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Is the fishing village of Phan Thiet victim of climate change ?

Le village de pêcheurs de Phan Thiet est-il victime du changement climatique ?

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Résumé : Le réchauffement climatique est une réalité, attesté par des observations les plus diverses comme l'élévation globale des températures de l'atmosphère et des océans, l'extension de la fonte des neiges et des glaciers et la montée des niveaux marins. Ce dernier élément est potentiellement une certitude ; la montée du niveau de la mer affectera à l'avenir les zones côtières, l'ensemble de leurs écosystèmes, la santé humaine et les économies régionales. Le Vietnam est vraisemblablement une des régions qui sera parmi les plus touchées par le phénomène avec ses 3200 km de côtes qui amplifieront une vulnérabilité résultant déjà de la subsidence des deltas du Mekong et du Fleuve rouge.
En janvier 2009,une émission internationale d'information a relayé la nouvelle que 27 habitations situées dans le village de pêcheurs de Phan Thiet situé sur la côte méridionale du Vietnam, à 200 km à l'est d'Hô Chi Minh-Ville, s'étaient effondrées et qu'une centaine d'autres étaient menacée de destruction. Selon des experts, cet événement serait à considérer comme la conséquence indubitable du réchauffement climatique.
Le présent article tend à démontrer, en utilisant les données de Google Earth, que cette hypothèse est infondée. Il met en évidence les causes réelles du retrait rapide et inévitable de la ligne de rivage au niveau du village, à savoir : l'inexistence de politique de gestion des risques naturels, l'absence totale de plan d'aménagement régional, les constructions incontrôlées des lieux de villégiature côtiers de Mui Ne situés quelques kilomètres à l'est.

Mots-clés : changement climatique, érosion des plages, tourisme, Binh Thuan, Vietnam

Abstract : Warming of the climate system is unequivocal, as it is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level. In this framework, sea level rise is virtually certain. This will impact ecosystems, coastal areas, human health, and economies. Vietnam is very likely to be one of the most affected countries with its 3200 km of shorelines with amplified vulnerability in large areas already affected by subsidence such as the Mekong and Red River deltas.
In January 2009, international broadcast news have relayed the information that 27 houses located on the southern coast of Vietnam, in the fishing village of Phan Thiet, 200 km east of Ho Chi Minh City, have collapsed and that another hundred buildings were also threatened of destruction. According to experts, this event was definitely one of the consequences of global warning.
This article shows, using the multi dates of Google Earth, that this assumption is not correct and highlights the real causes of this rapid and inevitable retreat of the coastline in this village, namely the mismanagement of natural resources, the lack of land use planning and the non-existence of policies focused on natural hazard management in the uncontrolled construction the seaside resort of Mui Ne, a few kilometers east.

Keywords: climate change, perception, beach erosion, tourism, Binh Thuan, Vietnam

INTRODUCTION

Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level. Yet, according to the Climate Research Unit of the University of East Anglia (JONES, 2012), the period 2001-2010 (0.44°C above 1961-90 mean) was 0.20°C warmer than the 1991-2000 decade (0.24°C above 1961-90 mean). The warmest year of the entire series has been 1998, with a temperature of 0.55°C above the 1961-1990 mean. After 1998, the next nine warmest years in the series are all in the decade 2001-2011. During this decade, 2008 was the coldest year of the 21st century although it was the 13th warmest year of the whole record (1850-2011).

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According to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2007), most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gases (GHG) concentrations. The observed widespread warming of the atmosphere and ocean, together with ice mass loss, support the conclusion that it is extremely unlikely that global climate change of the past 50 years can be explained without external forcing and very likely that it is not due to know natural causes alone. During this period, the sum of solar and volcanic forcings would probably have produced cooling, not warming.

Some extreme weather events have received increased attention in the last few years within the perspective of climate change. Studies show that they have changed in frequency and/or intensity over the last 50 years. Yet, it is very probable that cold days, cold nights and frosts have become less frequent over most land areas, while hot days and hot nights have become more frequent elsewhere. It is also likely that heat waves have become more frequent over most land areas, that the frequency of heavy precipitation events (or proportion of total rainfall from heavy falls) has increased and that the incidence of extreme high sea level has occurred at a board range of sites worldwide since 1975 (IPCC, 2007).

In addition to the climate change impacts, population and infrastructure continue to develop in areas that are vulnerable to extremes such as flooding, storm damage and intense heat or cold. Furthermore, land use change can often further increase vulnerability by creating more potential for catastrophic impacts from climate extremes, such as flooding due to hard precipitations events. Recent increase in atmospheric CO_2 is driven by fossil fuel burning since 9.1 GtC were emitted in 2010, compared to the 7.7 GtC/y during the 2000-2009 period and to the 6.4 GtC/y recorded during the 1990s. This increase is very important: +49% from 1990 to 2010. In addition land-use change contributed to 0.9 GtC/y in 2010. These 10.0 GtC released in 2010 are largely sufficient to exceed the balancing effect of natural pits: land (2.6 GtC) and oceans (2.4 GtC). As a result, 50% of the CO_2 released currently remains into the atmosphere, far more than the 39% in the 1990s (FRIEDLINGSTEIN and *al.*, 2010; Global Carbon Project, 2011).

Increase of sea level is consistent with warming. Global average sea level rose at an average rate of 1.3 mm/y since 1870, then of 1.8 mm/y over 1961 to 2003 and of about 3.4 mm/y from 1993 to 2008 (IPCC, 2007; CAZENAVE & LLOVEL, 2010). Since 1993, approximately 30% of the rate of sea level rice is due to ocean thermal expansion in response to ocean warming. Mass loss in mountain glaciers and ice sheets accounts for approximately another 55% (CAZENAVE & LLOVEL, 2010).

The latest IPCC report predicts, by the mid- to late 21st century, a virtually certain sea-level rise but many uncertainties remain about the impact of the future climate. For example, the latest IPCC report projected a global sea level rise of 18 to 59 cm from 1990 to the 2090s, plus an unspecified amount that could come from changes in the large ice sheets covering Greenland and Antarctica (IPCC, 2007). But since 1993, sea level has risen about 80% faster, at 3.4 mm/y, than the average IPCC model projection of 1.9 mm/y (CAZENAVE & LLOVEL, 2010). IPCC's projections may therefore be obsolete. Yet, as presented in Fig. 1, a number of recent studies taking a semi-empirical approach have predicted much higher sea level rise for the 21st century than the IPCC, exceeding one meter if greenhouse gas emissions continue to escalate (RAHMSTORF, 2010; NICHOLLS & CAZENAVE, 2010).

Such uncertainty on future sea level rise is extremely important since its immediate effect is submergence and increased flooding of coastal land, as well as saltwater intrusion of surface waters. Longer-term effects also occur as the coast adjusts to the new conditions, including increased erosion and saltwater intrusion into groundwater. Coastal wetlands such as salt marshes and mangroves will also decline unless they have a sufficient sediment supply to keep pace with sea level rise, which is rarely the case. These physical impacts in turn have both direct and indirect socio-economic impacts, which appear to be devastatingly negative. These impacts are likely to be even worst in lower areas already affected by subsidence such as the Mekong and Red River deltas in Vietnam (NICHOLLS & CAZENAVE, 2010; BOATENG,

2012). Flooding of coastal land and increasing shoreline erosion will probably cause massive population displacements, as frequently forecasted as one of the most dramatic possible consequences of climate change (LACZKO & AGHAZARM, 2009).

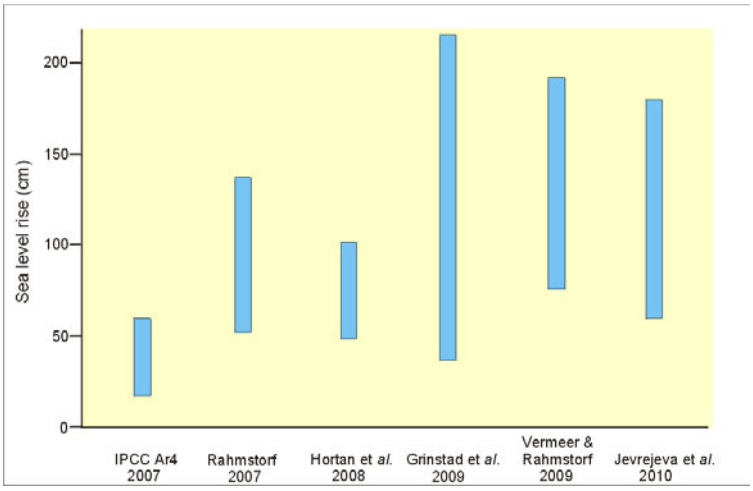

Fig. 1 : Estimates for 21st century sea level rise from semi-empirical models as compared to the IPCC Fourth Assesment report (IPCC, 2007). For exact definitions of the time periods and emissions scenarios, see Rahmstorf, 2010

THE CASE STUDY: A FISHING VILLAGE VICTIM OF CLIMATE CHANGE

In March 2011, we undertook a fieldtrip in the Binh Thuan Province in order to assess recent trends and perceptions of climate change in the driest area of Vietnam. During a survey realized among farmers, water resources planners and the agriculture administration, all interlocutors pointed out that the area of interest was already affected by climate change, the destruction of a fishing village on the western side of the Phan Thiet city being the undergoing symbol of climate change impact. Yet, the retreat of the shoreline is indubitable (Fig. 4). While searching on the web, it indeed appears that in January 2009, 27 houses located on the southern coast of Vietnam, in the village of Phan Thiet, into a tourist area, 200 km east of Ho Chi Minh City, have collapsed. A hundred other buildings were also threatened of destruction. The international media relayed the following information: “hundred of soldiers, coast gards and volunteers were mobilized to raise sandbags on site and try to limit the damage. Involved: coastal erosion, eroded by strong waves. According to experts, Vietnam and more than 3200 km of coastline are among the areas most vulnerable to the effects of global warming, whether rising sea level or increase the frequency of typhoons and floods” (RTL, 2009). So, this is definitely one of the consequences of global warming (Fig. 2).

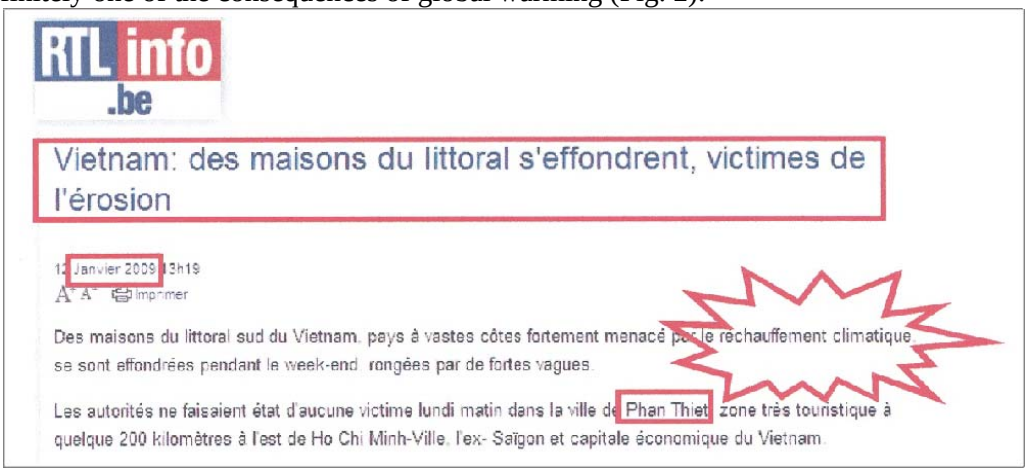

Fig. 2: Example of how the international media relayed the information about the destruction – because of “global warming” – of 27 houses located on the southern coast of Vietnam in a fishing village, east of Phan Thiet (RTL, 2009)

WHAT HAPPENED IN THE FISHING VILLAGE VICTIM OF CLIMATE CHANGE

In order to understand the shoreline dynamics in the eastern Phan Thiet area and what really happened to the fishing village, we used multi dates from remote sensing data in Google Earth. Figure 3 presents the global area and shows the littoral sea drift.

Fig.3: Presentation of the study area with the city of Phan Thiet on the western part and three areas of special interest: the fishing village, the Phu Hai Resort area and the limit of the western tourist zone. The blue arrow presents the main direction of the littoral sea drift.

It appears that the fishing village has suffered from very fast shoreline erosion since the beach totally disappeared in just a few years (Fig. 4) and is now roughly protected by large rocks (Fig. 5). Although the tide height is unknown for the different satellite images; the marling in this area is not important and it is unlikely that it may impact the global interpretation of rapid shoreline changes. But, when having a look a few kilometres on the eastern side, we can notice that many luxury resorts and highly standardized hotels were erected along the coastline. The first hotel was built in 1994 (Coco Beach) and since then, all the coastline has been built with direct access to the beach. Mui Ne has modified its space to accommodate tourists, mainly Western ones. Coconut plantations have been removed to make way for coconut trees for making only decoration on the beach; sand has been levelled and the hotel facilities have covered the dunes to be in direct contact with the beach. Thus, any “exotic” decor that is created to be conform with the tastes of Western tourists (PEYVEL, 2008).

The result was known in advance: the fragile coastline equilibrium is broken and the sediment balance becomes negative. This section of the coastline has been analysed previously by THAO and *al*. (2008). Using satellite images between 1973 and 2002, they found that the shoreline of Mui Ne retreated by 0.1-0.3 m/y. But the erosion rate is now much higher. Yet, between March 2006 and May 2009, the thirty meters beach has totally disappeared in front of the Romana Resort & Spa as a result of the construction of a groyne in front of the White Sands Resort. Yet, westwards of this resort, all sand beaches disappeared (Fig. 6)

Since the beach is the rationale of this place, it had to be preserved at all costs. Thus, developers have used the construction of groynes of over 100 meters long to recreate long

Fig. 4: The fishing village, east of Phan Thiet in 2006 and 2009 (for location, see Fig. 3 [a])

Fig. 5: The fishing village in 2011 with rocks for protection against erosion

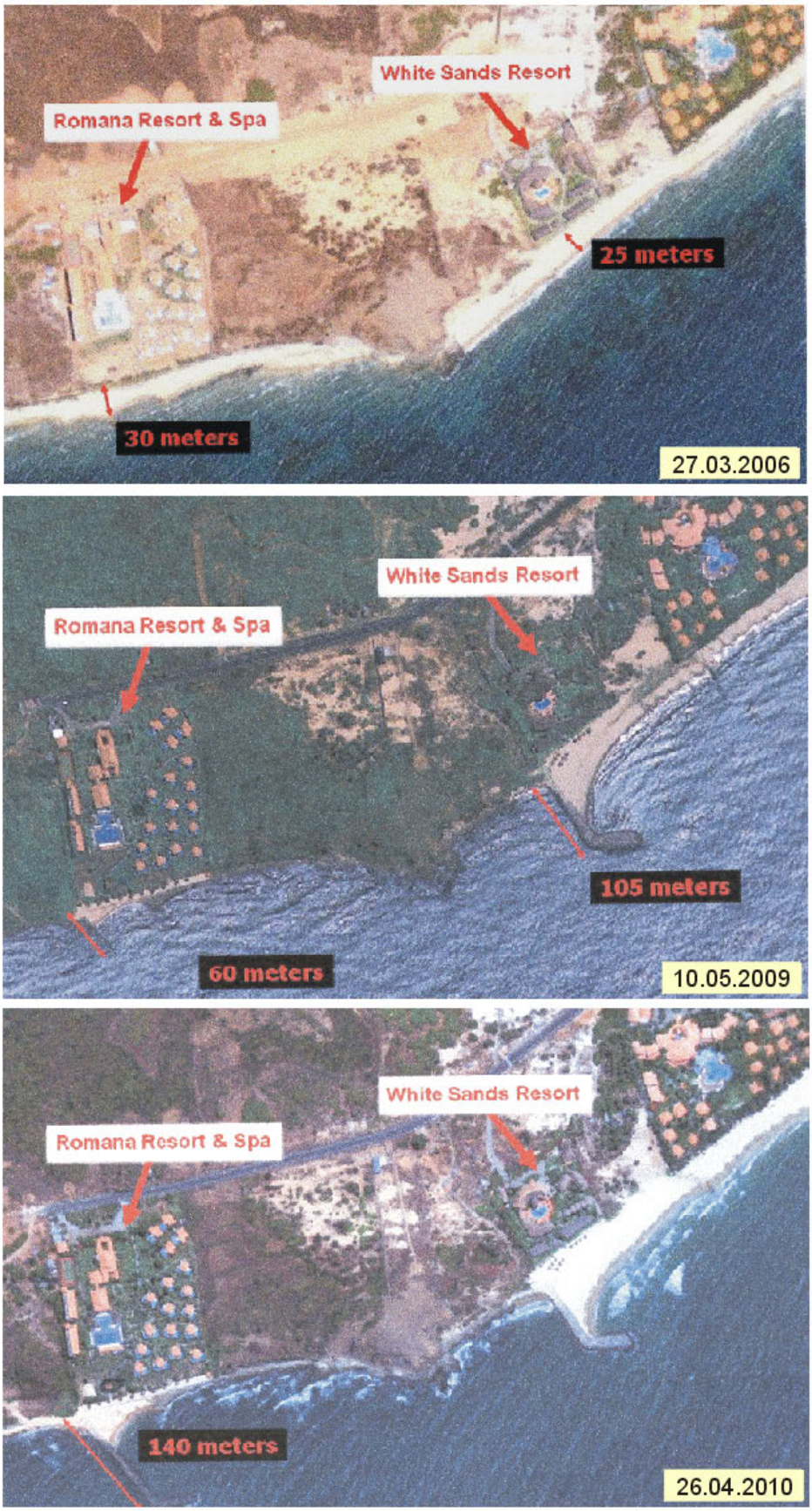

Fig. 6: Evolution of the beach erosion and consecutive construction of jetties for protection, first in front of the White Sands Resort (2009), then in front of the Romana Resort & Spa (2010). For location, see: Fig. 3[b]

Fig. 7: Constructions of jetties for beach protection, first in front of the White Sands Resort

Fig. 8: View of the jetty for beach protection in front of the Romana Resort & Spa (from its web site: http://www.romanaresort.com.vn)

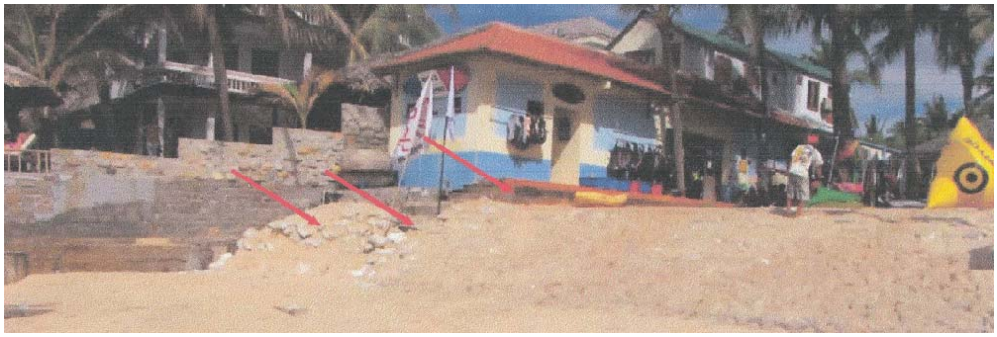

Fig. 9: Beach erosion at the limit of the western resorts (for location: see Fig.3 [c])

beaches artificially that interrupt the longshore sediments as shown in figures 6 to 8 in front of the White Sands Resort in 2009 (105 meters long), then in front of The Romana Resort & Spa in 2010 (140 meters long). The beach recess in the tourist area is therefore controlled by groynes and jetties but it results of a displacement of the erosion spots to somewhere further down drift of the shore and causes the disappearance of beaches provoking the collapse of fishermen houses. The main reason of the beach erosion in the area is not likely linked directly to climate change and consequent sea-level rise but is due to mismanagement of natural resources, the lack of land use planning and the non-existence of policies focused on natural hazard management in the uncontrolled construction of the seaside resort of Mui Ne (TUNG and *al.*, 2008; VAN TO, 2008). Now, unprotected areas are facing erosion processes as shown in figures 9 and 10, and beaches are artificially refilled on daily basis (Fig. 11).

Fig. 10: Seawalls destroyed by erosion processes at the limit of the western resorts (For location, see: Fig. 3 [c])

Fig.11: Artificial refill of beaches. Sand comes by truck (large arrow on left), then distributed on the beach on a daily basis in order to slow erosion (For location, see Fig 3 [c])

DISCUSSION AND CONCLUSION

Current CO_2 emissions are well above the worst Intergovernmental Panel on Climate Change (IPCC) scenario (A1FI) projecting a global average surface warming of 2.4 to 6.4°C and a sea level rise of 26 to 59 cm at 2090-2099 relative to 1990-1999 (IPCC, 2007). Therefore, a sea level rise of well above one meter is not unlikely anymore (RAHMSTORF, 2010). Vietnam could be one of the most affected countries with its 3200 km of shorelines. But what we showed in this paper is that the term "climate change" is misused probably because it is easier to blame that than the mismanagement of natural resources, the lack of land use planning, the non existence of policies focused on natural hazard and the uncontrolled constructions such as those of seaside resort of Mui Ne.

The impacts of tourism development on beach erosion have been highlighted since de 1970s. The build up of large hotels along sea-shores, interfering with the beach-dune interplay and amplifying the beach depletion, is now recognized as a locally major factor of erosion (MIOSSEC & PASKOFF, 1979; SALMON and *al.*, 2010). In many cases, tourism development becomes unsustainable in coastal areas as it also may provoke water resources decrease and

wetland degradation (BALDWIN, 2000; GARCIA & SERVERA, 2003; BOUMEAZA and *al*., 2010). In 1998, WONG already warned about the negative impacts on the coastal environment resulting from the increasing demand for resorts in Southeast Asia. He underlined the urgent need for environmental impact assessment when considering new coastal resort development as being usually unplanned and spontaneous in order to meet the tourist wishes. According to its research, such development has been encouraged by the developer's pursuit for fast profits, the slow response by the governments to the rapid tourism development and the lack of little or no enforcement, although legislation may exist. Consequently, it appears that it is difficult to enforce policies aimed at minimizing environmental impacts from coastal resort developers in Southeast Asia (LEE, 2010; ONG and *al*., 2011).

At a global scale, it appears that the tourism industry is not yet close to sustainability (BUCKLEY, 2012). This paper further illustrates that coastal resort development in Vietnam, mainly for Western tourists, is done without any consideration for environmental protection, nor social equity.

This reflection about the wrong perception of climate change and mismanagement of natural resources, which may cause several economic problems, could be extended to water availability which may not be sufficient to support recent developments of irrigated agriculture (DOUTRELOUP and *al*., 2011; HOUNTONDJI and *al*., 2012). Understanding current problems may help developing adaptation strategies in the next decades.

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