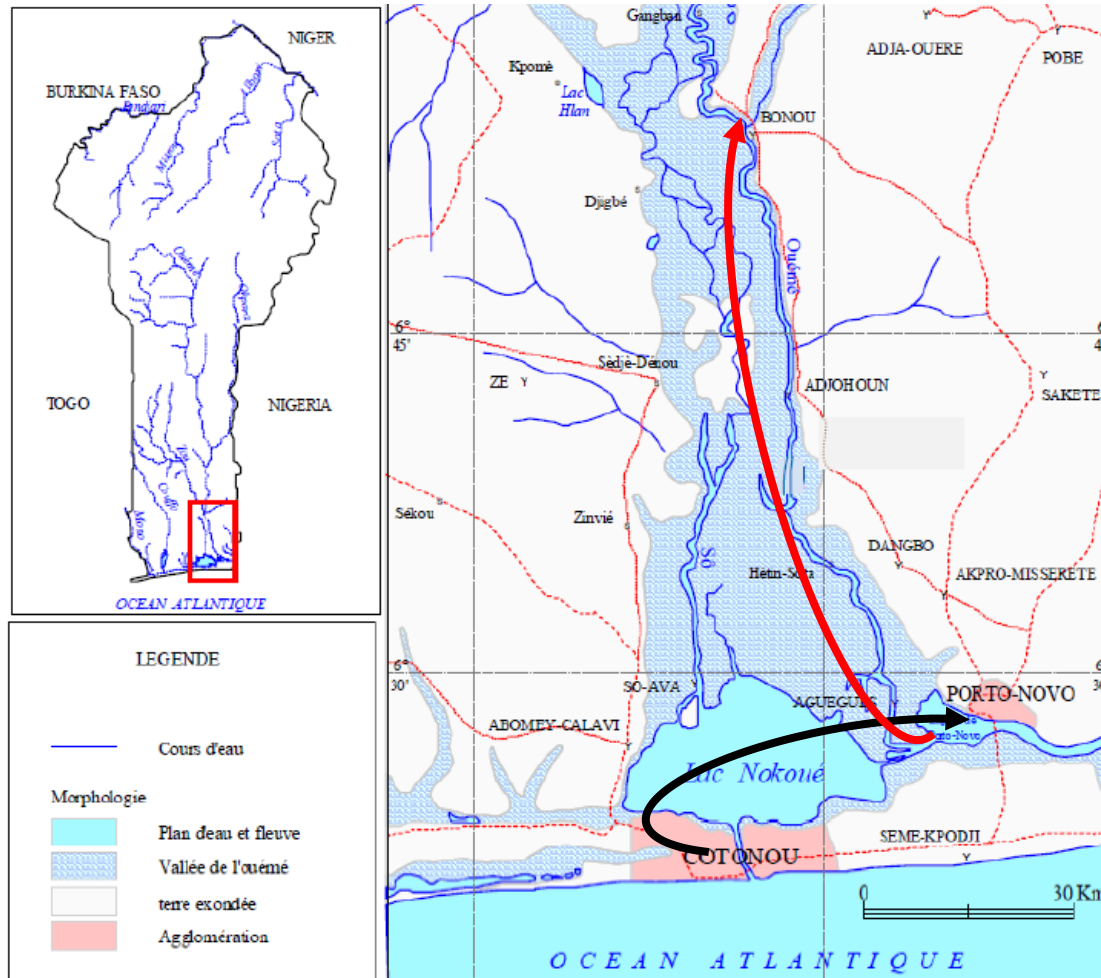
« Overview of the city of Cotonou and South of the country by helicopter for the assessment of claims. It appears from this aerial view that the crisis was underestimated. In essence, the country is hit by flooding in nearly 2/3 in terms of area, over 76 500 km² » .



16 October 2010

Rapport de situation OCHA #5:

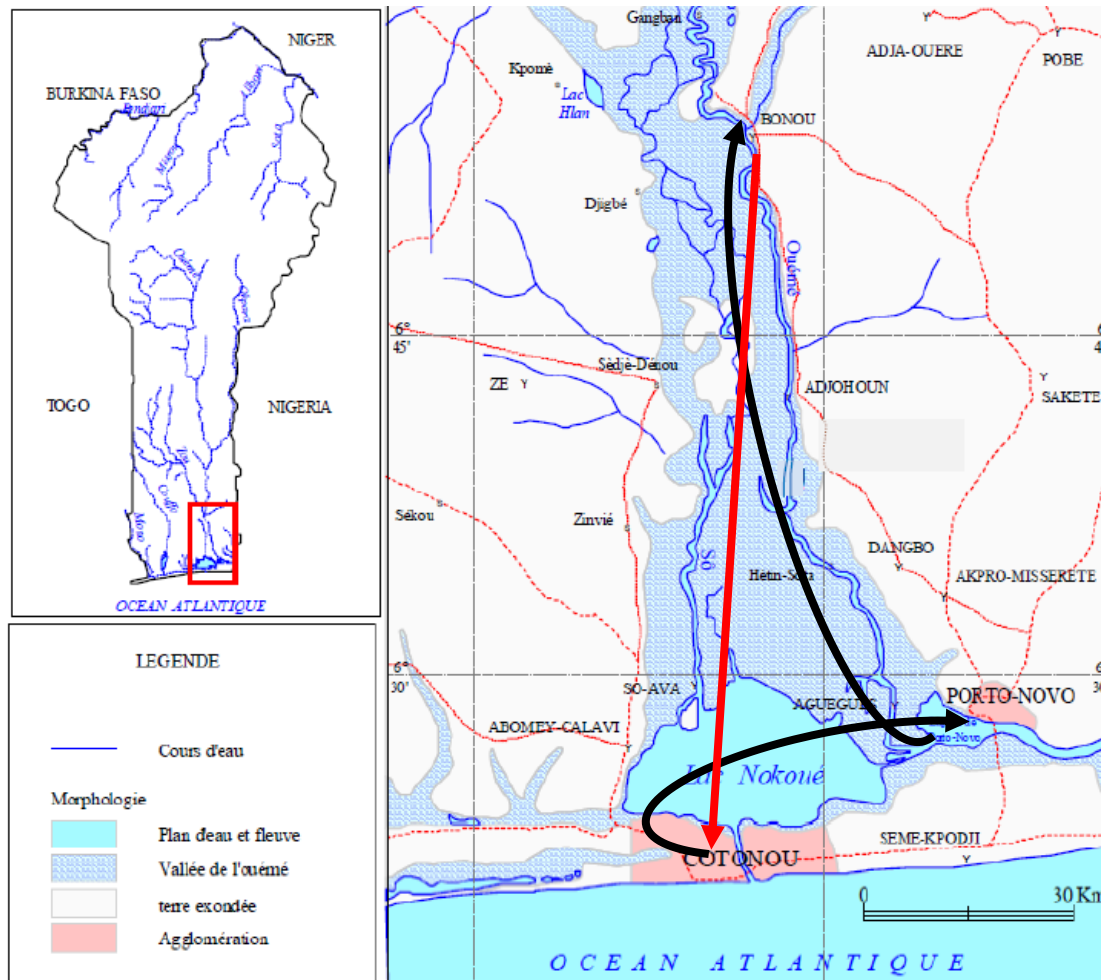
« Overview of the city of Cotonou and South of the country by helicopter for the assessment of claims. It appears from this aerial view that the crisis was underestimated. In essence, the country is hit by flooding in nearly 2/3 in terms of area, over 76 500 km² » .



16 October 2010

Rapport de situation OCHA #5:

« Overview of the city of Cotonou and South of the country by helicopter for the assessment of claims. It appears from this aerial view that the crisis was underestimated. In essence, the country is hit by flooding in nearly 2/3 in terms of area, over 76 500 km² » .



In September 2010, Benin has been affected by **exceptional** floods, «**the most disastrous of its history**», due to **climate change**.

WHO PROVIDES THE DATA ?

The President (Yayi Boni)

The government

A special « commission »

Election campaign communication

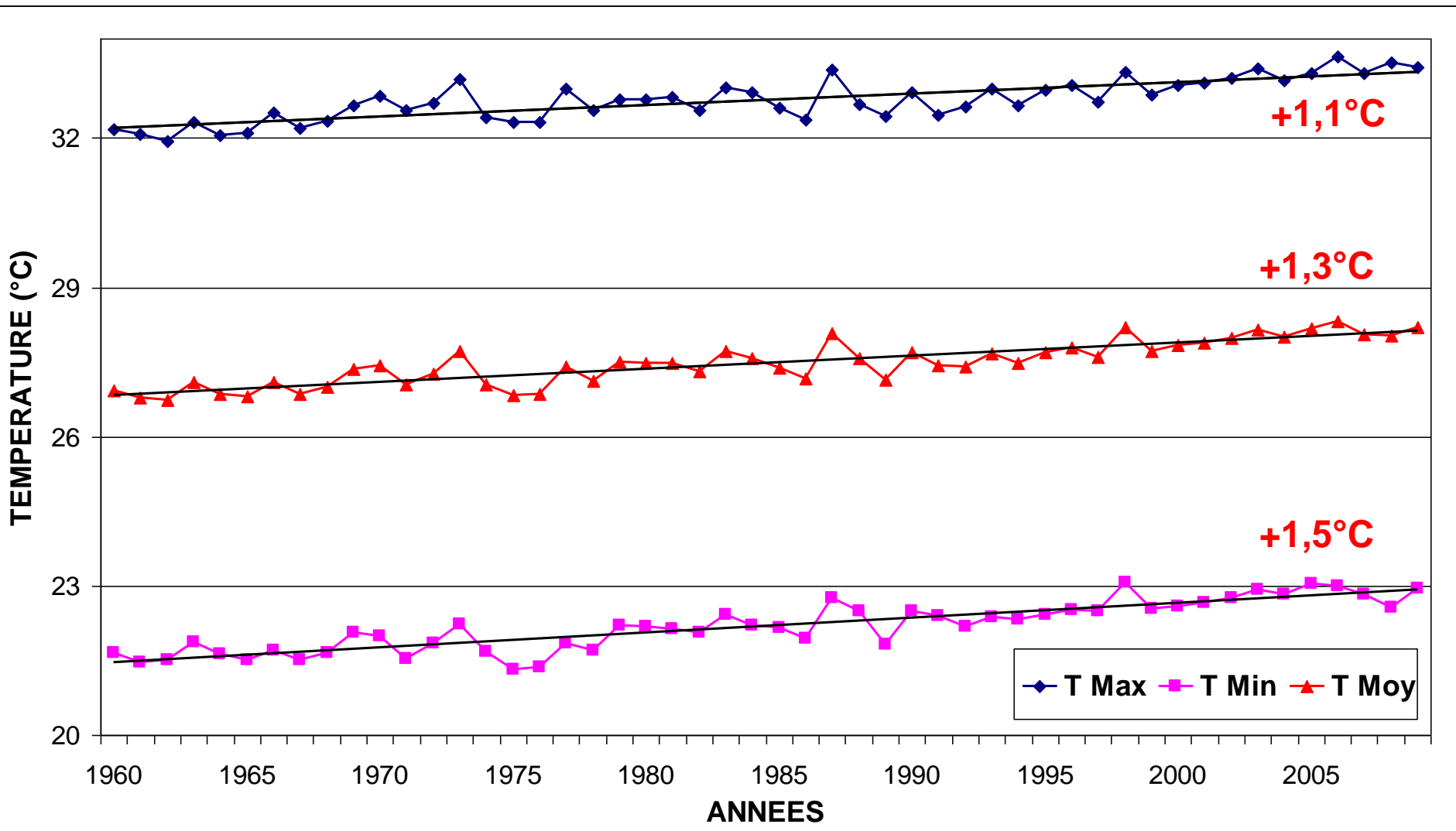
**Powerful story telling for
election campaign purposes**



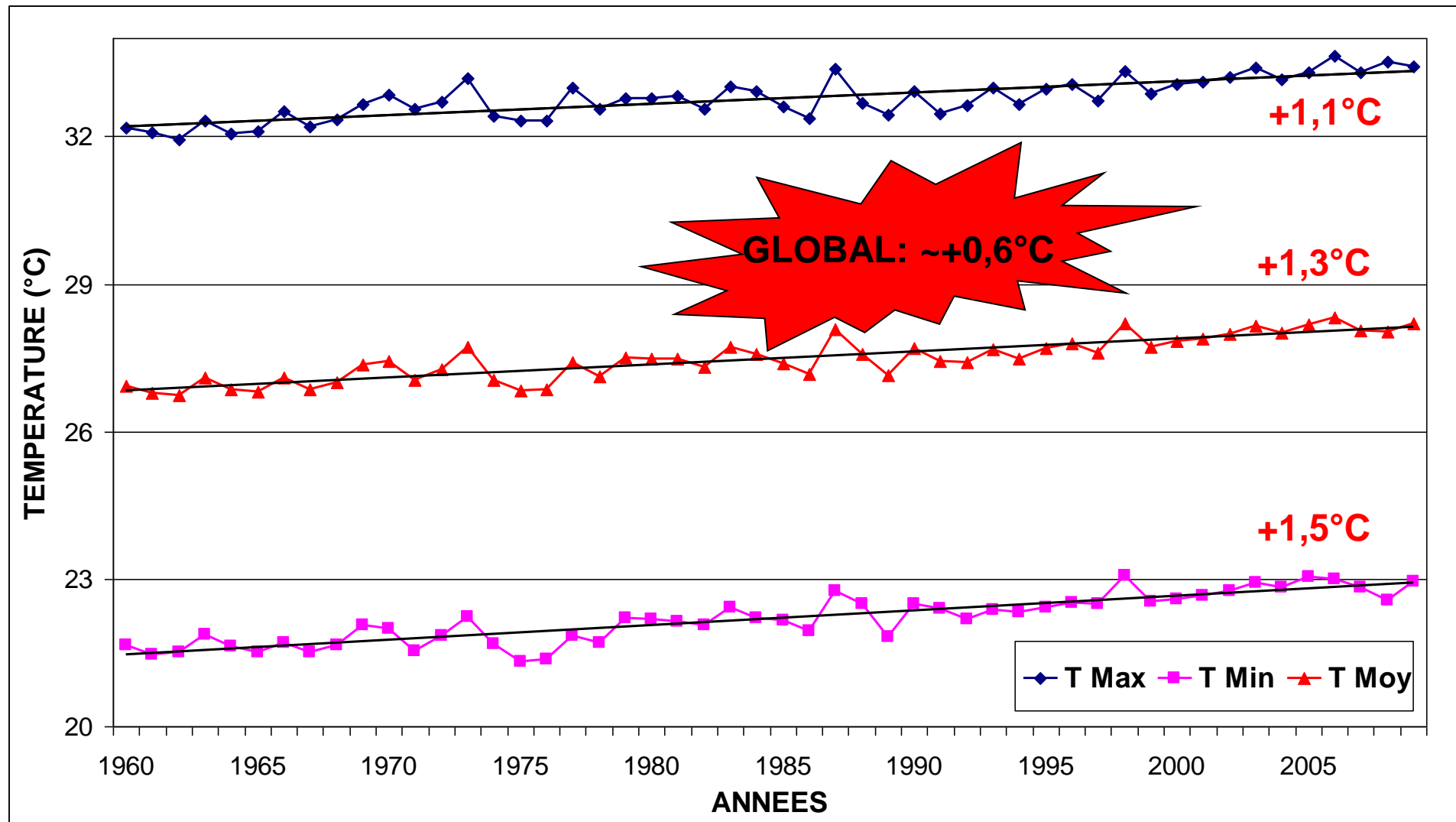
IS BENIN AFFECTED BY
CLIMATE CHANGE ?

TEMPERATURES

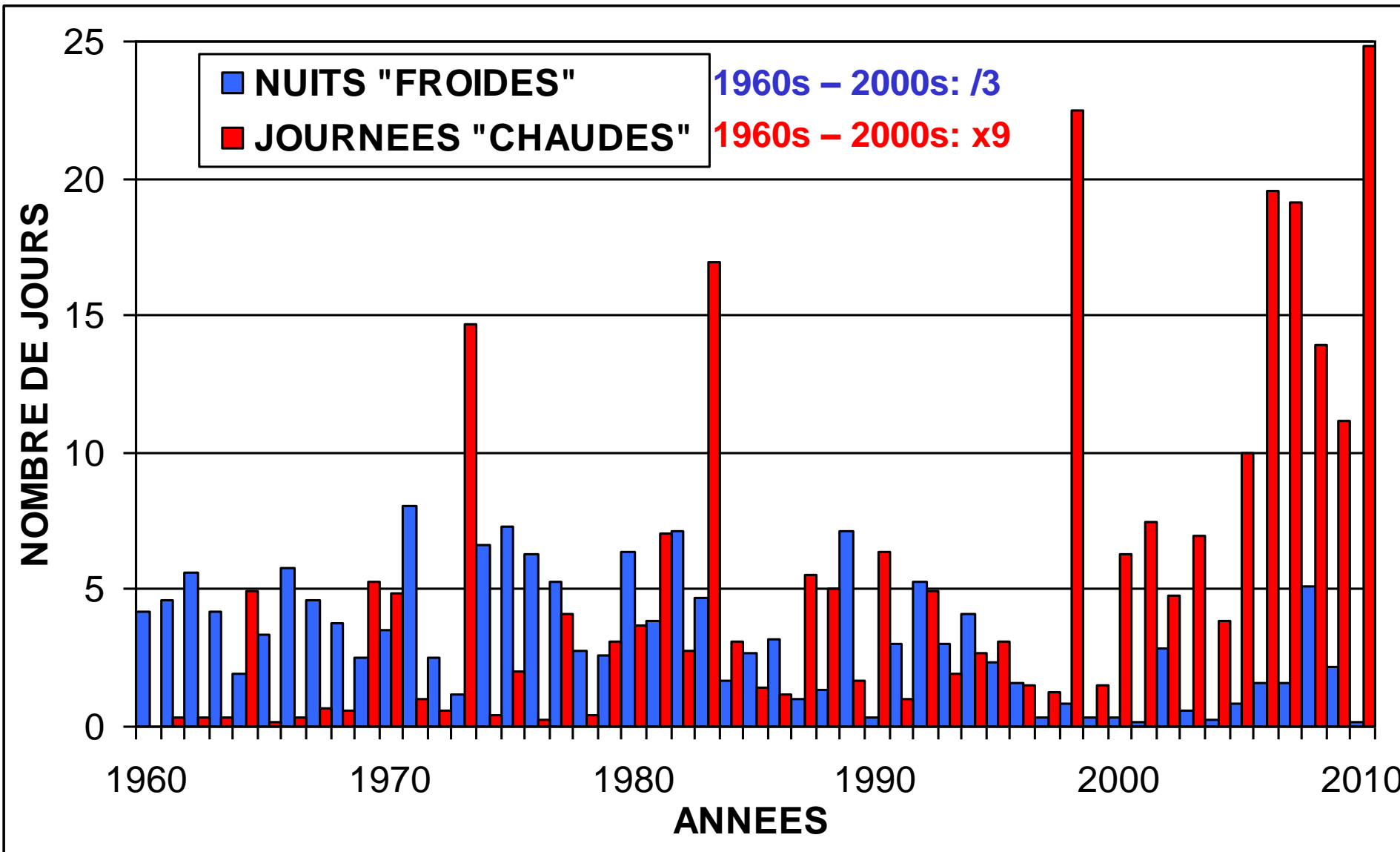
TEMPERATURES IN BENIN (SYNOP) 1960-2009



TEMPERATURES IN BENIN (SYNOP) 1960-2009



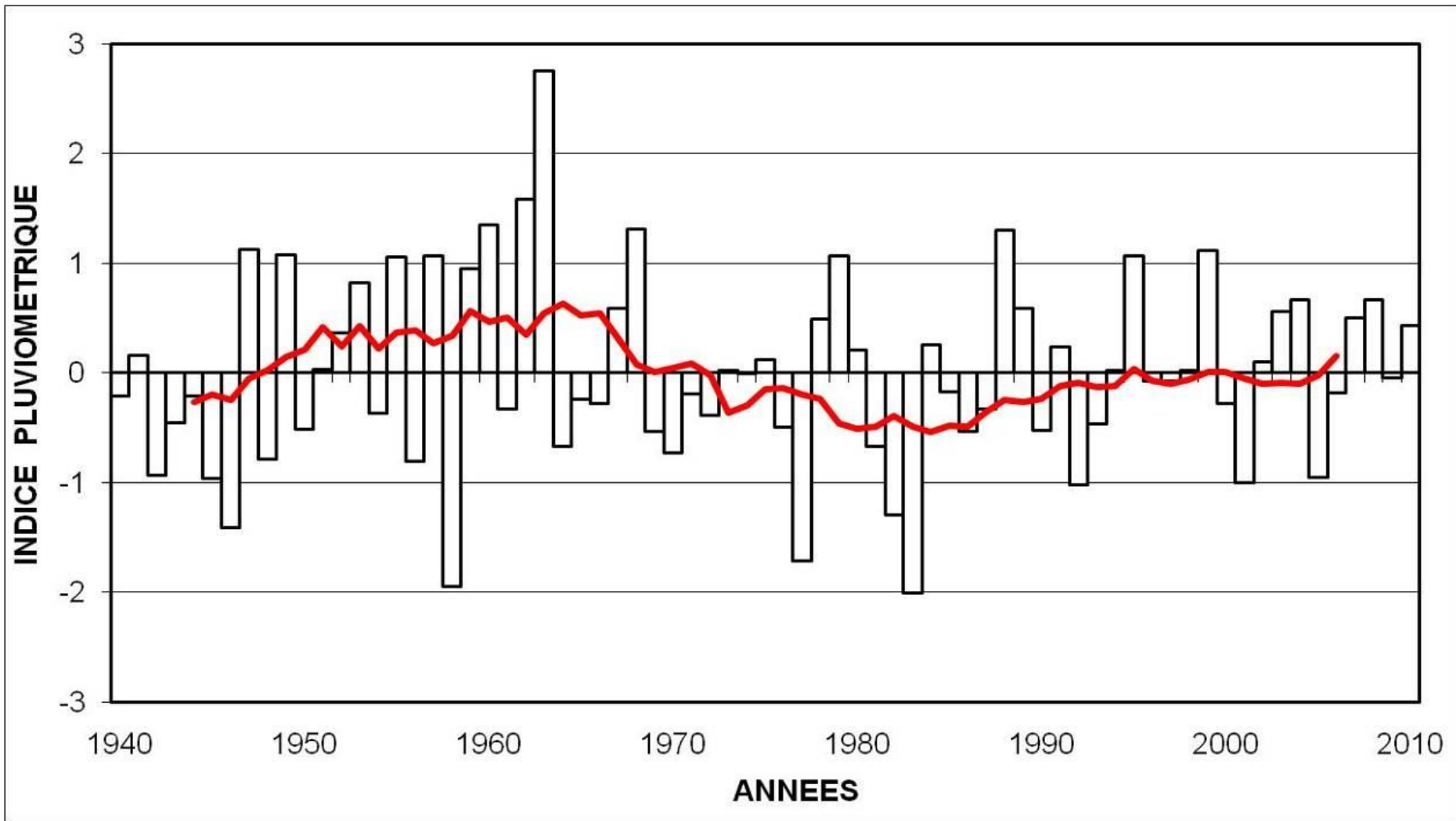
EXTREME TEMPERATURES IN BENIN (SYNOP) 1960-2010



IS BENIN AFFECTED BY
CLIMATE CHANGE ?

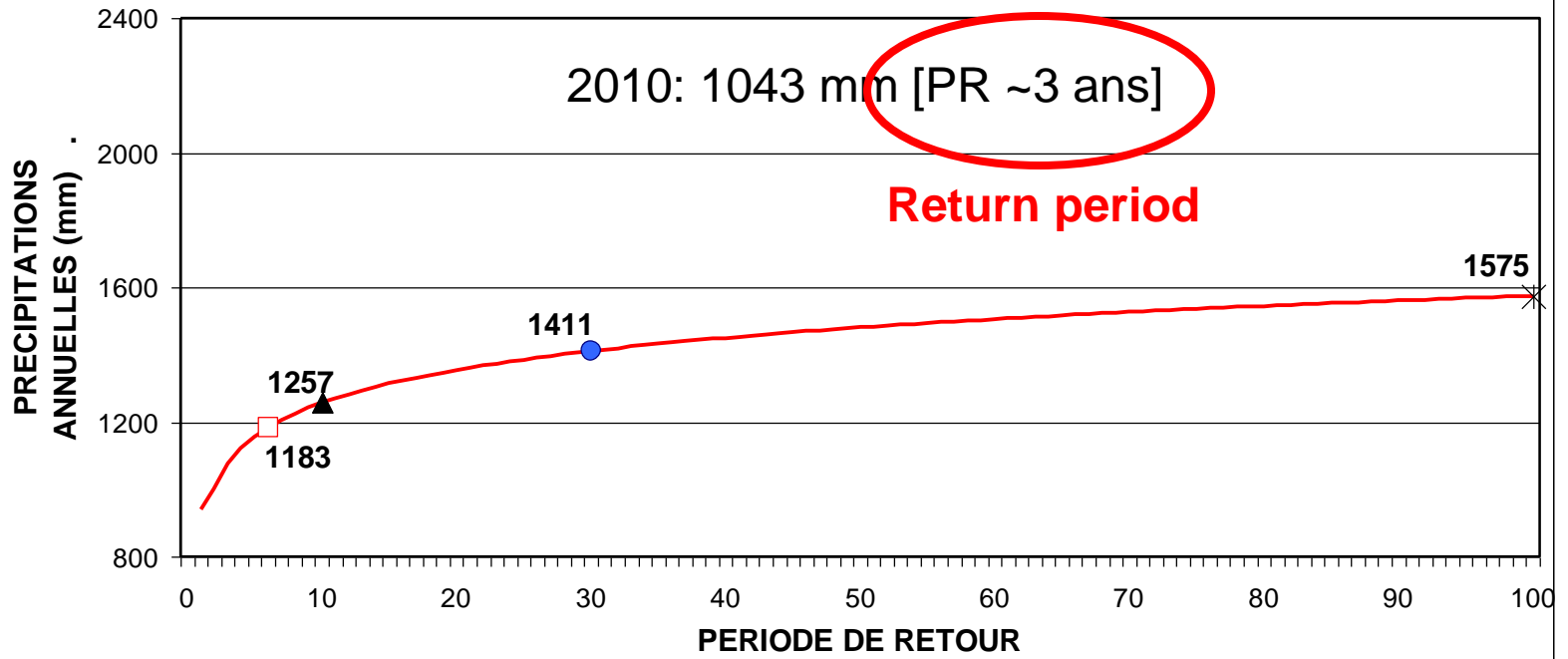
RAINFALL

RAINFALL ANOMALY INDEX IN THE OUEME WATERSHED (SYNOP), 1940-2010

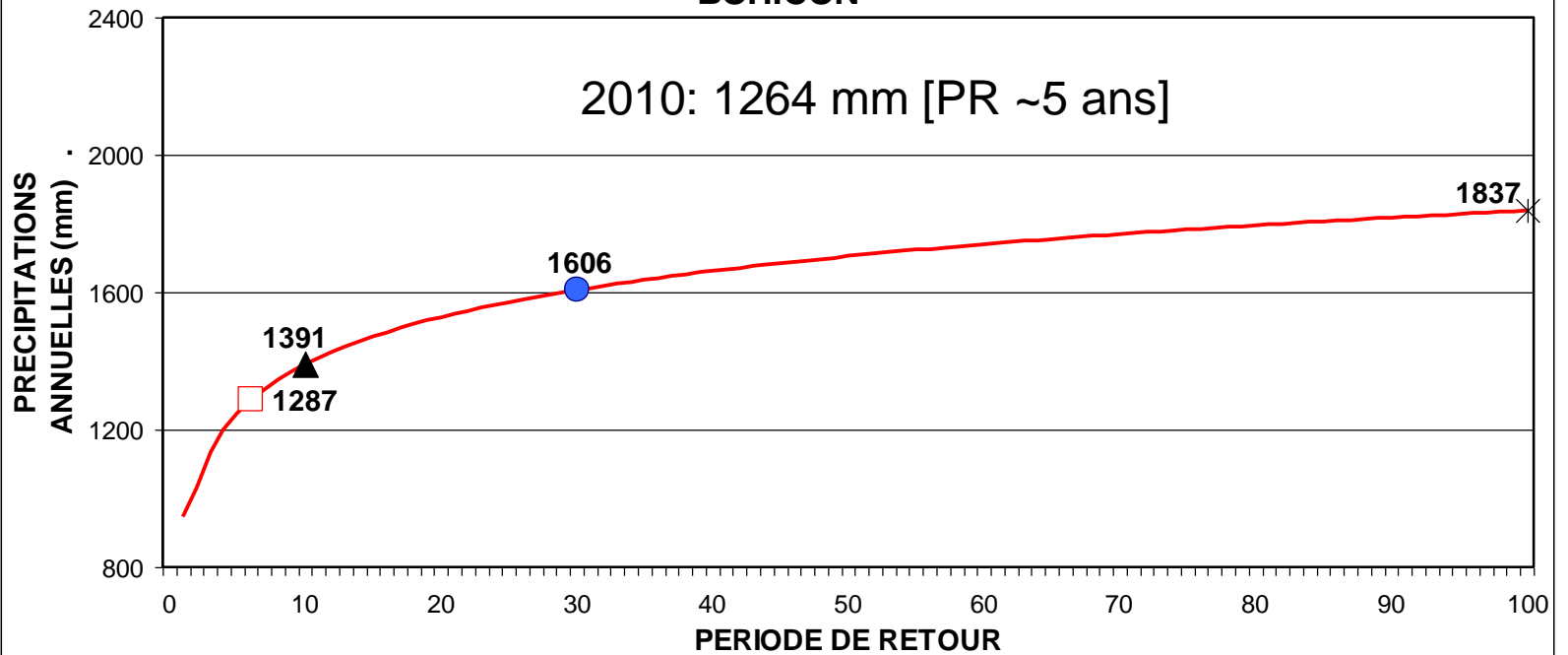


Based on rainfall data from SYNOP stations of Bohicon, Parakou and Savé

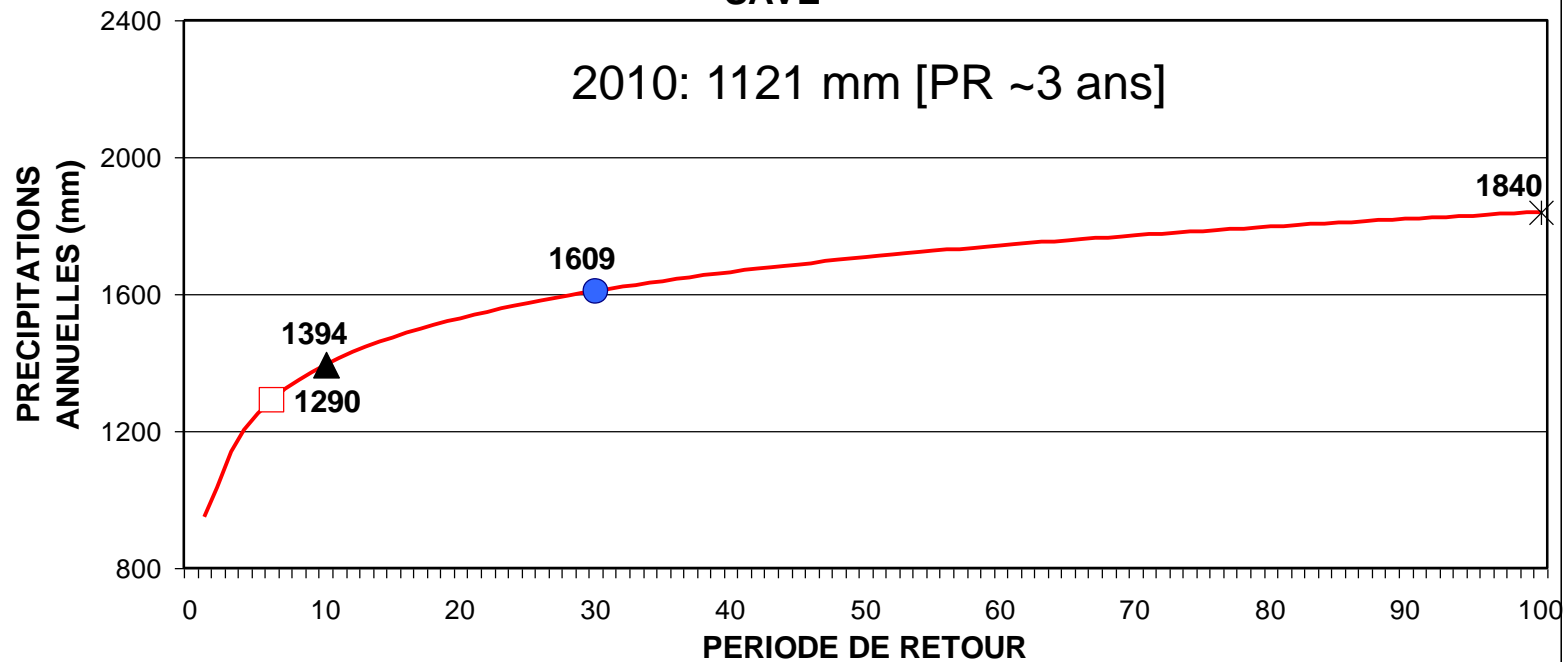
KANDI



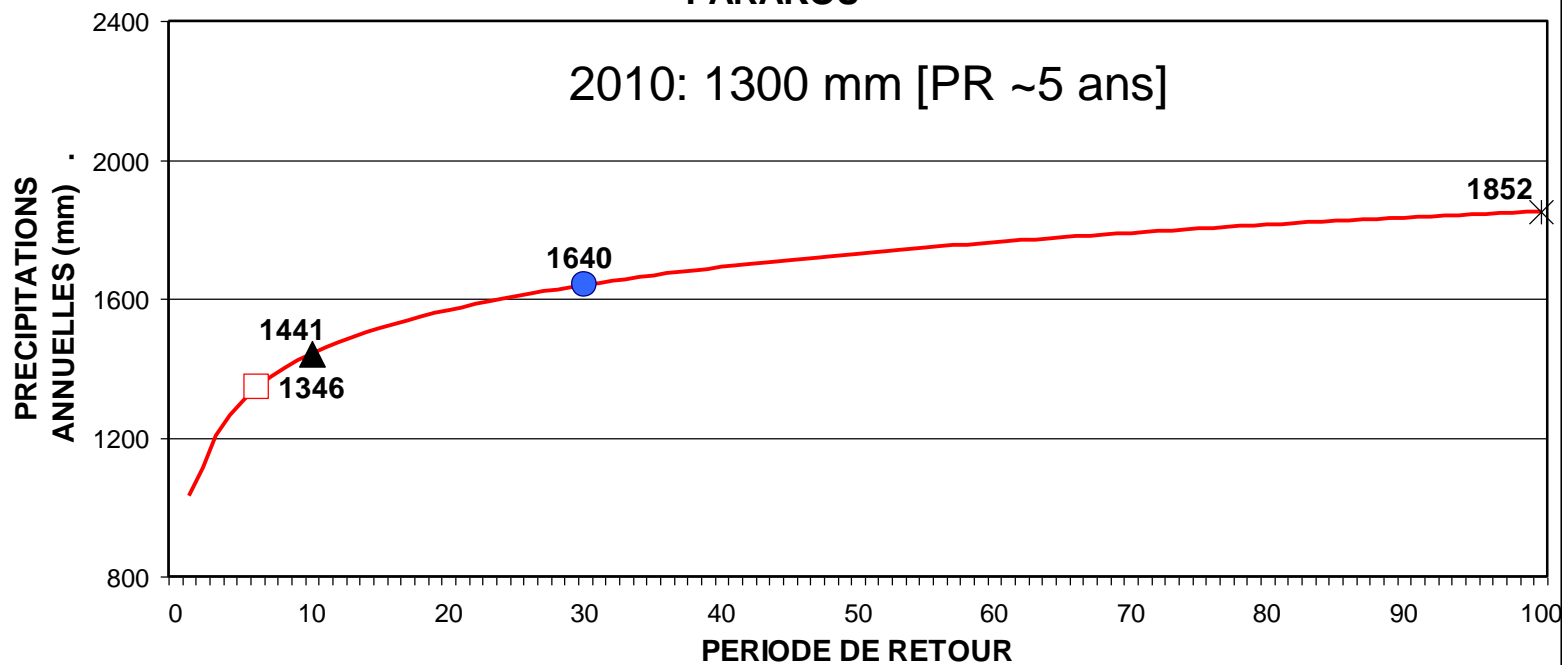
BOHICON



SAVE

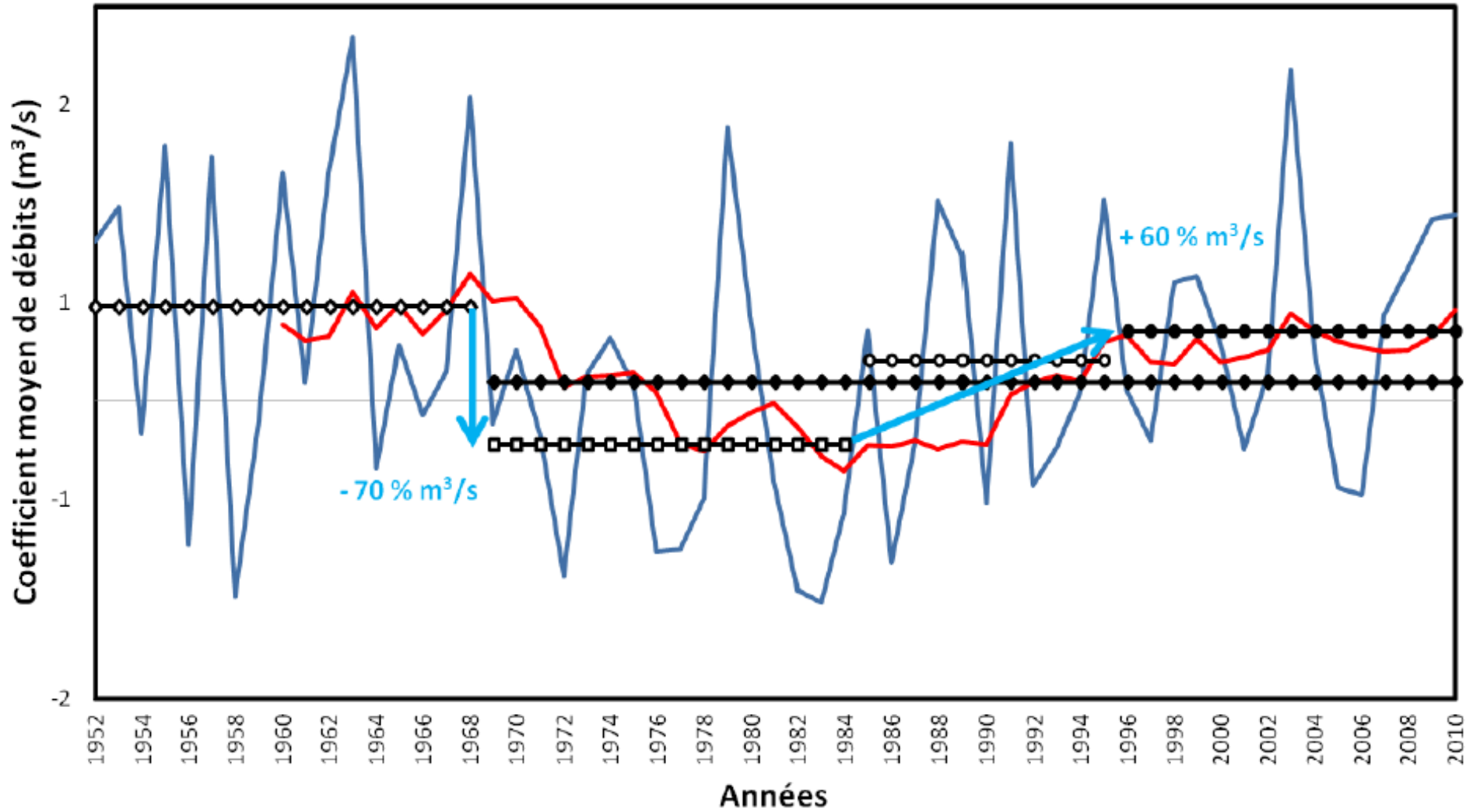


PARAKOU



IS BENIN AFFECTED BY
CLIMATE CHANGE ?

STREAMFLOW

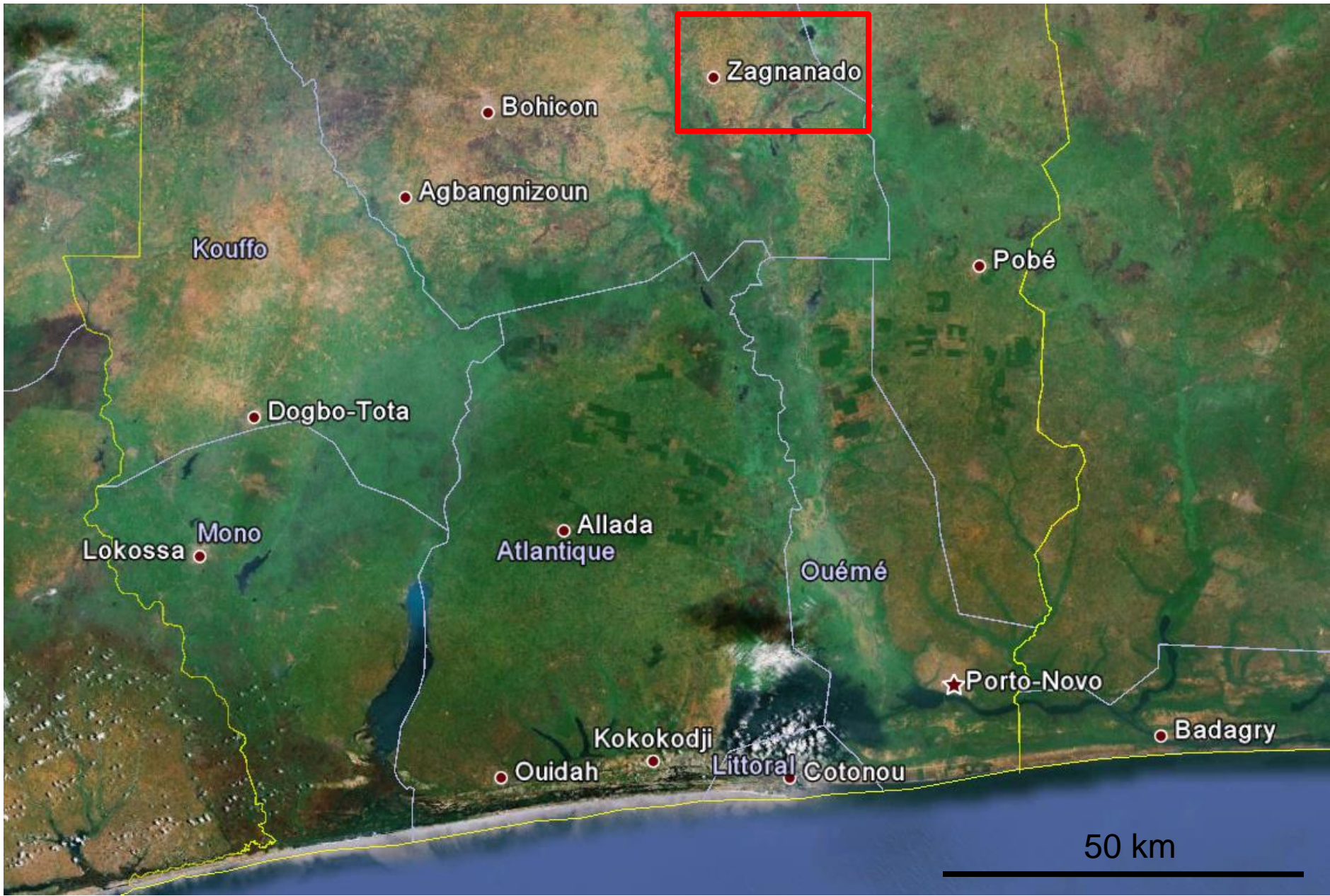


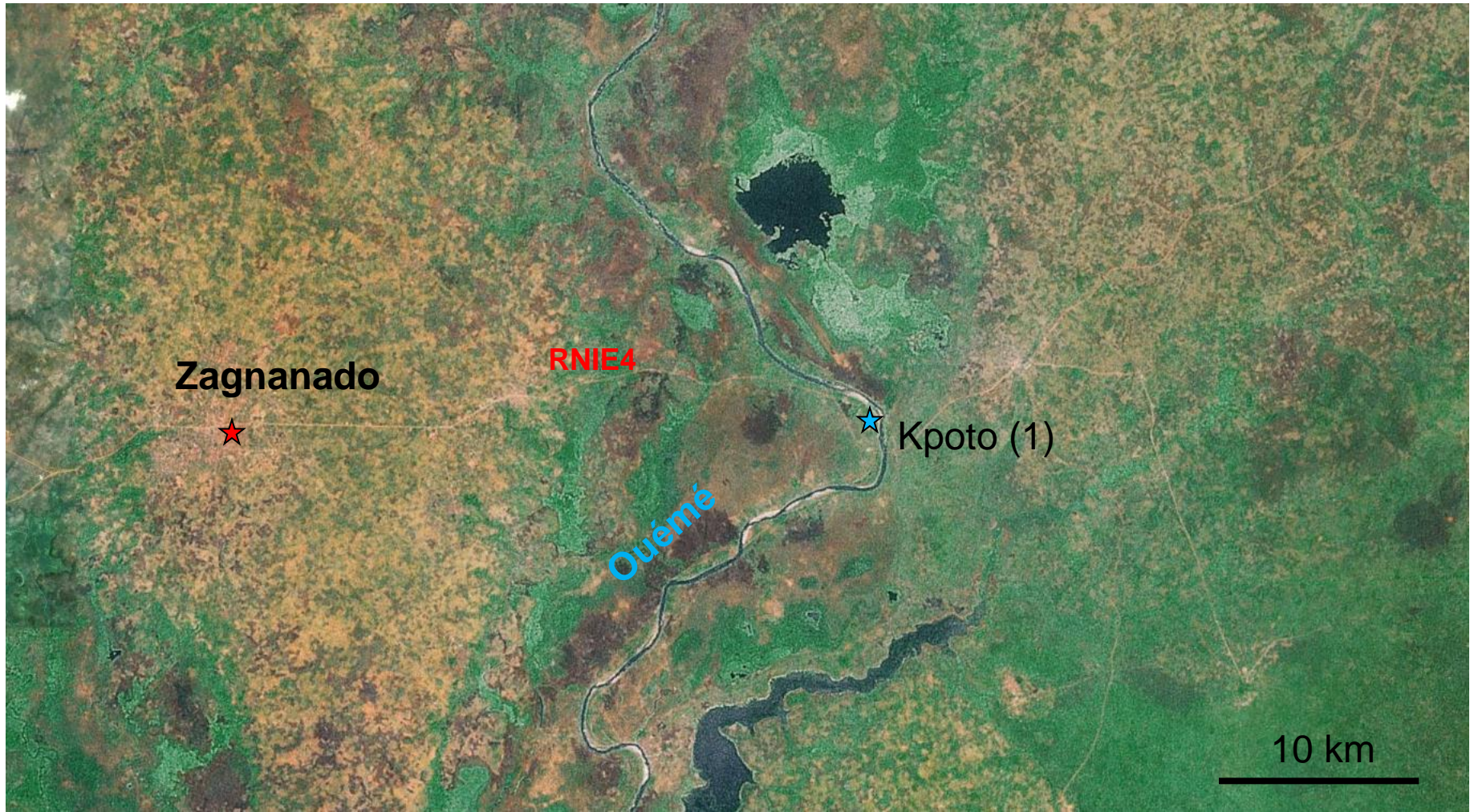
— Débit moyen annuel (m^3/s) — Moyenne centrée [9 ans] — Moyenne 1952-1968 — Moyenne 1969-1984

— Moyenne 1985-1995 — Moyenne 1996-2010 — Moyenne 1969-2010

IS BENIN AFFECTED BY
CLIMATE CHANGE ?

THE CASE OF KPOTO







September 2010
KPOTO, Commune of Zangnanado

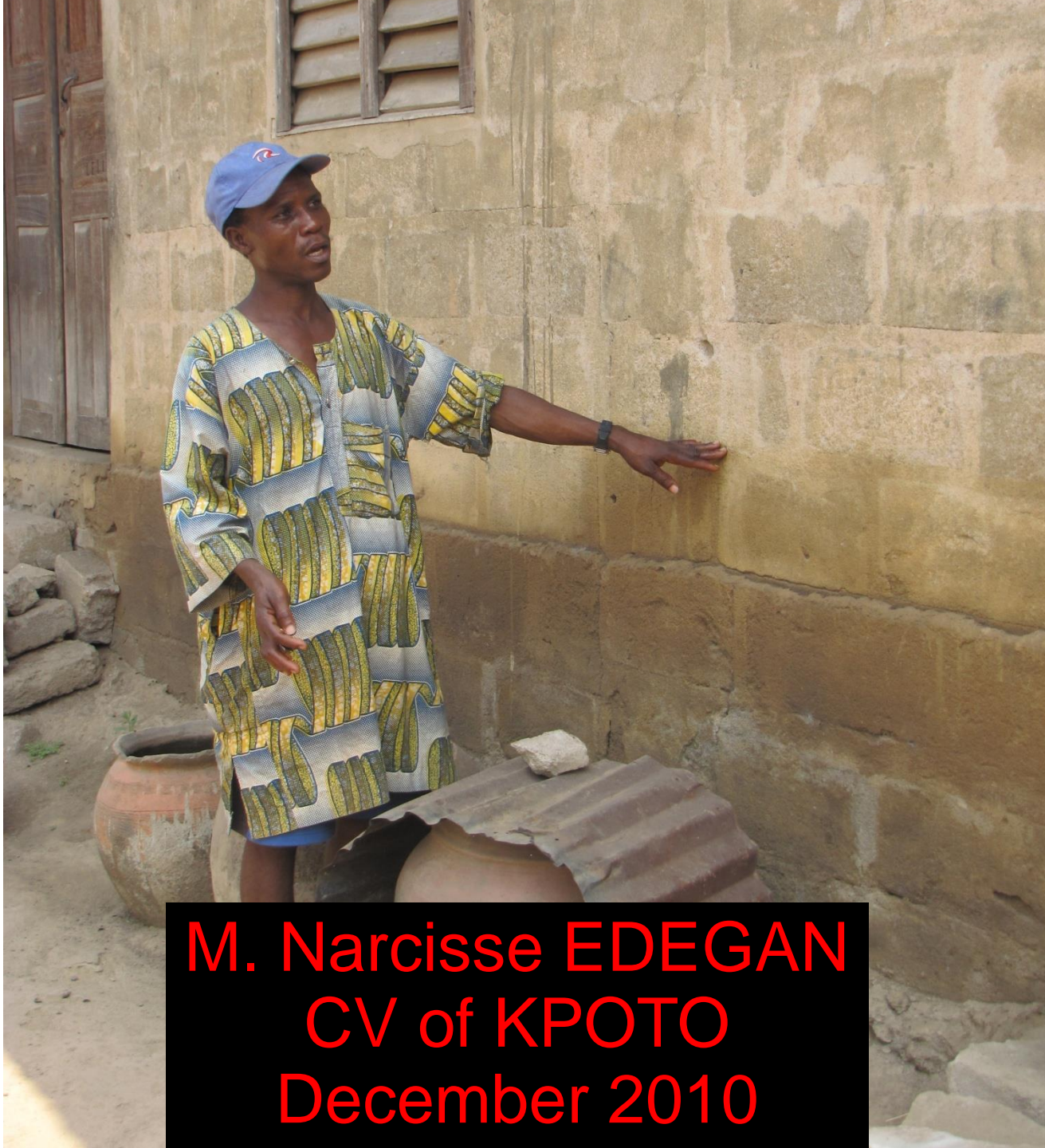


REFUGEE CAMP :

800 people, < ½ ha

at 2 km from KPOTO, Commune of Zangnanado

December 2010



**M. Narcisse EDEGAN
CV of KPOTO
December 2010**



Village of KPOTO
December 2010



Village of KPOTO
December 2010



Village of KPOTO
December 2010

Strong resignation among the affected population

« *Durant les deux premiers mois, nous avons fait l'objet de visites incessantes de politiciens et autres mécènes pour des 'dons' très médiatisés. Puis, plus rien... »*

<http://www.youtube.com/watch?v=I1vD6AzU8cc>

'dons' [donation] means 500,000 FCFA (762 EUR) for the commune of Zagnanado (5940 affected people), that is 0.13 EUR per capita.

BUT, this donation rarely reached the targeted people !!!

Local authorities response to prevent future floods

- Creation of a communal cell for flood early warning.



The image shows a screenshot of a news article from the website 'Le Matinal'. The page features a navigation bar with categories like 'ACCUEIL', 'POLITIQUE', 'SPORT', 'SOCIETE', 'ART & CULTURE', 'ACTU NATIONALE', 'ACTU AFRIQUE', 'ACTU MONDE', 'INSOLITES', and 'EMPL'. The article is dated '27 septembre 2012' and is titled 'Zagnanado, Ouinhi et Zogbodomey: Les autorités s'arment contre les inondations'. A photograph shows a person wading through floodwaters. The main text of the article reads: 'Le débordement des cours d'eau dans le Septentrion met en état d'alerte les élus locaux des Communes de Zagnanado, Ouinhi et Zogbodomey dans le département du Zou. Ils activent déjà leur plan de contingence pour prévenir les calamités naturelles auxquelles sont confrontées chaque année leurs populations.'

→ September 27th, 2012

AUTORITES COMMUNALES
(Cellule Communale Permanente de Gestion de Crises d'Inondations)



ELUS LOCAUX

**METEOROLOGUE
COMMUNAUTAIRE**

**ONGs intervenant en matière
d'adaptation aux changements
climatique**

DST

SAPEURS POMPIERS

**REPRESENTANT LOCAL DE
L'ASECNA**

SAGES ET NOTABLES

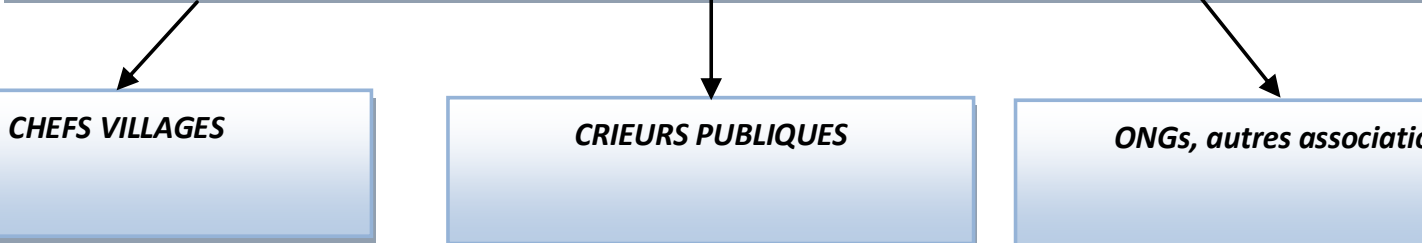


DIFFUSION DES DECISIONS PRISES

CHEFS VILLAGES

CRIEURS PUBLIQUES

ONGs, autres associations



AUTORITES COMMUNALES
(Cellule Communale Permanente de Gestion de Crises d'Inondations)

ELUS LOCAUX

**METÉOROLOGUE
COMMUNAUTAIRE**

**ONGs intervenant en matière
d'adaptation aux changements
climatiques**

**REPRESENTANTS
COMMUNAUTAIRES**

SAPEURS POMPIERS

**REPRESENTANTS LOCALS DE
L'AGRICULTURE**

**ANALYSE DES RISQUES
HYDROCLIMATIQUES ET PRISE
DE DECISIONS**

SAGES ET NOTABLES

DIFFUSION DES DECISIONS PRISES

CHEFS VILLAGES

CRIEURS PUBLIQUES

ONGs, autres associations

September 2012

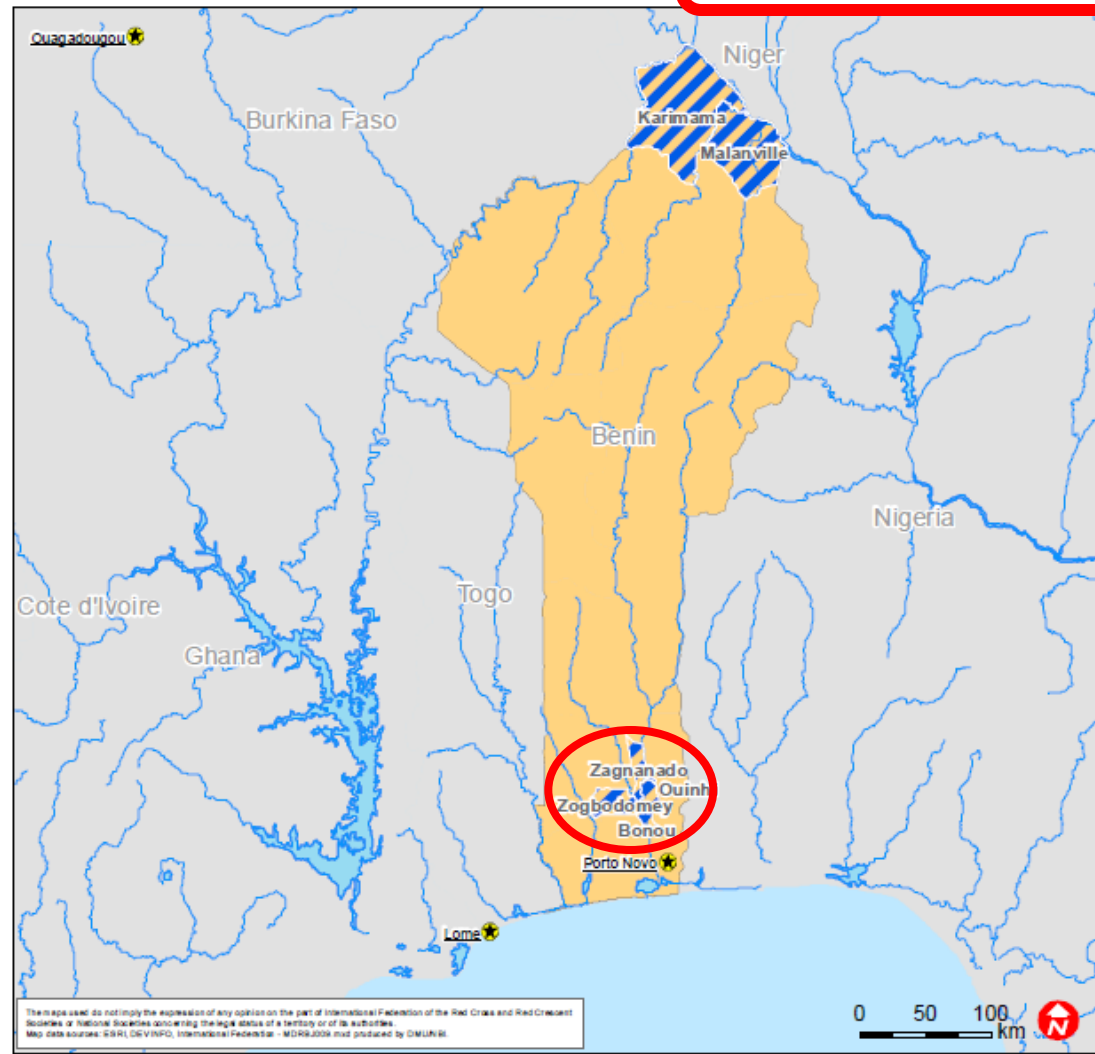
- 100% of the population of Kpoto left the refugee camp to go back to the village.






September 2012

- 100% of the population of Kpoto left the refugee camp to go back to the village.



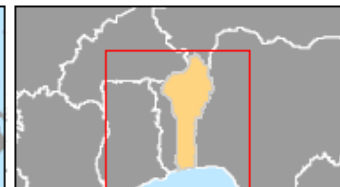
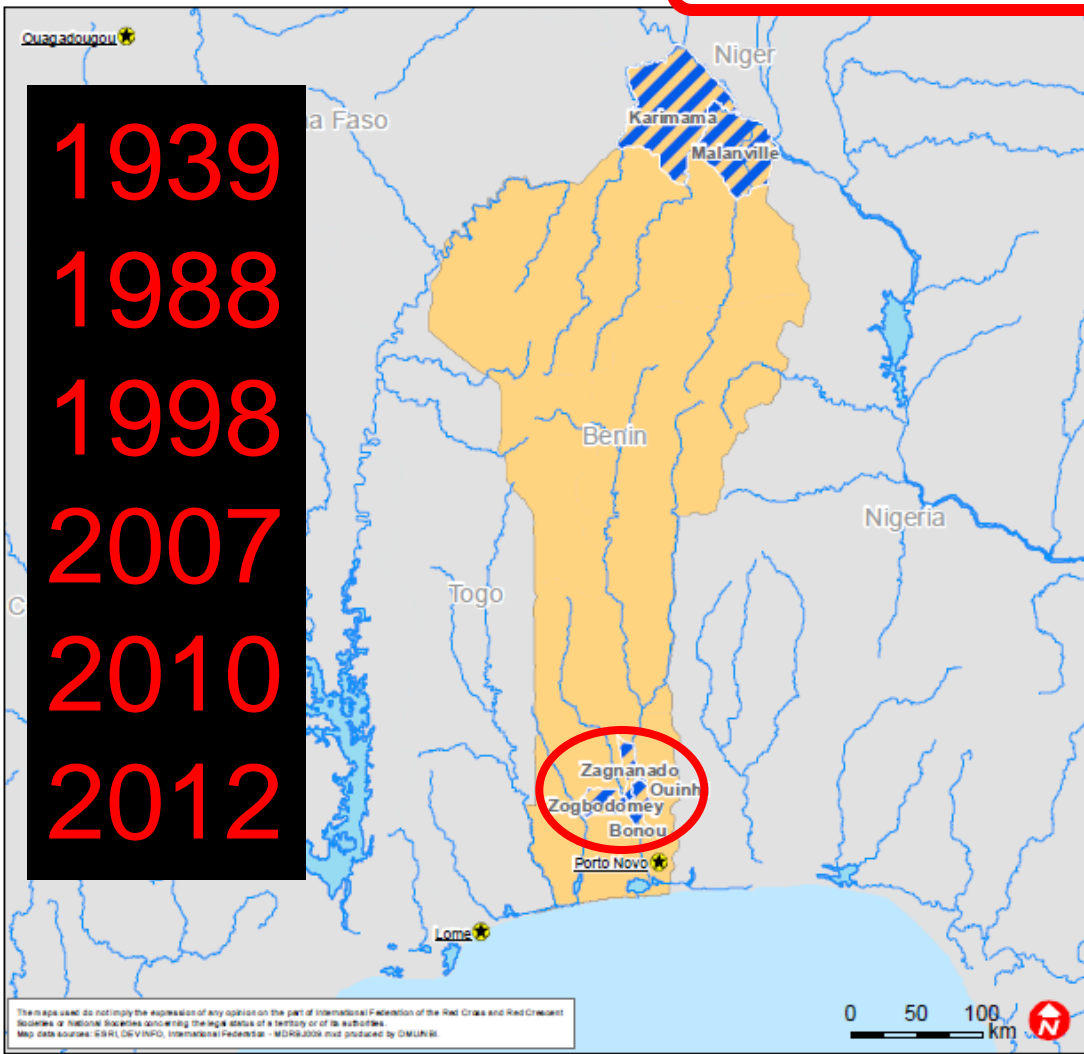
 Most affected municipalities





September 2012

- 100% of the population of Kpoto left the refugee camp to go back to the village.



Most affected municipalities

NO

BENIN

**WAS NOT VICTIM OF
EXCEPTIONAL FLOODS DUE TO
CLIMATE CHANGE**

YES

BENIN

WAS VICTIM OF

« CLIMATE CHANGE » (but who cares?):

POOR BECAME POORER

Case study # [3]: BENIN



Cotonou: Shorelines from the sky



Cotonou: Shorelines from the sky



Cotonou: Shorelines from the sky



Cotonou: Shorelines from the sky



16 November 2012



9 September 2013



Cotonou: Shorelines from the sky



9 September 2013



Cotonou: Impacts of shoreline erosion

- We analyzed a stretch of 6 km from 2002 to 2011 at the eastern part of Cotonou.
- A total land area of **53 ha** disappeared in the sea.
- A total of **487 homes** were destroyed by the encroachment of the sea, out of which **426 informal settlements** and **61 villas**.
- **1900 people were forced to leave** because of the advance of the sea: that is **316 people per linear km**.

Cotonou: shoreline erosion – RESPONSE (2013-09)



Cotonou: shoreline erosion – RESPONSE (2013-09)



Cotonou: shoreline erosion – RESPONSE (2013-09)



Cotonou: shoreline erosion – RESPONSE

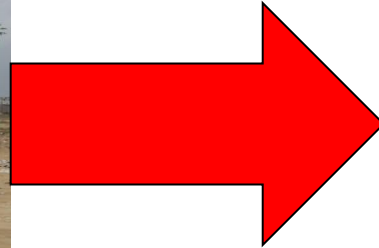


Cotonou: shoreline erosion – RESPONSE



- The project to protect the coastline is supported by the White House's Millennium Challenge Account (MCA) together with the Islamic Development Bank (IDB), Saudi, Kuwait and OPEC Funds.
- The MCA aims to adapt to climate change & to reduce poverty.

Cotonou: shoreline erosion – RESPONSE



- The project to protect the coastline is supported by the White House's Millennium Challenge Account (MCA) together with the Islamic Development Bank (IDB), Saudi, Kuwait and OPEC Funds.
- The MCA aims to adapt to climate change & to reduce poverty.
- **People are displaced by force without any compensation.**

NO

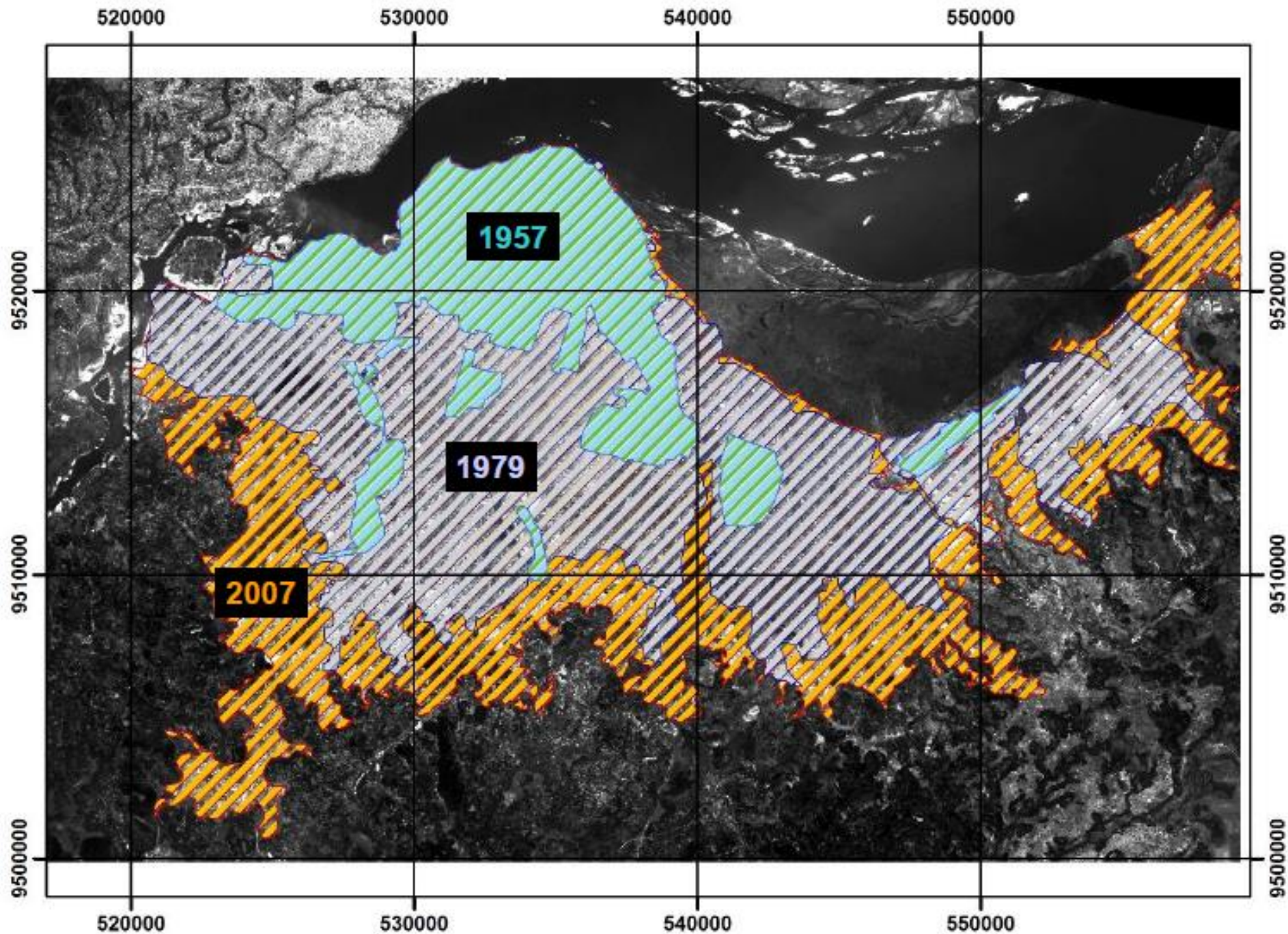
**COTONOU
WAS NOT VICTIM OF
SHORELINE EROSION DUE TO
CLIMATE CHANGE**

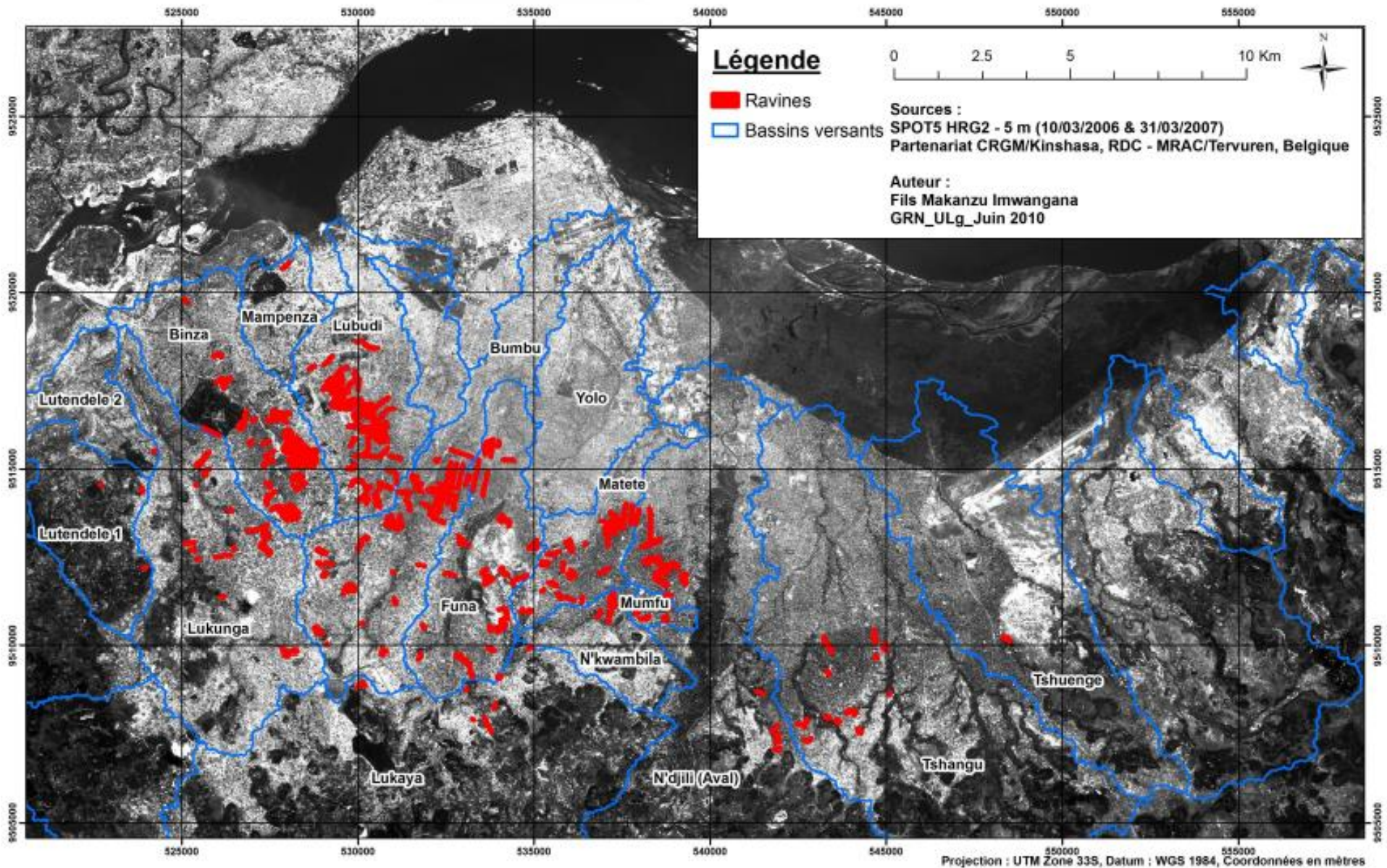
YES

COTONOU
WAS VICTIM OF
« CLIMATE CHANGE »:
POOR BECAME POORER (and disappeared)

Bonus extra case studies:

KINSHASA (DR Congo)





Légende

- Ravines
- Bassins versants



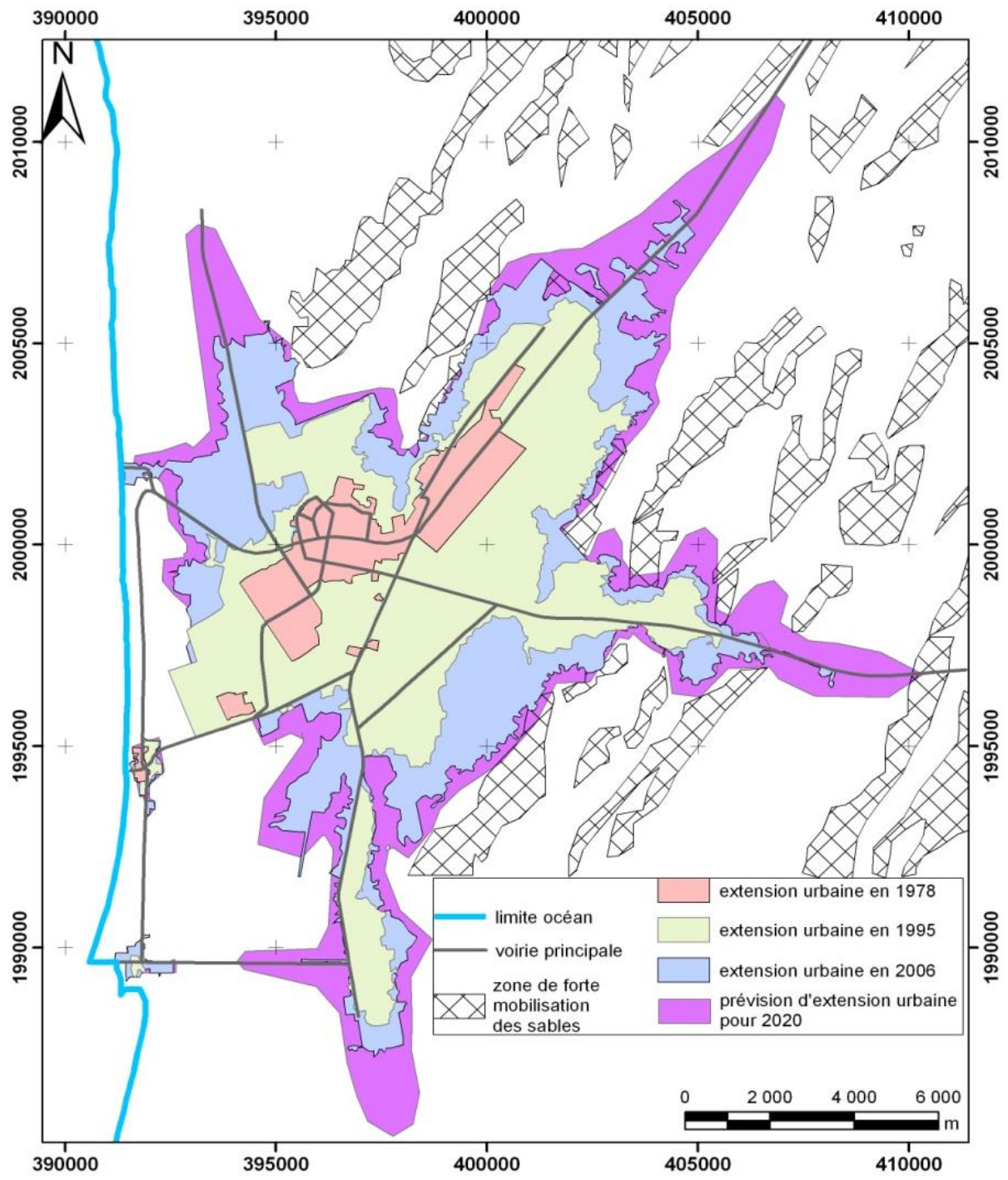
Sources :
 SPOT5 HRG2 - 5 m (10/03/2006 & 31/03/2007)
 Partenariat CRGM/Kinshasa, RDC - MRAC/Tervuren, Belgique

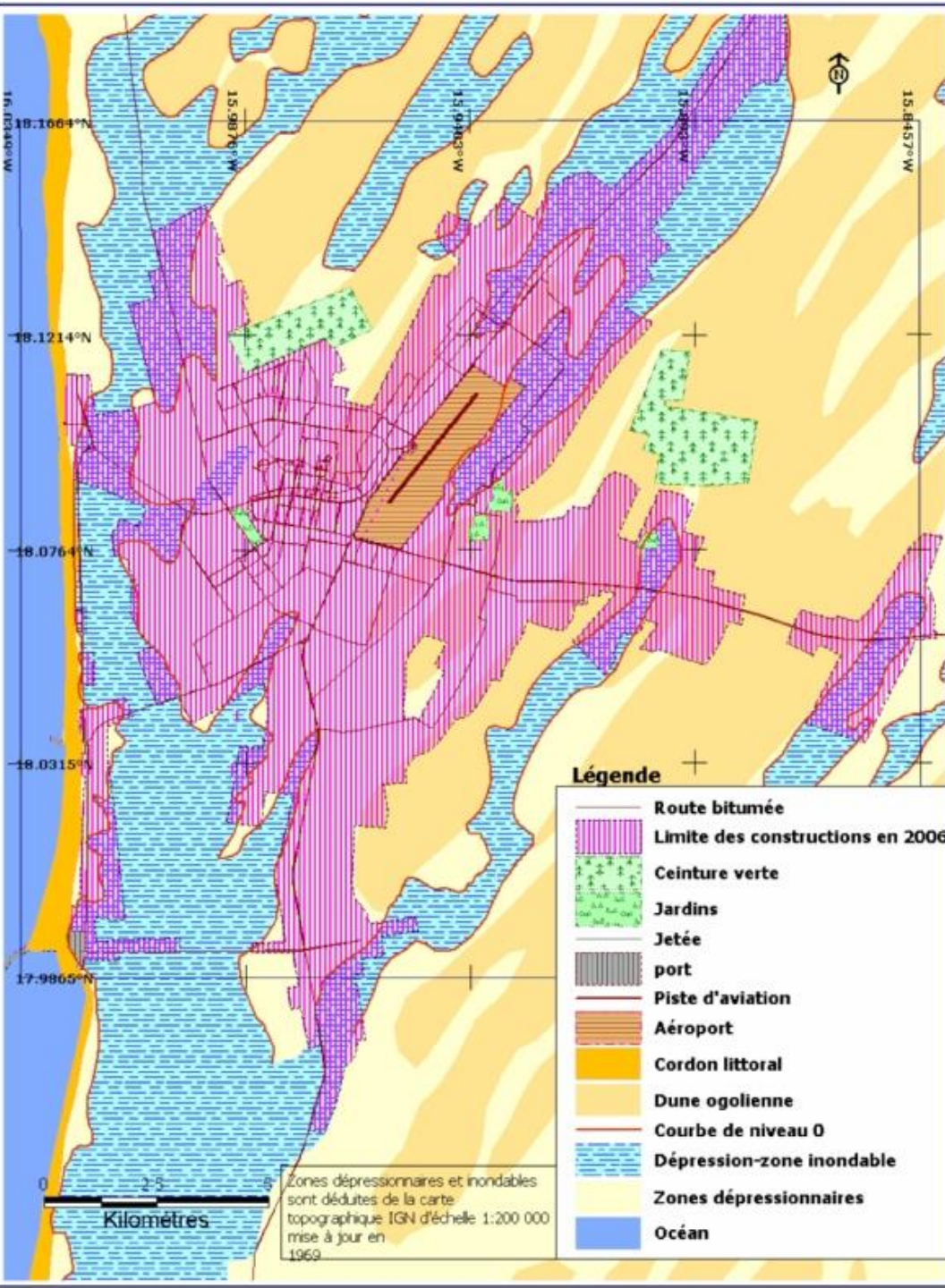
Auteur :
 Fils Makanzu Imwangana
 GRN_ULg_Juin 2010

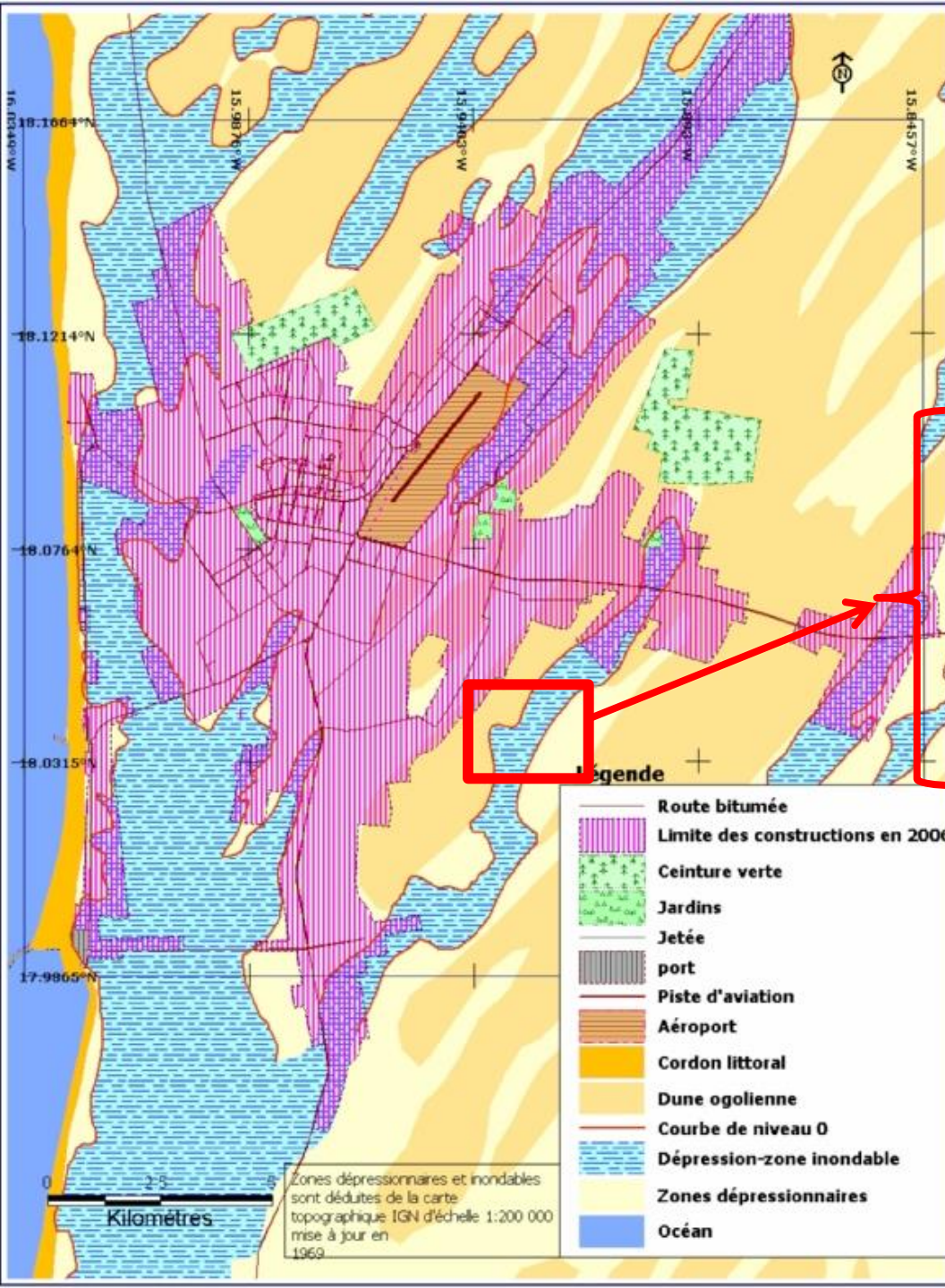


Bonus extra case studies:

NOUAKCHOTT (Mauritania)





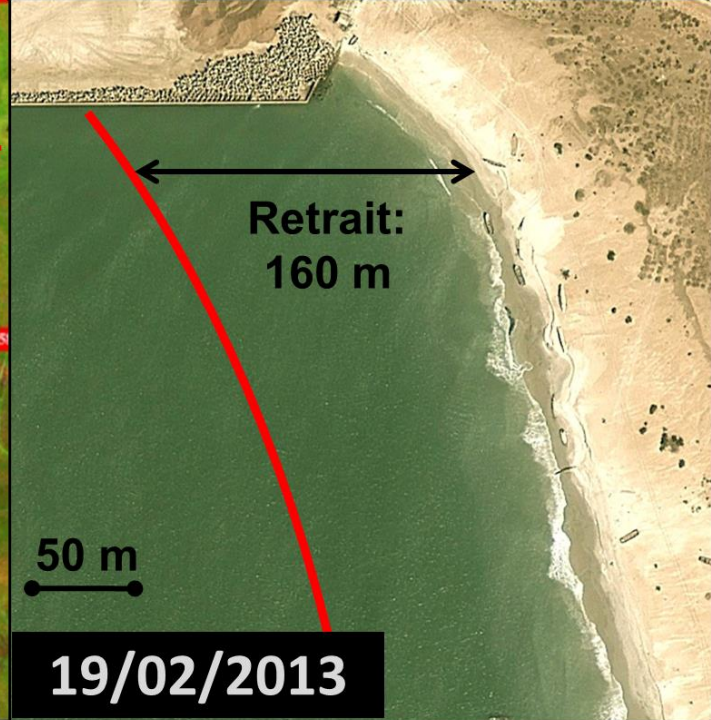
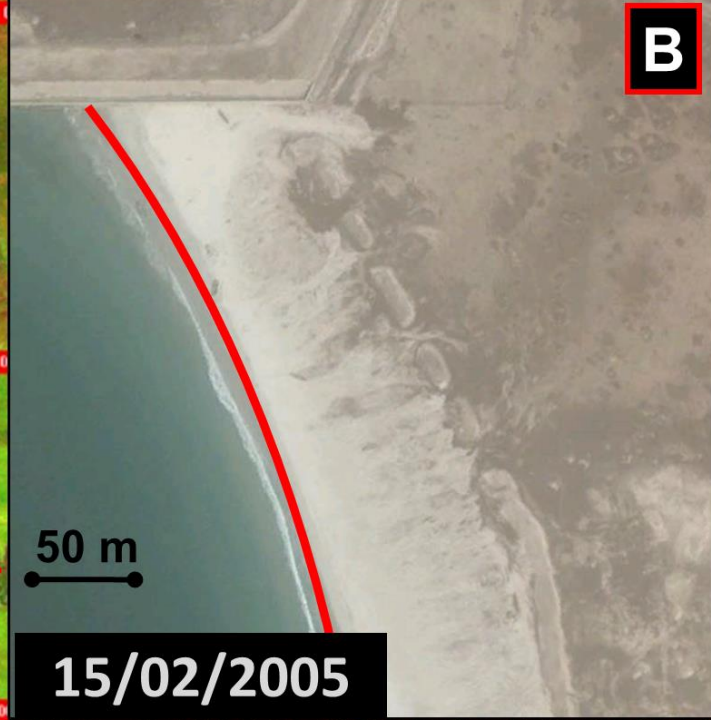
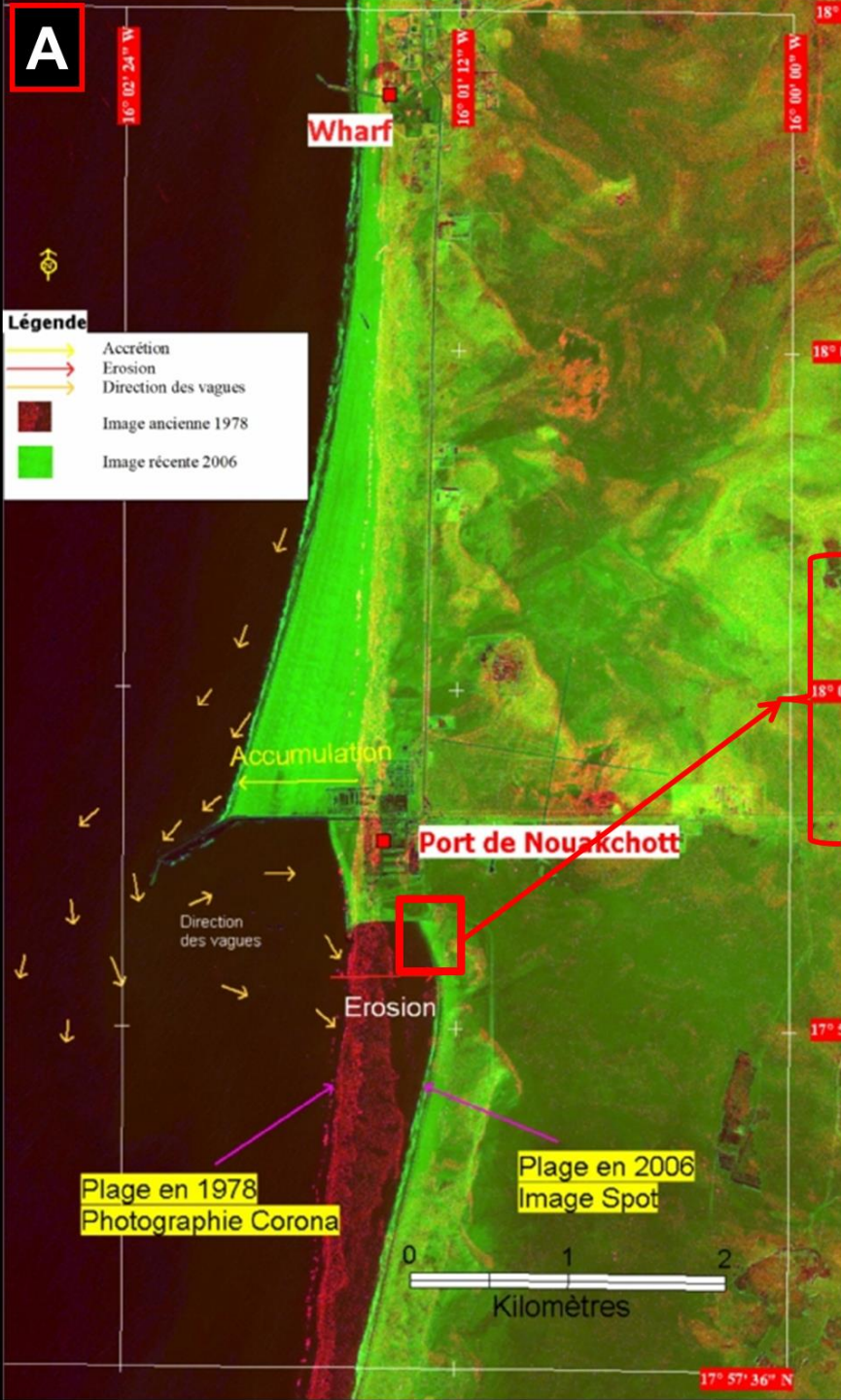


15/06/2010



25/12/2012





THANK YOU

pozer@ulg.ac.be

References (work in progress)

- [1] Ozer, P. (2012). Is the fishing village of Phan Thiet victim of climate change? *Geo-Eco-Trop*, 36, 29-38. <http://hdl.handle.net/2268/157495>
- [2] Ahouangan, MBD, Hountondji, YC, Thiry, A, de Longueville, F, Djaby, B, & Ozer, P. (2013). Adaptation et résilience des populations rurales face aux catastrophes naturelles en Afrique subsaharienne. Cas des inondations de 2010 dans la commune de Zagnanado, Bénin. *Eau, milieux, et aménagement : une recherche au service des territoires* (sous presse). Angers, France: Presses Universitaires d'Angers. <http://hdl.handle.net/2268/156391>
- [3] Ozer, P, Hountondji, YC, de Longueville, F. (2013). Erosion littorale et migrations forcées de réfugiés environnementaux. L'exemple de Cotonou, Bénin. In : 8th International conference (IAG) on Geomorphology: « Geomorphology and sustainability », Paris, 27-31 August 2013, p. 588. <http://hdl.handle.net/2268/155861>
- [4] Makanzu, F, Moeyersons, J, Vandecasteele, I, Trefois, P, Ntombi, M, Ozer, P. (2013). Les villes d'Afrique Centrale balafées par l'érosion ravinante : inventaire cartographique et impact socio-économique à Kinshasa (RDC). In: Territoires périurbains : développement, enjeux et perspectives dans les pays du Sud, Gembloux, Belgium, 19 décembre 2013. <http://hdl.handle.net/2268/156890>
- [5] Ozer, P, Ould Sidi Cheikh, MA, Ozer A. (2013). Etalement urbain des villes en Afrique subsaharienne et vulnérabilité croissante face au risque d'inondation : l'exemple de Nouakchott (Mauritanie). In: Territoires périurbains : développement, enjeux et perspectives dans les pays du Sud, Gembloux, Belgium, 19 décembre 2013. <http://hdl.handle.net/2268/156896>