Chapter 2

Climate change and adaptation in Viet Nam
contributions from environmental history

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Abstract

Through the knowledge it brings of past climate fluctuations and its description of how societies have adapted to those changes, history has an important contribution to make in refining global warming scenarios, particularly in terms of adaptation and resilience. This is the demonstration that this chapter provides for Viet Nam, by referencing varied sources that range from dendrochronology to the meteorological bulletins of the colonial period and the imperial archives. Thanks to this combination of archive material and sources from the natural sciences, we can retrace natural and climatic variations from the XIIIth century onwards — and well beyond, in the case of some data. It also enables us to grasp the climate knowledge and theories of the past, and to understand that the desire to intervene in the climate is not a new one. This chapter opens up new horizons for research: although not yet highly developed in Vietnamese historiography, they deserve particular attention as tools to both foster academic knowledge and support the development of contemporary climate policy.

Tóm tắt

Thông qua tri thức về thay đổi khí hậu trong quá khứ và mô tả về cách thức các xã hội thích ứng với những thay đổi đó, lịch sử có đóng góp quan trọng trong việc tiếp cận các kịch bản nóng lên toàn cầu, đặc biệt là với khả năng thích ứng và chống chịu. Chương này chính là sự phản ánh điều đó trong khung cảnh Việt Nam bằng việc thống kê các nguồn tài liệu khác nhau từ phân tích vòng tuổi thân cây tới dữ liệu trên các bản tin khí tượng thời thuộc địa và kho lưu trữ hoàng cung. Nhờ sự kết nối tài liệu lưu trữ với dữ liệu từ các ngành khoa học tự nhiên, chúng ta có thể tái hiện những biến động về tự nhiên và khí hậu từ thế kỷ XIII trở đi – thậm chí là từ trước đó nữa đối với một số loại dữ liệu. Chúng cũng cho phép chúng ta nắm rõ tri thức khí hậu và các lý thuyết tiếp cận trong quá khứ, để hiểu rõ rằng nỗ lực can thiệp vào khí hậu không phải là một vấn đề mới. Chương này sẽ mở ra những đường chân trời mới cho lĩnh vực nghiên cứu này: dù hiện tại vấn đề chưa được phát triển trong nền sử học Việt Nam, chúng xứng đáng có được sự chú ý đặc biệt như những công cụ để thúc đẩy tri thức học thuật và giúp cho sự phát triển của chính sách khí hậu hiện tại.

Résumé

L'histoire, par la connaissance des fluctuations passées du climat qu'elle apporte, et la description des adaptations des sociétés à ces changements, contribue fortement à affiner les scénarios du réchauffement climatique, particulièrement sur les questions d'adaptation et de résilience. C'est la démonstration qu'apporte ce chapitre pour le Viet Nam en utilisant une grande diversité de sources, de la dendrochronologie aux bulletins météorologiques de la période coloniale en passant par les archives de l'époque impériale. Cette combinaison d'archives et de sources issues des sciences naturelles permet de retracer les aléas naturels et climatiques depuis le XIII^{ème} siècle et pour certaines données parfois très au-delà. Elle permet aussi de saisir les connaissances et les théories du climat d'autrefois, et de comprendre que la volonté d'agir sur le climat n'est pas nouvelle. Ce chapitre ouvre ainsi de nouveaux horizons de recherche encore peu développés dans l'historiographie Vietnamienne alors qu'ils méritent une attention particulière non seulement pour nourrir les connaissances académiques mais aussi appuyer l'élaboration des politiques climatiques contemporaines.

> *“We have only two ways to anticipate the impact of a future catastrophic climate change, neither of them particularly precise or entirely reliable. Either we “fastforward” the tape of history and predict what might happen on the basis of current trends; or we “rewind the tape” and learn from what happened during the global catastrophes in the past. Although many experts (mainly climatologist, sociologists, and political scientists) have tried the former, few have systematically attempted the latter.”*
>
> Parker, 2008, p. 1078

1. Introduction

Climate policies aimed at mitigating global warming, whether national or international, are the result of complex processes involving scientific evidence, the economic feasibility of instruments and proposed solutions, and — of course — diplomatic compromises between parties with varying interests in taking action [Aycut & Dahan, 2015]. This chapter focuses on the place occupied by climate history in providing evidence of global warming and its anthropogenic origin, and also in recalling past human concerns and adaptations to climate changes.

The history of climate is written by two very distinct communities: hard scientists (climatologists, meteorologists, glaciologists, palaeoclimatologists, atmospheric physicists, etc.) on the one hand, and professional historians on the other. The importance of the former has been decisive in providing evidence of the anthropogenic origin of climate change [Charney *et al.*, 1979; Crutzen, 2002; Steffen, Crutzen, & McNeil, 2007], and then in building an active climate diplomacy, particularly since 1988 with the creation of the Intergovernmental Panel on Climate Change [IPCC, 1990]. The role of professional historians, on the other hand, is relatively unknown, although their contributions are quite remarkable.

This chapter focuses on the originality of this latter community’s contribution. We will defend the thesis that the sources deployed by climate historians produce a *human history of the climate* that is much more attentive to the observation of societies in the face of climate change than the *natural history of the climate* produced by climate scientists. For this reason, the climate history produced by historians is absolutely essential for policymakers. It sheds light on the way in which past societies perceived and recorded climate fluctuations, how they adapted to them, and even how they sometimes tried to correct them through their actions.

The aim of this chapter is to highlight the potential contribution of history to the development of public policies to mitigate climate change. It is also to warn the reader that, despite the existence of some recent academic work [Lieberman & Buckley, 2012], this *human history of climate* remains largely under-researched for Viet Nam and Southeast Asia, and that it is precisely this kind of history that needs to be promoted, in order to encourage its development and quickly reap its benefits. This chapter will nevertheless show that a number of already-published works of Vietnamese environmental history have contributed valuable material, which deserves to be taken into account. In particular, these academic works show that the Vietnamese imperial

archives carefully recorded a number of climatic phenomena (such as typhoons, floods, droughts, etc.). Precursory work on these archives already allows us to glimpse how the Vietnamese people were able to develop different strategies for adapting to these recurring climatic phenomena, and also how the State (the emperors and mandarins) attempted to influence the climate [Langlet & Quach, 1995; Dyt, 2015; Phung, 2017; Liêm, 2018].

By unearthing the ways in which imperial power dealt with climatic calamities over past centuries, climate history helps to anchor contemporary debates on, and responses to, climate change in a long historical tradition that is currently largely unknown. We believe that anchoring contemporary climate challenges in national and local history provides a way of fully appropriating international greenhouse gas reduction objectives at the national level. These objectives are defined by international experts, who are quite rightly trying to govern the climate as a global commons, but who know little about the national and cultural specificities of societies in their relationship to climate — and nature in general — because it is not their job. This anchoring is also a response to many experts from the IPCC's Group 2 (responsible for assessing the regional impacts of climate change and adaptation measures), who have commented that the continental scales they work with are too broad to offer effective mitigation and adaptation measures. They suggest adopting more human scales (agricultural activities, transport, and urban planning in particular) [Le Treut, 2018]. Environmental history should make this re-appropriation possible. We hope that this chapter will contribute to this academic and policy-making goal.

The first part consists mainly in a discussion about what constitutes climate history. It first recalls that the history of the climate is as old as humanity itself: people and societies have always paid great attention to the climate. It goes on to describe the specificities of the history of climate since its revival in the 1950s, particularly as concerns its treatment of sources and its definition of legitimate questions.

The second part is devoted to the immense potential of the Vietnamese primary sources for writing a rich climatic history of the country. It emphasizes that climate and weather — and the place allotted to them by society — are essential features of Viet Nam's classical culture. This explains why the Imperial Annals and a host of other sources carefully recorded all the climatic disasters that have struck the country.

The third part examines sources from the XIXth century to the present day. It includes the colonial archives of the French Meteorological and Climatic Service, and the contemporary archives of the Meteorological Services of the Socialist Republic of Viet Nam.

2. What is climate history? Ancient and modern approaches

Mankind's interest in the climate and in its influence on humans and societies is as old as history itself. Western historiography often traces it back to Aristotle's Meteorologica, which established a cosmology that saw meteors as the result of interactions (forces, principles, substances, essences, etc.) between the stars, the ether and the four elements of the Earth: earth, water, air, and fire. In this closed

universe [Koyré, 1962], the influence of the climate on humans has been a constant — and even central — concern of Aristotelian and Hippocratic medical thought over the centuries; it extends well beyond Kepler, as shown by the project of the astronomer Guiseppe Toaldo in the late XVIIIth century to develop *astrometeorology*, a science correlating weather with the position of the stars in order to forecast the weather using knowledge of the movement of the planets [Fressoz & Locher, 2020].

Similar cosmologies flourished in many parts of the world, even before Aristotle, and particularly in China (see the *Book of Documents* (Shujing), the *Book of Odes* (Shijing), the *Book of Mutations* (Yijing): there, the Dao and the male and female principles (*yin* and *yang*) were seen as the origins of a respiratory movement in the world (between 9 constellations, 5 planets and the 5 elements of the Earth (Metal, Water, Wood, Fire, and Earth) [Granet, 1934; Major, 1993; Cheng, 1997; Smith & Kwok, 1993; Tucker, 1994].

In both cases (classical Greek and Chinese cultures), the intimate correspondences between macrocosm and microcosm gave rise to the development of a deterministic conception of the world, which allowed scholars to infer other laws of nature from their general knowledge of the movement of the universe [Jullien, 1983]. All Chinese sciences are based on this determinism [Needham, 1973], and in particular those of the climate and its profound influences on humans, their health and their individual and collective destiny. The author of the *Huainanzi*, a synthesis of all cosmographic speculations in the Han period (the 2nd century B.C.) shows this particularly well:

> “ *As Heaven and Earth were not yet formed, as everything was vast, immense, dark and aspectless, this was called the Great Beginning. The Dao began in the vastness of the void. It then took on contours. That which was pure and light rose and spread out to give Heaven. What was heavy and coarse was difficult. Therefore, Heaven was completed first, and the Earth formed only afterwards. The assembled essences of Heaven and Earth gave Yin and Yang. The concentrated essences of Yin and Yang gave the four seasons. The dispersed essences of the four seasons gave the ten thousand beings. The hot breath of Yang in accumulation gave fire, and the essence of the breath of fire gave the sun. The cold breath of Yin in accumulation gave water, and the essence of the breath of water gave the moon. (...) Of the breaths rejected by Heaven, those which are unleashed give the wind, of the breaths contained by the Earth, those which are harmonious give the rain. The furry and feathered beasts are the species that walk and fly: so they belong to the Yang. The animals with shells and scales are the species that crouch and hide: so they belong to Yin. (...) Beings of the same species shake each other, the root and the branches respond to each other.* ”
>
> *Huainanzi*, ed. ZZJC, p. 3 & 35,
> quoted by Anne Cheng, 1997, p. 282

As we can see, the ancient civilizations shared common conceptions of the climate and its influence on human destiny for many centuries. Indeed, the interim of the 19th and 20th centuries — between these ancient cosmologies and the contemporary Anthropocene — when modern scientists set themselves the sole task of understanding the climate without acting on it, was short-lived in the overall history of mankind: contemporary climate change brings us back to this desire for human action on the climate.

Contemporary climate history, as a specific historiographical stream, emerged in the 1950s, at a time when western scientific culture had lost faith in the ancient cosmologies and the beliefs that man could influence the climate. Climate historians have thus distanced themselves from these old theories of reciprocal influence between man and climate, and adopted scientific methods to establish new approaches to climate history. They were mainly medievalists and modernists, who were moving away from economic history and rural history towards a 'geohistory' — like Fernand Braudel (1949) — that makes the environment, and the climate in particular, their real object of research. They combed the archives for a quantity of climatic information, which could be combined into thermometric series to reconstruct climatic trends on a centennial (or decennial for the most recent periods) scale (See Box 2.1).

Mobilising data from two distinct kinds of archives — human and natural — calls for imagination. The first ones, referred to as "human" because they have been created by humans, are made up of dynastic chronicles, letters and diaries, judicial and government records, newspapers and broadsheets, oral traditions, calendars for harvesting certain crops, harvest volumes, iconographic documents like glacier paintings or engravings, and archaeological information (such as inscriptions on structures that date flood levels, etc.). The second ones are created by "non-human beings" — like glaciers, pollens or trees — that have registered past climate variations, sometimes with extreme precision.

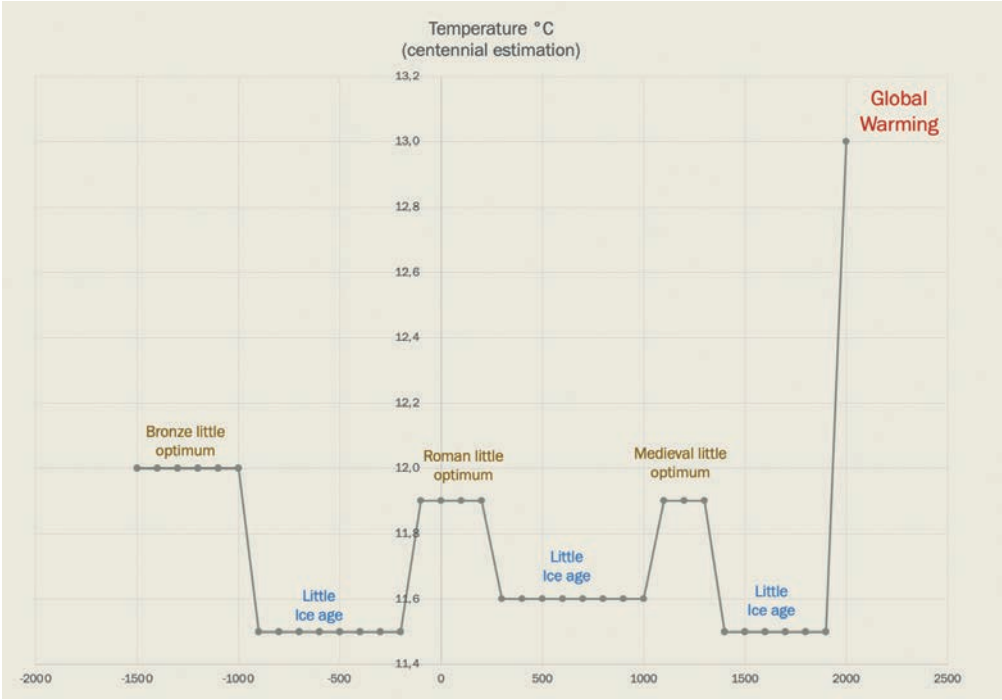
[Box 2.1]

The founding fathers of climate history in the second half of the XXth century

Gordon Manley produced the first large thermometric series for England in 1946, which indicated monthly average temperatures for each year from 1659 to 1973 [Manley, 1946]; in 1955, Gustave Utterström published a history of the climate of Iceland and Sweden between the XIVth and XVth centuries (cooling period) and the XVIIth century, using a whole range of sources, in particular glacial chronologies and data from vines and cherry trees in England [Utterström 1955]; the medievalist John Titow in England discovered hundreds of unpublished texts in the manuscript accounts of the bishopric of Westminster on XIIIth century meteorology... [Titow, 1960]. In France in 1967, Emmanuel Le Roy Ladurie published *Histoire du climat depuis l'an Mil (History of the climate since the year 1000)*, an impressive compilation and an exceptional archival work [Le Roy Ladurie, 1967].

Ladurie very pragmatically raised questions of interdisciplinarity and collaboration of historians with the climate sciences, to compile "human archives" and "natural archives" of climate. He considers that the climate sciences (meteorology, palynology, archaeology, glaciology, atmospheric physics, etc.) should be auxiliary disciplines to the history of the climate and that, in consequence, historians should become familiar with these disciplines in order to be able to integrate their data into their own work. He himself seized upon dendrochronology (dating and identifying climatic variations using the annual growth rings of trees) and the American and Canadian tree-ring methods with enthusiasm. He also makes extensive use of phenology data (the study of the dates when certain plant phenomena — such as flowering or fruit ripening — take place). These data are present in the archives, particularly for plants such as grape vines. Because their advance or retreat also indicates climate changes, the glaciers of the Alps were a third significant source for Ladurie, who compiled all data concerning them in the communal and episcopal archives. Here again, he also used data from glaciologists: by citing data from the Alestsch glacier in Switzerland — which gives an idea of the climate in Western Europe from 1500 B.C — he encompassed a period of that includes almost all human history, thus initiating the early stages of global history.

[Figure 2.1]
Climate history in Europe from thermometric series and data from phenology, dendrochronology and glaciology



From E. Le Roy Ladurie, *Histoire du climat depuis l'an mil*, 1967.
Gathered by Frédéric Thomas

By combining all these types of data, historians have succeeded in reconstructing a very detailed chronology of climate change over the last three millennia. Figure 2.1, which is our synthesis made from the data provided by Ladurie, is a useful way of demonstrating the interest of the historian's methods. It shows the succession of seven major periods lasting several centuries, during which relatively mild climates, known as the 'Little Optimum', alternate with colder periods that historians are accustomed to calling the 'Little Ice Age', but which should not be confused with the last Pleistocene glaciation, the Würm, which lasted from 120,000 until 10,000 years ago.

Currently, the temporality that historians bring to climate history — thanks to their specific archival skills — is generally more precise than that of climatologists and glaciologists [Le Roy Ladurie, 1967, p. 48]. This has led Ladurie to conceptualise and defend *"a history of the climate for the climate, autonomous in its object"*, in which the climate is a historical object to be studied as such. In his introduction, he clearly states the nature of this project: *"Gradually, a broad perspective, from which this book stems, imposed itself on me: that of a climate to be studied historically for itself, and no longer only for its human or ecological impacts."* (p. 25). From this perspective, the

history of the climate becomes an auxiliary science to the natural history of the climate, and departs from a conventional history centred on historical facts, which are always made up of humans, society, economic issues, culture, ideas, morals, religions, etc.

Alongside this Ladurian tradition, other approaches to climate history — focused more on the place of the climate in the life of past societies — have also blossomed over the years, from Clarence Glacken's seminal *Rhodian shore* [Glacken, 1967] to the contemporary climate historians like James Fleming and Vladimir Jankovic (2011) and Jean-Baptiste Fressoz and Fabien Locher (2017), to name only few examples. In the next section, we will attempt to expose the various trends that are emerging in Vietnamese climate history.

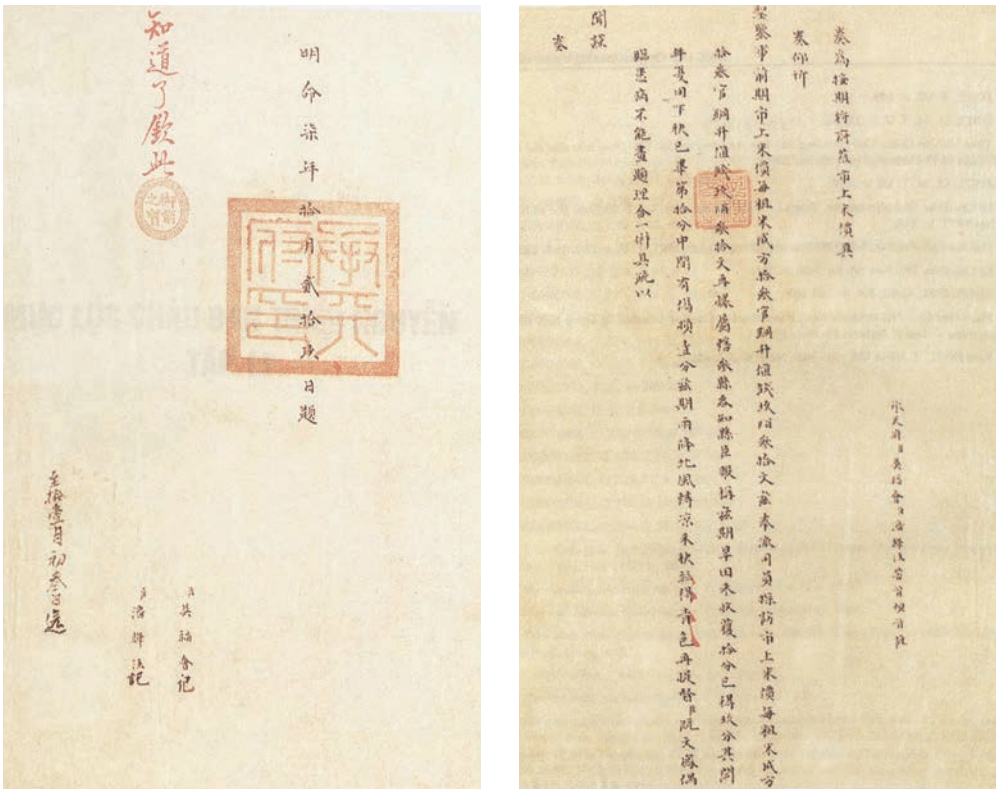
3. Climate history of Viet Nam via the Imperial Annals

The climate of Viet Nam is particularly complex; it is the result of the encounter between the Chinese climate on the eastern side of the continent and the tropical monsoon climate of South-East Asia, and follows climatic regimes whose history is still only partially known, and whose advances are today much more the result of climatology and palynology based on natural archives (palynology, dendrochronology, lake sediments, coral reefs, etc.) than of human-archive based history.

Nevertheless, the history of the climate in Asia, Southeast Asia and Viet Nam is not a total blank by any means. The Japanese historian Arakawa has notably published the annual dates of the first snowfall in Tokyo from 1632 to 1950 (this was the ritual day when the *daimos* came to pay their respects to the *shogun* Togukawa), and the Lake Suwa series for the period from 1444 to 1954, with the archives of a temple that recorded the dates of the lake's ice jam [Arakawa, 1954]. For Southeast Asia, the Australian historian Anthony Reid has argued that in the second half of the XVIIth century, the region suffered what was recognised as a Little Ice Age, which led to weaker monsoons, droughts and famines, and reduced the ability of the region's people and states to engage in trade, thus leaving the field open to European traders [Reid, 1993]. In Viet Nam, a new generation of young Vietnamese historians is demonstrating that local climate history is an emerging and very dynamic field, although primary sources still need to be mined to build long time series from existing archives.

In the first section we will begin by establishing a short review of the primary sources available to write the climate history of Viet Nam. In so doing, we will discover that there are almost two ways to build a history of climate in Viet Nam. One consists in examining the way the climate was considered in previous centuries: by analysing, for example, why — since practically the XIIIth century — the imperial power was so concerned by climatic issues and wanted an account of the weather. This kind of climate history pays particular attention to the cosmology and ontology of the classical Vietnamese culture that underpinned ways of thinking about the climate over the past century. The third section examines the second trend which, following in Le Roy Ladurie's

[Figure 2.2]
Report of rice price and weather conditions in Hue in the first quarter of 1826



Source: Nguyen dynasty state archive, memorials of the Minh Menh reign, vol. 20, National Archive N° 1.

footsteps, aims to rebuild the history of past climate thanks to a combination of natural and human archives. In a forth and final section, we will discuss the issue of climatic determinism in history, to highlight a certain inclination of many authors to develop such an approach to explain Viet Nam's national history.

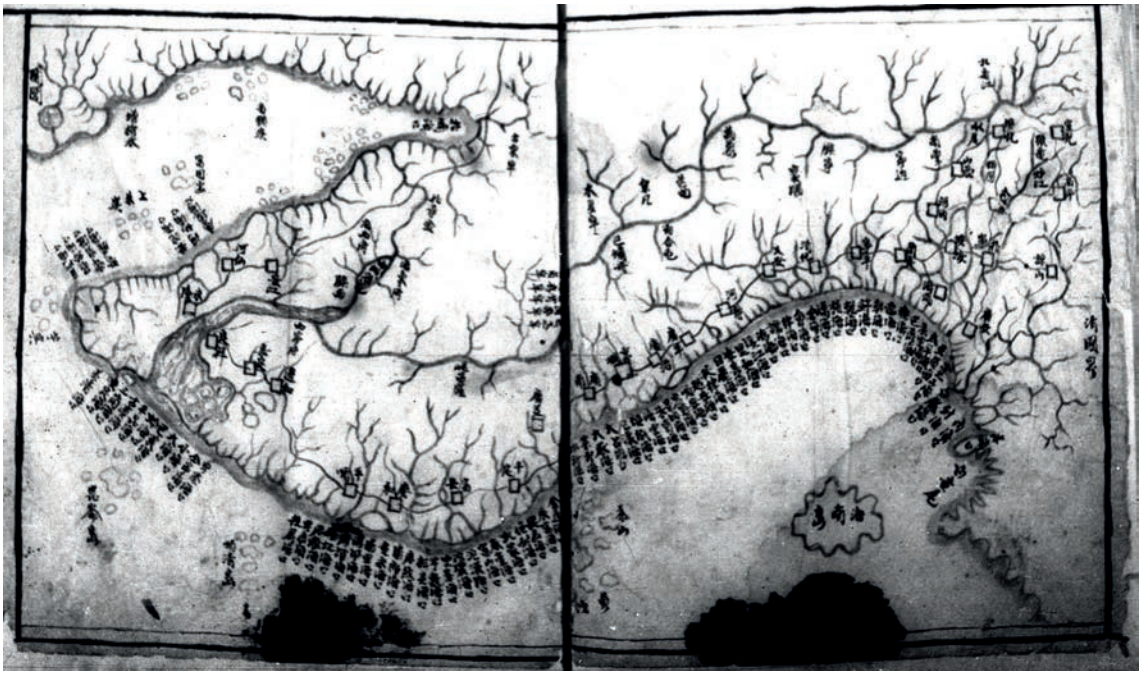
3.1 Inventory of primary sources and the different "schools" to make them talk

Court reports and dynastic chronicles are among major sources of climatic information. Most important among them are the *Complete Book of the Historical Records of the Dai Viet* [Đại Việt sử ký toàn thư, 1697]. This book is the first extant dynastic chronicle of independent Viet Nam, dealing with the period from the early history of XIth century to the XVIIth century. From the XVIIth century, climate information is more abundant, and appears in the voluminous historical works produced by scholars of the Le and Nguyen dynasties. They include the first encyclopædia – the Categorized Records of the Institutions of Successive Dynasties [Lịch triều hiến chương loại chí, 1820] and the Nguyen Veritable records [Đại Nam Thực Lục, 1884].

Containing meteorological information, natural irregularities, calamities, pandemics, descriptions of natural landscapes and human responses to nature-fluctuated conditions, these documents are essential for understanding past Vietnamese society's experience of climate, and more broadly its relationship with nature. The Nguyen court established an organization called the Directorate of Imperial Observatory (欽天監). Among its many functions was measuring rain volume in the capital Huê (Đại Nam thực lục). Unfortunately, we know no more about how the Directorate of Imperial Observatory worked, and none of its records have survived.

Last but not least come maps and atlas collections produced between the XVth and 19th centuries. Although Viet Nam perused the Sinitic tradition of cartography [Whitmore, 1994], state authorities had invested heavily in mapping both communication lines and natural landscapes. Mountains, rivers, valleys, seaports, estuaries, canals, islands, and lagoons were recorded on paper in astonishing detail [Li, 2016; Liêm, 2016]. Map collections – such as the *Hong Duc Atlas* [*Hồng Đức Bản Đồ*, 1490], the Book of Maps of the Four Cardinal Points of the Southern Country [*Thiên Nam tứ chí lộ đồ thư*, 1686], and the Complete maps of Dai Nam [*Đại Nam nhất*

[Figure 2.3]
The Complete map of Dai Nam, illustrated with rivers and river estuaries



Source: Dai Nam Toan Do, A. 2959 (microfilm, EFEO, Paris).

thống toàn đồ, 1834] — are extremely valuable sources for reconstructing past topographies and their evolution over time under both human and natural impacts.

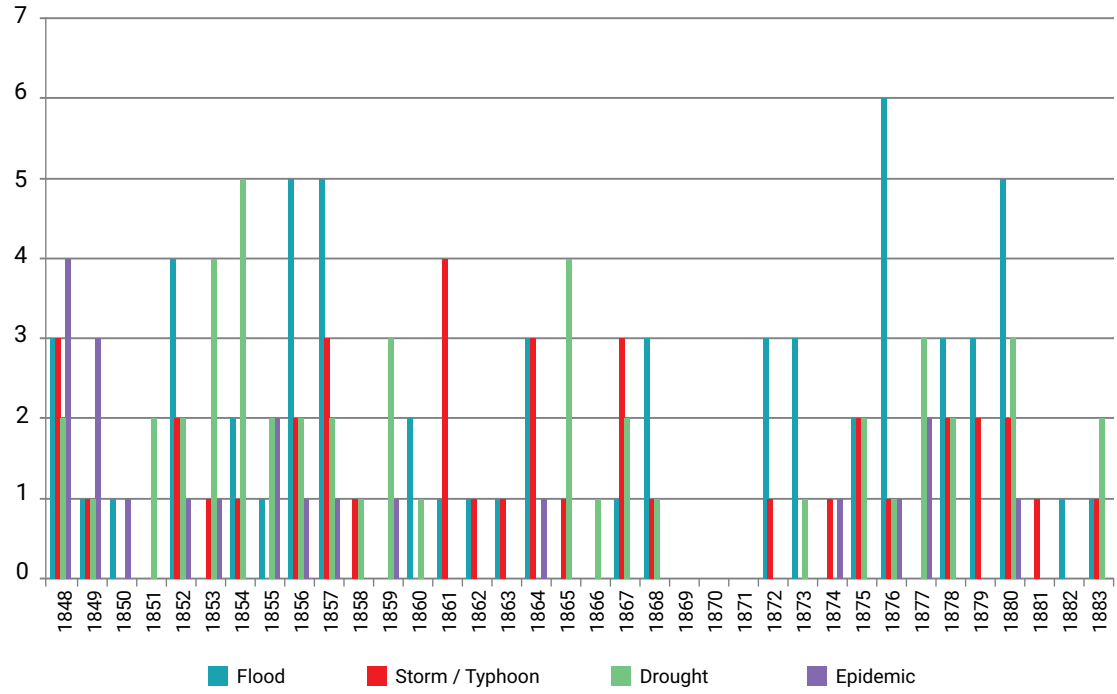
All these primary sources show without question that the history of Viet Nam has been constantly hit by violent climatic events, and that far from being exceptional, the alternation of droughts, floods and typhoons is Viet Nam's "normal" climatic regime due to its geographic position (Inter-tropical and East coastal region of a continent). Throughout the XIIIth, XIVth and XVth centuries, and repeatedly during XVIIth, XVIIIth and XIXth centuries, imperial chronicles report a high frequency of droughts, floods and typhoons.

There is, however, much debate as to whether these sources can enable contemporary historians to trace the climatic trends of past centuries. To answer this huge question, it is important to consider the process that led to a climate event being recorded in imperial registers. What kinds of phenomena were selected? How were they selected? Why? By who? The historian's skill lies precisely in understanding the conditions of production for the sources they use.

Due to their cosmographic and political significance, which we will analyse in section 2.2, the selection of meteorological information was carefully guarded. In theory, court historians — guided by profession candour — were expected to recall all natural indications, and especially any anomalies because they represented Heaven's review of the ruler's conduct. On the other hand, the ruler had to commit to fully acknowledge all climatic events, whether good or bad, and to learn from those heavenly messages in order to behave better. In reality, dynastic chronicles and court records systematically selected meteorological 'data' to illustrate political messages. Natural signals were therefore carefully chosen. For example, when Gia Long (1802–1820) came to power in 1802, the Dynastic Veritable Record implied that the Mekong river in Sai Gon suddenly became fresh and crystal clear for miles. Two decades later, the emperor Minh Menh (1820–1841) received a memorial from Sai Gon officials, reporting that the river once again turned crystal clear for miles. That could only be a blessing from Heaven, indicating a prosperous age to come [*Đại Nam thực lục*, 1884].

This clearly shows that the climate data recorded in the dynastic chronicles cannot simply be regarded as a faithful reflection of past climate variations. This remark leads historians such as Catherine Dyt or Hieu Phung to distinguish their work from approaches focused on gleaning climatic information from dynastic chronicles to reconstruct the past climate history of Viet Nam, and its impact on political history. They propose a very different conception of climate history, consisting in using the climatic data registered in the chronicles to understand political changes, via the way climatic events were recorded. It is thus apparent that at least two approaches to the history of climate are emerging in Viet Nam. The first one focuses on the conditions of production of climatic data in the dynastic chronicles to write the history of the reflections, ideas and actions of the time on climatic phenomena. The second one takes climatic data in the Imperial Annals as serious proxy to reconstruct past climate history: it compares them with climatic information stemming from dendrochronology to build correlations between climatic variations and major events of political, social and economic history. In the following sections we are going to examine the progress of these two trends, taking care

[Figure 2.4]
Incidence of disaster during Tự Đức's Reign



Based on data compiled from the *Veritable Records* and the *Annales of the Propagation of the Faith* [Dyt, 2016].

not to separate them too much, since their complementary nature is essential for the advance of the climatic history in Viet Nam.

3.2 The emperor's climatic actions in the cosmological framework of early-modern Viet Nam

Viet Nam, deeply penetrated by the classical Confucian and Taoist culture of China that we alluded to in the first part, has developed similar conceptions and theories of the climate, and its influences on man and society. In this classical Confucian cosmology, meteorological calamities were interpreted as signals of disturbances in the cosmos, and therefore as signs of a challenge to the mandate of Heaven (天命) which the sovereign was entrusted with to ensure harmony on Earth. Thus, climatic calamities constituted a double challenge for political power: they plunged the people into misery (with all the risks of revolt against the power that resulted), but they also directly challenged the legitimacy of power, which could be suspected of being immoral. As a result of these concerns, climatic events were meticulously calculated and care-fully reported in official paperwork until the XIXth century during the Nguyễn period [Figure 2.4].

It is therefore hardly surprising that the imperial power developed what we might call a

climate policy[1] very early on. Vietnamese rulers even created specialized agencies to register extraordinary naturel events: the Directorate of Sky-Watching or of Astronomy and dedicated buildings, like the Astral Tower named "Five Phoenixes" (Ngũ Phượng) in Thang Long (actual Hanoi). These premises appear to have existed since the XIth century; but its really during the XIIIth century that the Office of Supplication was transformed into the Astrological Service [Phung, 2017, pp. 163-65].

In 1248, the post of Royal Commissioner of Dikes (河堤使) was created [*Đại Việt sử ký toàn thư*, book 5, p. 15b]: it is from this date on that the Vietnamese Imperial Annals became a valuable source for climate historians, since floods and droughts are carefully mentioned. These events were a recurrent phenomenon, and their impact on crops was so serious that flood management via a dyke system became an important concern for the imperial power [*Đại Việt sử ký toàn thư*, book 5, p.20a]. While there is no evidence to suggest that the peasant rebellions of the late XIIIth century and the overthrow of the Tran dynasty in 1400 were direct consequences of an increase in flooding (as it is unknown whether there were fewer floods annually in earlier periods of political stability), it is clear that the recurrence of violent climatic events played an important role. The poor harvests following these floods explain why hungry tenants and sharecroppers plundered and burned down Hanoi several times at the end of the XIVth century [*Đại Việt sử ký toàn thư*, book 8, pp.17a-b, 36a]. When a new state emerged (the Ho dynasty, 1400–1407), they had to abandon the basin by relocating the capital 180 km to the south of Hanoi (present-day Thanh Hoa). In the XVth century, the Imperial Annals show that the most fertile regions of the Red River Delta (Hai Duong, Son Tay, etc.), where royal and aristocratic fiefdoms and estates were located (*điền trang, thái ấp*), continued to be particularly affected by numerous and severe floods, leading to migratory flows and an significant number of village abandonments. Japanese scholars estimate that 3,120,000 people had left northern Viet Nam by the early XVth century [Sakurai, 1997, p. 133]. That forced migration and social violence provide a good example of how droughts and floods impacted on key political policies and state stability.

The rise of neo-Confucianism at the imperial court, from the XVth century onwards [Whitmore, 2010], made this cosmography increasingly prominent in the actions of the emperor. Currently, Hieu Phung — in her doctoral thesis focusing on XVth century Viet Nam — discusses Whitmore's thesis by asking whether or not the Chinese Confucian cosmography can really be applied to understand the climatic ritual performed by the Vietnamese Kings of Dai Viet. Her analysis, based on several case studies, shows that before XVth century many of those rituals were still related to Buddhist and Taoist deities (like Jade Emperor), but that over time during the Lê dynasty, climate rituals (like calls for rain to stop drought) referred more and more to the Confucian theory of resonance between political justice and the harmony of Heaven/sky [Phung, 2017, pp.170-190]. For example, in response to the drought of 1438, the Imperial Annals report that the sovereign himself proclaimed a decree in which the moral responsibility of the sovereign and his administration were clearly engaged to explain this climatic calamity.

> *"Consistently throughout these years, droughts and insect infestations have re-*

1. From this point of view, the contemporary need for governments to act to limit global warming is reminiscent of the climatic duties and obligations of the emperors of old.

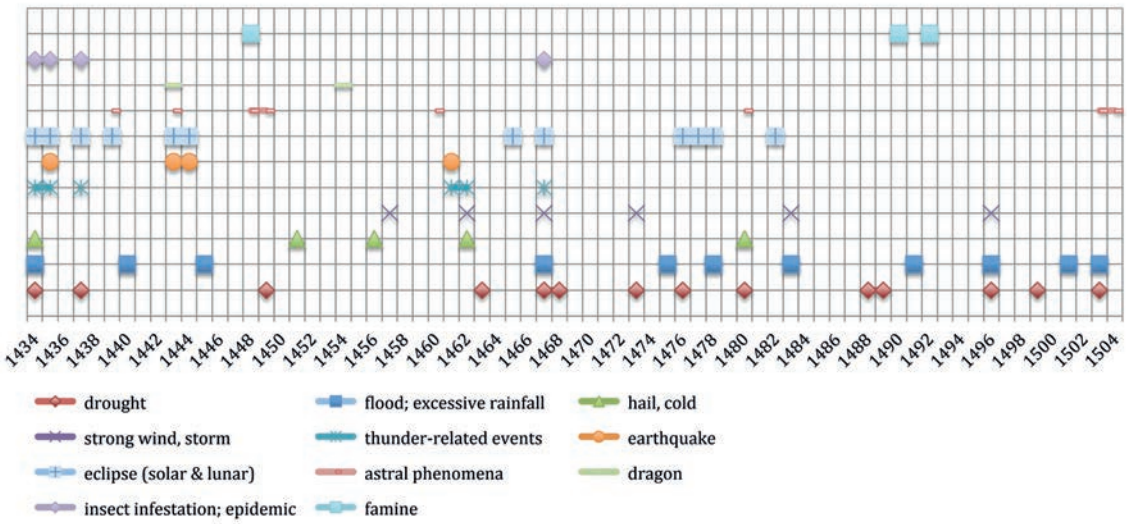
curred while natural calamities frequently appear. During the fourth and fifth lunar months of this year, thunders repeatedly rattled those trees in front of the Royal Ancestral Temple in Lam Kinh (i.e., the hometown of the Le kings in Thanh Hoa). Contemplating these problems will show us some insights. Have I, the King, not cultivated my virtue and is my governing therefore abandoned to wild idleness? Is the Grand Councillor not competent and is he therefore not harmonizing and regulating [the operation of the court properly? Is our court not recruiting the right people and those who are worthy are therefore not being distinguished from those who are unworthy? Is bribery occurring openly and is the law court therefore being deluged with false accusations? Are the people overloaded with public construction projects and are they therefore becoming exhausted? Is the government overtaxing the people and are they therefore suffering further impoverishment? I have cited those problems in order to make self-reproach and I will perform a great amnesty. ”

Quoted by Phung, 2017, p. 186.

The bureaucrats believed *“in their ability to adjust the current political situation by carefully observing and successfully reacting to meteorological portents”* (quoted by Phung, 2017, p. 186). By the 1460s, Lê emperors also established the Nam-giao ritual: a sacrifice made by the emperor himself at the beginning of a new cultural cycle, to obtain the auspices of Heaven for a good harvest [Whitmore, 2010]. Over the centuries, the same cosmographic framework and the same ceremonies were maintained. Australian historian Kathryn Dyt has carefully described the conduct of the wind and rain call (*cầu đảo*) ceremonies, as codified by the Nguyen dynasty from Emperor Gia Long to Tu Duc [Dyt, 2015]. She also demonstrates the importance and frequency of this ritual, its cost, and the strong involvement of the Emperor himself and the Ministry of Cults for its proper execution. Kathrin Dyt reports that in 1805, when the country was experiencing a serious drought from the North to the South of Viet Nam, the emperor Gia Long immediately issued *“a proclamation imploring officials in all drought-stricken areas to set up an altar and conduct “calling for wind and rain” ritual, known as cầu đảo, for seven days and nights”* [Dyt, 2015].

Speaking about China, Mark Elvin describes this Imperial power over the climate as a “moral meteorology” [Elvin, 1998]. Yet in Viet Nam, this power of the Sovereign over the meteors did not only result in religious rites like the Nam Giao, or striving towards greater moral probity in order to avoid the wrath of Heaven. It also led to empirical actions, like the construction of “cauldron-handle” dikes that began to be built in the mid XIIIth century, which aimed to limit and contain floods [Phung, 2017, 118]. In fact, the Emperor’s climatic action was both moral and empirical, with no real separation of the two *modus operandi*. Thus, the 1438 decree also stipulated construction of dykes to divert floods from the major rice producing areas; when the new dynasty moved the capital back to Đông Kinh (東京) (today Hanoi) in 1430 [Papin, 2001], it proceeded to build the Hong Duc dykes — the first flood diversion system to both secure the Imperial Capital, Đông Kinh, and extend the rice growing areas to the eastern and southern edges of the delta (the present-day provinces of Nam Dinh and Ninh Binh) [Kế, 1985]. Along the Day River (Ninh Binh), the remains of a 25 km long dyke, probably dating from the XVth century [Kế, 1985], testify to the ancient climatic action of the Emperors.

[Figure 2.5]
Natural incidents reported for the period from 1434 to 1504



Based on the *Complete History of Dai Viet* [*Đại Việt sử ký toàn thư*, 1697, quoted in Phung, 2017].

The work carried out by Hiêu Phung, on the census of exceptional climatic, telluric and astronomical events recorded in the Imperial Annals in the XVth century, makes it possible to analyse the cosmological framework and rationality of the Emperor's climatic actions deeper still [Phung, 2017]. The diversity of the events recorded reveals the analogical thinking of the period [Thomas, 2003; Culas, 2019]. Together we find droughts, floods, storms and typhoons, earthquakes, insect invasions, epidemics and famines, eclipses and various astronomical phenomena, as well as appearances of dragons, as if all these phenomena and manifestations shared a kind of identity that could be brought to light by recording their recurrences [figure 2.5]. The mention of the dragon's appearance should come as no surprise. In both classical Confucian and popular culture, dragons were responsible for dispensing rain [Capitiano, 2008; Dyt, 2015]. Severe droughts or floods were therefore interpreted either as a collective punishment inflicted on inhabitants for various faults, or as the forgetfulness of duties by a whimsical dragon. In both cases, the mediums led ritual sacrifices to the dragon variously to request, entice or intimidate the dragon into making or stopping rain. The Emperor (whose utmost symbol of power was a dragon) was also supposed to restore the balance for normal and regular rain [Zhang, 2009].

The belief that dragons dispensed rain should not be understood as a sign of the irrationality of pre-modern climatic thought. Both aquatic and aerial animals, dragons have a very strong consubstantiality with clouds and the atmospheric phenomena triggering rain in Chinese analogical thought. They are associated so closely with climatic phenomena that a number of Chinese scholars continuously made efforts to rationalize Confucian cosmography and popular beliefs by describing dragons as

almost climatic phenomena, as the following examples show: in the first century AD, Wang Chong explained, *"Clouds and dragons belong to the same category of being [associated with water]; therefore, their respective qi responds to each other and causes each other to appear."*; Zhu Xi (1130–1200) explains that *"the dragon is an aquatic animal; therefore, when it comes out [of water] and encounters the yang qi [in sky], rain is formed. But ordinarily rain is formed when yin qi is in confrontation with yang qi. It does not necessarily involve the dragon."* (quoted by Zhang, 2009). A very long Chinese rationalist tradition, very well described in Qiong Zhang's article, constantly tries to make the Confucian cosmographic framework compatible with a naturalist explanation of climate phenomena. In the same vein, it is useful to recall that thien tai (天災) — literally "disasters caused by Heaven" — means "natural disasters", a shortcut to better understand the relative equivalence of Heaven and nature in explaining natural disasters.

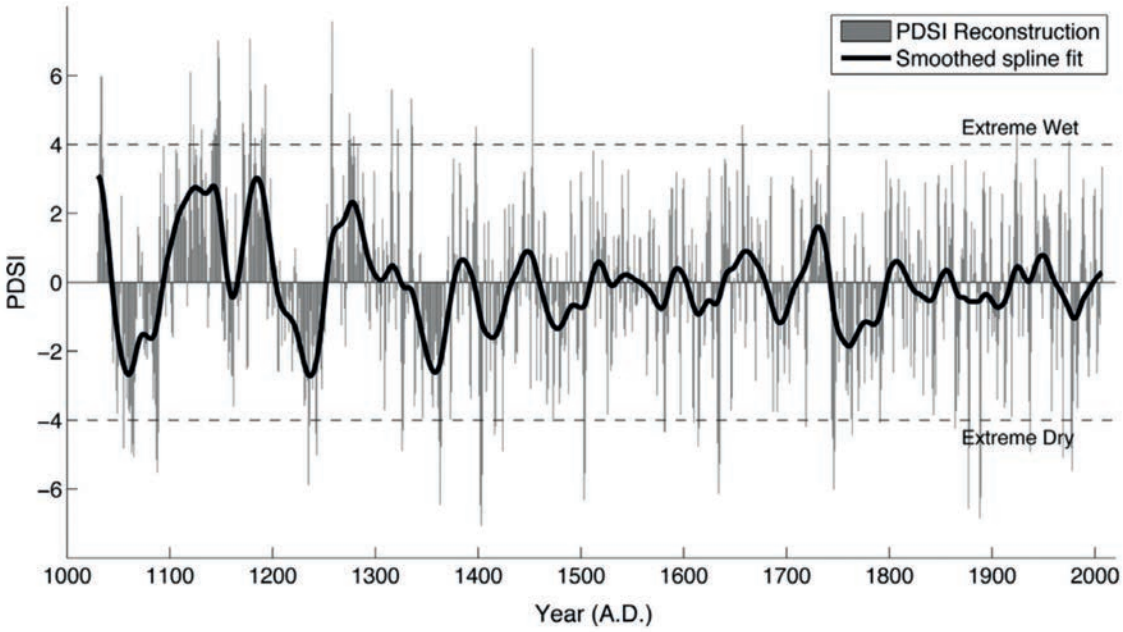
Hence, to analyse the Imperial Annals, historians must bear in mind that analogical thought in China and Viet Nam led to what Marcel Granet called a *naturism*, which led scholars to observe natural phenomena with the same rationalist and empirical approaches as scientific ones — an approach held to be the exclusive preserve of the scientific revolution of the European Renaissance. This fact should today help climatic scientists grasp the rationality and logic behind the imperial power's action on the climate. It is irrelevant that the mode of analogical thinking appears irrational to contemporary scientists. The only significant element, unrelated to their cosmological framework and climatic theories, is that they have given rise to empirical observations of climatic phenomena and concrete action to govern them. This last point leads us naturally to the second way of using this climate information, as a proxy to reconstruct the history of past climate trends.

3.3 An almost constant drought/flood/typhoon regime over the century

Among the main historians currently working to reconstruct the climate of the past, we will rely particularly on the work of Lieberman, Buckley and their colleagues, who have particularly sought to build an interdisciplinary collaboration between historians and paleoclimatologists [Lieberman & Buckley, 2012].

Based on the *Complete History of Dai Viet* (1697), the *Histoire du Royaume de Tunquin* of Alexander De Rhodes (1651), and the *Imperially Ordered Mirror and Commentary on the History of the Viet* (1884), Buckley and his colleagues have shown that floods and droughts occurred every four years between 1720–1779 [Buckley *et al.*, 2010, 2014]. Droughts particularly damaged fifth-month rice cropping seasons, while floods destroyed mainly the tenth month crop in the delta's core region [Sakurai, 1990, 1997]. This information — extracted from human archives — is completed with modern scientific data obtained, for example, from the shifting sea level or tree-ring analysis. Buckley and colleagues have found teak trees in north-western Thailand with well-defined annual growth rings, despite the subtropical climate, which distinguish locally-distinct wet and dry seasons since 1558. They have also succeeded in using dendrochronology techniques on Fokienia hodginsii (*Po Mu* in Vietnamese), cypress trees found in the mountains of North Viet Nam and in the Southern Highlands. These trees are somewhat equivalent to the

[Figure 2.6]
Precipitation in southern Viet Nam since one thousand years



Source: Lieberman and Buckley (2012, p. 1057).

Canadian Sequoia used by Emmanuel Le Roy Ladurie, and have provided a very long data set covering the last millennium from 1030 to 2008 [Lieberman & Buckley, 2012]. Climatic history in Viet Nam can also greatly benefit from including climatic data collected in South China and Southeast Asia [Buckley *et al.*, 2010, 2014; Bankoff & Christensen, 2016; Bankoff & Boomgaard, 2007; Boomgaard, 2005, 2007]. Such trans-national and trans-regional perspectives place the Vietnamese environment of the past in a broader context and longer time-frame.

Taking the period between 1300 and 1900 for instance, both Vietnamese and foreign sources are now able to shed light on periods of climatic extremes. The curve of precipitation in southern Viet Nam in Figure 2.6, for example, has been measured using the Palmer Drought Severity Index (PDSI), and corrected with tree-ring-widths from cypress trees (Fokienia hodginsii) growing in the highlands of Viet Nam (Hoang Lien and Bidoup Nui Ba National Parks). The higher the PDSI, the higher the annual rainfall.

Although the sample size prior to 1250 is smaller than after 1250, the overall trend and multi-decadal structure of the reconstruction imply far wetter than average conditions throughout key portions of the Medieval Warm Period, consistent with La Niña-like base state conditions.

Lieberman and Buckley consider in their articles that flood, torrential rains, drought, and epidemics could provide the explanation for

the most dramatic upheavals of the country's history. The collapse of the Tran dynasty in the late XIVth century, for instance, which was long attributed to political and economic factors only, appears to them to be the direct outcome of an existential crisis, rooted in the desperate climatic situation of a long drought. It may have resulted in massive rebellions of distressed peasants, and invasion by the Dai Viet's southern neighbour, the Champa kingdom. Together, emigration, famine, disease, and Cham attacks may have slashed Dai Viet's population from around 3,000,000 in 1300 to barely half that a century later [Lieberman & Buckley, 2012]. They consider that the correlations they manage to weave between their climate series and the general history of the region clearly show the influence of variations in the monsoon regime on the genesis, apogee and collapse of the great kingdoms of the region: Angkor, Pagan and the Dai Viet [Lieberman & Buckley, 2012].

The same reasoning is applied to one of the most violent eras in the country's past: the XVIIIth century. The Palmer Drought Severity Index (PDSI) indicates that it was a period of extreme drought, the highest since the XIIIth century [Buckley *et al.*, 2014]. Droughts, drought-related famines, and epidemics could be responsible for the most devastating uprisings in Vietnamese history: the Tay Son movement, which led to the collapses of Nguyen Viet Nam from 1771–1785, and Trinh Viet Nam in 1786 [Li, 2015].

Finally, the thesis that the Nguyen dynasty and Vietnamese society was devastated by unusually frequent floods, tropical storms, droughts and epidemics at the eve of modernization and western colonisation is a seductive one. It would explain the collapse of the Nguyen dynasty under the assault of French imperialism, as at least 400 uprisings took place between 1802 and 1883 [Liêm, 2018].

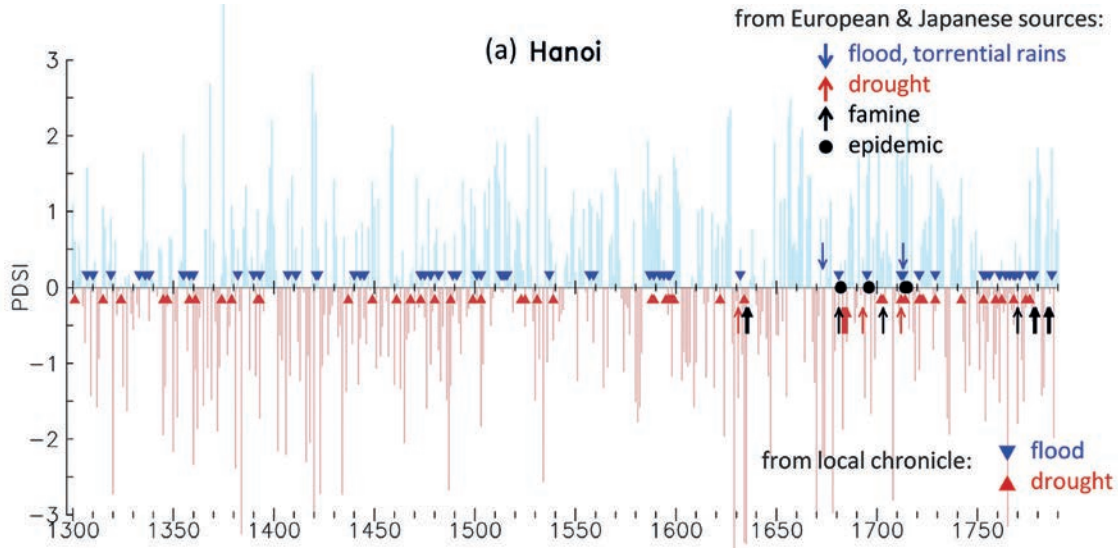
3.4 Critical analysis of climate determinism in history

However, while it can be said that great economic misery and social instability undoubtedly contributed to the weakening of Nguyen power, and indirectly played into the hands of colonial interests, it would be over-simplistic to conclude that floods were the only cause of the people's misery, or that drought was the direct cause of colonization.

In fact, as the authors themselves acknowledge, the climatic history of Viet Nam is still at an early stage [Lieberman & Buckley, 2012, pp. 1095-96], and the correlations that are drawn between a still poorly-understood climatic history and the major political events of the State remain tenuous. For example, Figure 2.7 — which aims to show the correlation between PDSI variation, the record of droughts and floods in the Imperial Annals, and famines and epidemics — does not really establish a clear chain of causality between climatic disturbances, famines and political upheavals. Therefore, the authors are unconvinced by climatic explanations that are not sufficiently well supported by causal relations, and lean towards Le Roy Ladurie's recommendations to proceed cautiously with the links between climatic history and general history (see Box 2.2).

If one really wanted to analyse the link between climate disasters and the Tay Son revolution, or the collapse of Nguyen dynasty and so on, it would useful to start on the basis of the historical materialism of Karl Marx. In this framework, the *"modes of production"* (slave-

[Figure 2.7]
Reconstruction of PDSI (Palmer drought severity index) for Hanoi



Based on historical documents [Buckley *et al.*, 2014].

ry, feudalism, capitalism, socialism) are the result of a peculiar combination of *"productive forces"* and *"relations of production"*. The *relations of production* (the practices, customs and laws protecting society's productive assets, *i.e.* property regulations, which govern relations between people and the objects, etc.) are generally considered the main factors generating the misery of the population, the wealth of the ruling classes, and therefore revolutions. Actually, environmental history and climate history raise the question of the place of nature and natural resources in the *"productive forces"*. In *The Capital*, the productive forces exclusively consist of twin inputs: *"human labor power"* and the *"means of production"* (financial capital, tools, productive machinery, commercial and industrial buildings, other infrastructure, technical knowledge, materials, plants, animals and exploitable land). Nature is not regarded as a means of production, because in the XIXth century nature was considered to be inexhaustible [Neyrat, 2016]. Contemporary eco-Marxist thinkers aim to reintroduce natural capital into the Marxist framework, to explain today's global environmental crisis [Malm, 2016]. Simple and ambitious, the project of environmental history does not propose to replace the Marxist explanation of history via the relations of production with an explanation of history by nature, but to reintroduce nature into the Marxist equation between forces of production and relations of production. This enables us to avoid all simplistic climatic or environmental determinism, while reintroducing the limits of the biosphere as a determining factor in the trajectories of societies, and today in humanity's common future.

To conclude on these two main ways of dealing with the abundant climatic information contained in the imperial annals — the first centred on analysing the conditions of production of these data, the second on their use to

[Box 2.2]

Le Roy Ladurie's caution with regard to climatic determinism

Ladurie (1967) is part of a long tradition of French social sciences that are **critical of over-simplistic explanations of social phenomena via natural causes**. He thus strongly criticizes the various forms of climatic determinism that have flourished in the course of history, particularly the nationalist historiography of the XIXth century that explained the superiority of European peoples by the temperate climate of Europe, and thus justified the colonial domination and racism of the period. In keeping with this tradition, Ladurie begins the first chapter of *History of the climate since year 1000* by criticizing the *"perilous approach"* of the English historian Elsworth Huntington (1907, 1915), who explains the history of Mongol migrations via the climate in Asia, without even bothering to study climate history *"for itself"* (p. 27). He thanks the historian Gustave Utterström for having written a history of the climate in Scandinavia, this time *"for its own sake"*, but criticizes him for seeking explanations of economic developments in the XIVth and XVth, and the XVIIth and XVIIIth, centuries in somewhat frivolous climatic causes. Ladurie also refutes the idea that the vineyards north of Paris were abandoned because of excessive humidity in the XIVth century. He demonstrates from the archives of the abbey of Saint Denis that abandoning the vineyards was linked to a labour shortage after the Great Plague, which made working the vineyards very expensive and economically unviable. He also shows that throughout the XIVth century, the impact of the climate on human development was insignificant compared to the Great Plague (biological influence).

Secondly, Ladurie underlines the remarkable stability of the climate over the last three millennia, and concludes that the small amplitude of variations exerted *"little importance to human evolution"* (p. 25); this is the main reason why he rejects explanations of great episodes in human history (long migration, depression, economic expansion, etc.) by reference to fluctuations in climate. The mildness of the year 1000 cannot explain the great Western land clearings, he says, nor the so-called *"economic sluggishness"* of the XVIIth century by the rigours of the climate. Ladurie considers these links to be badly posed, unfounded and ultimately insoluble (p. 501). His position is therefore to separate the history of climate from the question of the influence of climate on general history.

Thirdly, even if he totally recognizes that the peasant harvests are highly dependent on the weather, Ladurie points out all the methodological difficulties of establishing robust causal links between climate variations and the way they affect local rural societies. The same large-scale climatic variations do not have the same effects on different agrarian systems and different cultivated species. Titow's work in England shows, for example, that dry seasons produce good harvests while rainy seasons produce bad harvests (pp. 498-99), but Ladurie shows that south of London, as in the Paris basin, the effects of spring and summer on harvests are more complex. He also points out that harsh winters do not have a negative effect on wheat harvests, that on the contrary rainy winters are negative, but that the influence of spring and summer on the harvest, if crucial, is not the same for northern, central and southern Europe. He also explains that moving from phenology data to climate assessment requires solid agronomic and ampelographic knowledge, since each vine and terroir reacts differently to variations in rainfall and temperature [Garnier, 1955]. The historian needed to be a great connoisseur of wine and vineyards, and of every Domain and Château he studied (it is no accident that in Burgundy, each micro-terroir is called a "climate"). Ladurie thus multiplies the examples to show that it is risky to establish causal links between crop performance and climatic performance (and *vice versa*); in this respect, he quotes an article by Slicher Van Bath from 1965 which shows *"the complexity of climate-harvest correlations" (*p. 496). Nothing is simple, Ladurie summarises: the data on climatic history are often too crude to be able to draw any well-founded conclusions as to the consequences it may have had on the history of the rural economy.

Thus, while Ladurie admits that — *"the Little Ice Age (in the XIVth century), especially when wars are added to it, can be linked to epidemics and famine episodes. For example, the one in 1314–1315 (which) killed 5 to 6% of the French population"* — he adds immediately after that the Little Ice Age of 300 AD does not explain anything about the end of the Roman Empire and the barbarian invasions. Similarly, while he admits that the small medieval optimum must have favoured the great land clearances of the period, he considers that political and social problems explain the upheavals of the French Revolution much more than poor harvests. In fact, Ladurie wants to be a serious historian, so he does not allow himself extrapolations and speculations that his sources do not allow him to defend.

Interestingly, Geoffrey Parker, in readdressing the issue of the climatic explanation for the 'Global Crisis' throughout the XVIIth century around the world, has provided ample evidence in favour of this explanation, and has criticised Ladurie's excessively *'modest'* position, while acknowledging that it was justified at the time Ladurie published his *History of the Climate since the year 1000* [Parker, 2008, p. 1065].

reconstitute past climatic trends — we would like to return to the importance of organising their complementarity. It is only at the price of critical work on the sources, which really puts the quality of the climatic data to the test, that we will be able to claim to be able to make use of these data to draw up climatic series that will be usable by climatologists. For this to be possible, the historical data must be recorded in accordance with criteria that are recognised as reliable climate data by historians, meteorologists and climatologists alike . Among these criteria, the analysis of possible biases at the time of recording the data is a crucial point, which falls within the historian's domain. This is an issue that we will return to in connection with the use of climate data from the colonial period, which we will now examine.

4. Contemporary climate history

4.1 French meteorological service during the colonial period

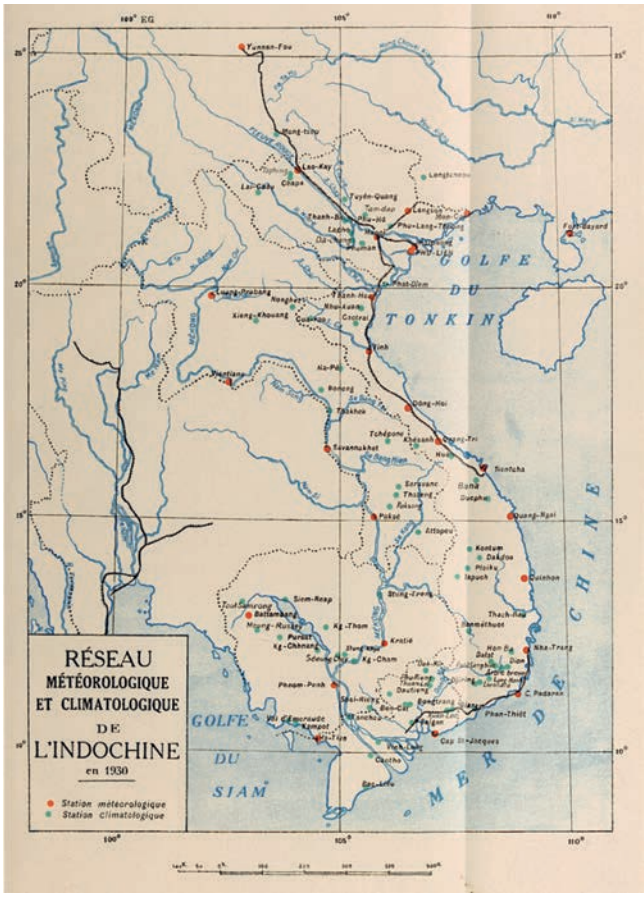
Colonial meteorological services are an important source for writing the contemporary climate history of Viet Nam. They provide the first modern statistical series that are readily available to sketch a history of the climate in the 19th and first half of the 20th centuries. The colonial administration progressively set up a meteorological and climatological service in Indochina, in charge of systematizing the recording of meteorological and climatic data in Indochina. Over the years, it developed a relatively dense network of meteorological stations, as shown on the map of these stations published in 1931 at the time of the Paris Colonial Exhibition [Figure 2.8].

Actually, meteorological and climatological services took some time to be established during the French colonisation. The process started in Cochinchina, where the Agricultural chamber and the Agricultural and Industrial Committee published some meteorological information in their Bulletin between 1865 and 1883, but no real meteorological service existed during the XIXth century. The first weather stations were established in 1897 [Lespagnol, 1902], and it was only in 1900, under the impetus of Governor General Paul Doumer, that the first unified Meteorological Service was set up. Around 10 principal stations and 20 secondary ones composed the network for the whole of Indochina (*Annales de Géographie*, 1900] [2]. From this date onwards and throughout the period of colonisation, the *Bulletin Économique de l'Indochine* published the monthly observations of the entire network. This network of stations was completed in 1902 by the creation of the Central Meteorological Observatory in Phủ-Liễn (9 km from Haiphong), in the typhoon ac-

2. Saigon, Cap Saint-Jacques, Poulo-Condore, Ong-Yeni, Tayninh and Soc-trang (for Cochinchina); Nha-trang, Langsa, Tourane, Quin-hone, Hué, Dong-Hoi, Vinh and Than-hoa (for Annam); Hanoi, Haiphong, Quang-Yen, Hon-gay, Mon-cay, Lang-son, Cao-bang, Lao-kay, Ha-giang, Bac-kan and Van-bu (for Tonkin); Vientiane, Luang-Prabang, Savannakhek, Khong and Attopeu (in Laos); Pnom-penh, Kampot and Pursat (in Cambodia). (La météotrologie dans L'Indo-Chine Française, *Annales de Géographie*, IX, 1900, p. 178.]

3. Voir *Annales de Géographie* (Bibliographie de 1899 n° 571 et de 1900, n° 506) ; dans le *Bulletin Économique de l'Indochine*, IV, 1901, Le Lay a publié "Climatologie comparée île Manille et des Stations de Backan et Hagiang dans le bassin de la Rivière Claire (Haut Tonkin), du 1er novembre 1899 au 31 octobre 1900", pp. 139-144 ; "Résumé des observations des stations météorologiques primaires et secondaires de l'Indo-Chine pendant l'année 1900, pp. 243-259, etc.; de Beljonne, une intéressante étude : "Observations sur les moussons en Indo-Chine ", pp. 797-801, cartes.

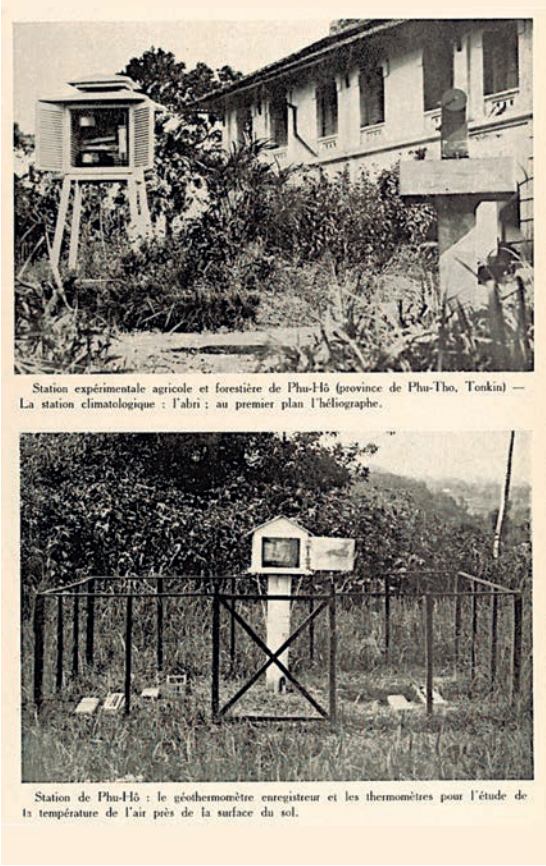
[Figure 2.8]
Meteorological and climatological station network in French Indochina, 1930



Source: Carton (1930a).

tion zone [3]. And it was only in 1907 that regular and usable meteorological observations were carried out by the Agricultural Services. Until 1927, the stations were mainly located along the coast, and it was not until the late 1920s that stations were set up in the Mekong valley, in the mountainous regions and on the central highlands. The responsibility for these stations was entrusted to agents of various services of the colonial administration or to personnel from certain private companies with an interest in climatology (plantations, Pasteur Institute, mines, etc.). In 1926, a Climatology and Agricultural Meteorology Office was created at the Central Observatory of the Meteorological Service, with a mission to centralize and control the observations of the stations, to publish these observations in the periodicals of the Central Observatory and the General Inspection of Agriculture, Livestock and Forestry, as well as in special works. This office was also to centralize all documentation concerning the studies of tropical agricultural meteorology (in particular agricultural ecology) carried out in the various tropical countries of the world and concerning the work of the International

[Figure 2.9]
Meteorological stations at agricultural stations (Pho Hô and Lang Hanh)



Station expérimentale agricole et forestière de Phu-Hô (province de Phu-Tho, Tonkin) — La station climatologique : l'abri ; au premier plan l'héliographe.

Station de Phu-Hô : le géothermomètre enregistreur et les thermomètres pour l'étude de la température de l'air près de la surface du sol.

Station expérimentale du Quinquina, de Lang-Hanh (province du Haut-Donnai, Annam).
La station climatologique : à gauche, le pluviomètre et les thermomètres sous abris pour la température de l'air près de la surface du sol ; au fond, l'abri météorologique et la girouette sur son mât ; à droite, l'héliographe sur sa table en ciment. La station est entourée d'une forte palissade empêchant l'accès du bétail et des animaux sauvages (cerfs, etc.) ; à la porte est une cahute pouvant servir d'abri à l'observateur.

The agricultural and forestry experimental station of Phu-Hô (in the middle region of Tonkin), was mainly devoted to coffee and tea tree research and the industrialization of their products; it was placed under the direction of Mr. Du Pasquier, Agronomist Engineer E. P. Z., specialized in these studies and Head of the Station, and Mr. Rémond Agronomist Engineer and Colonial Agronomist. The experimental station of Quinquina of Lang-Hanh, was located in the Haut-Donnaï, South-Annam, at an altitude of 950 meters and directed by Mr. Frontou, Agronomist and Colonial Agronomy Engineer
Source: Carton (1930b).

Commissions of Agricultural Meteorology and Ecology, in order to make them available to the technical services concerned and to farmers.

The meteorological and climatological stations were equipped with the following instruments: a rain gauge, a minimum thermometer, a maximum thermometer, a recording thermometer, a psychrometer, a recording hygrometer, a Piche's evapometer, (all under an Eiffel shelter modified for tropical countries) and in addition a wind vane (model of the Central Observatory). The meteorological stations were equipped with a mercury barometer and a recording barometer. The rainfall stations simply had a rain gauge.

It was essential that colonial meteorology and climatology be applied, particularly to colonial agronomy, as weather forecasting only made sense if it could meet the needs of tropical agriculture. The head of the Bureau of Climatology and Agricultural Meteorology at the Central Observatory of Indochina, Paul Carton, was thus an agricultural and colonial agronomy engineer. He described the challen-

ges of producing a climatology applied to tropical culture perfectly in several of his publications [Carton, 1930b]. For this purpose, the Climatology and Agricultural meteorology board (at the Observatoire Central du Service Météorologique) was to link the results of the stations and the Agricultural Services with the needs of colonial plantations and agricultural Companies. In fact, for Carton, meteorology and climatology had to contribute to what he then called "agricultural ecology" which, to be carried out successfully, required, according to him, the following conditions:

1] A well-developed network of climate and rainfall stations, with a good distribution of stations in the different regions of the country;

2] Phenological observations made at numerous points, equally well distributed. This implies the need to entrust responsibility for the climatological stations and the rain gauge stations to agents of the Agricultural Services and to farmers as much as possible.

3] Main stations for agricultural meteorology and ecology at the main agronomic stations, especially those specialised in the scientific study of certain field crops and in the selection and genetics of those plants.

An exhaustive examination of the archives of these stations and of this service would undoubtedly make it possible to produce new thermometric series, and thus write a history of climate in Viet Nam during the colonial times. As we can see, phenological data were collected during this period, but this data has yet to be examined; they are a rich potential source for the climatic history of Viet Nam in the first half of the XXth century, and could perhaps, with a bit of luck — the historian who hunts for archives always relies on luck — echo the data collected in the imperial archives to build long time series. In any event, the work of a serious and persistent historian should be financed in order to bring out all the richness of these archives, and follow in the footsteps of the founding fathers of climatic history such as Ladurie.

To pave the way, we have begun to read the publications of those in charge of the Meteorological Service of Indochina. In 1930, Bruzon and Carton published their first synthesis of meteorological and climatological data [Bruzon & Carton, 1930]. The data on which they based their work extended from 1907 to 1927. Admittedly, there are many gaps in the data (only twenty stations provide continuous temperature and precipitation series over 20 years), but the authors' synthesis is nonetheless the first 'modern scientific' study of the climate of the Indochinese peninsula. The decadal averages produced by the authors for the years 1907–1927 can also be compared with Gustave Le Cadet's previous study published in 1917, with data from 1907 to 1915. The comparison is interesting because it shows a relative consistency between the two sources, but also reveals climatic fluctuations that the sagacious geographer Charles Robequin did not fail to note in his review of Bruzon and Carton's work in the *Annales de Géographie* [Robequin, 1930]. Robequin, like any great geographer of the time, was a scholar and a devourer of data of all kinds, but was also fond of great syntheses; he emphasized the differences in the rainfall patterns of the various regions of the peninsula, based on maps of the isohyets in the two publications:

> *"The relatively dry zone of Lower and Middle Tonkin widens between the coastal maximum of Moncay and that of Upper Tonkin (more than 2500 mm Chapa); the maximum of Central Annam narrows around Hue (2907 mm) but a comparable*

> *maximum appears curiously enough in Lower Laos at South Attopeu; The western edge of the Annamite of Nha Trang is one of the wettest regions of Indochina (Hon-ba 3848 mm) above a remarkably dry coastal fringe (Padaran 789 mm); but the most considerable rainfall is received by the mountainous coast of Cambodia where some years of observations give an average of more than 4800 mm in 3 stations, one of which (Kas-kong) saw 7972 mm of rain fall in 1923!* ”
>
> Robequin, 1930

It would of course be unreasonable to infer changes in climate from these climatic variations. What Robequin is looking for (with his love of of great syntheses) are rules, causes, laws — the laws of the climatic regimes that bathe the peninsula, and which still largely eluded the understanding of the time.

It would be very interesting if contemporary climatologists — the atmospheric circulation physicists specializing in the region — could follow in Robequin's footsteps and take hold of these data. For this to be possible, they would need the help of historians, whose job is precisely to unearth these data. Very small amounts of funding would be required to put such a study online; it would undoubtedly be of great service to the entire scientific community working on climate change in Southeast Asia.

Finally, it should be noted that from this period onwards, meteorology has been perceived as being very useful for typhoon prevention. In this regard, Carton emphasizes that *"the development of small individual T.S.F. reception posts will greatly facilitate the dissemination of regional forecasts, typhoon warnings, etc."* [Carton, 1930b]. Bruzon and Carton devote the entire second part of their book *Le climat de l'Indochine et les typhons de la mer de Chine* to constructing these forecasts. From the records of the Phu Lien Observatory (near Hai Phong), they succeeded in establishing the periodicity and seasonality of typhoons in the region, and noted that out of 128 typhoons observed between 1911 and 1928, 114 occurred between June and November, leading the authors to assert that the transitional periods preceding the winter monsoon and the summer monsoon were not the periods of maximum typhoon frequency, as some authors of the time thought. Again, clearing this type of data and making it available online for use in a more general history of observable changes in seasonal typhoon patterns over the XXth century would be of great service.

4.2 Meteorological services during the Democratic and Socialist Republic of Viet Nam

In 1945, just after setting up the interim government of the Democratic Republic of Viet Nam, President Ho Chi Minh signed a Resolution to establish the Meteorological Agency, given the importance of the role of meteorological services. In 1956, the Meteorological Department was renamed the Hydro-Meteorological Administration, and attached to the Ministry of Communications and Public Works. In 1958, the Prime Minister transferred it to the Ministry of Water Resources, and in 2002 to the Ministry of Natural Resources and Environment (MoNRE).

On 11 November 1994, the Government reorganised the HMS, which consist of 9 regional hydro-meteorological Centres (RHMC), and 8 institutional units. Its missions are to manage and exploit national meteorological and

hydrological networks (including basic investigation activities, forecasts, meteorological and hydrological data management), monitor air and water environments in support of natural disaster prevention and preparedness, socio-economic development, national security and defence of the country [Word Bank, UNISDR, 2013, p. 40].

Today, two departments of MoNRE have climate-related tasks: the Department of Meteorology, Hydrology and Climate change, and the National Centre for Hydro-Meteorological Forecasting. For the management of surface water and climatic hazards, the "Dyke Management and Flood Control Department" is attached to MARD. On the one hand, this underlines the importance of precise knowledge of the climate and its variations for Vietnamese agriculture, as was already the case more than a century ago. On the other, the National Hydro-Meteorological Service is an intermediary, even a bridge, between water management and environmental problems.

Throughout the decades of war, the attention paid by the Socialist Republic of Viet Nam to climate was therefore constant, and these few historical milestones can serve as a basis for the historian who wishes to gather the archives of these services and collect the meteorological data they contain. Nevertheless, there was little in-depth study of climate and its measurements in Viet Nam between 1945 and 1986, although for the period 1971–2010, Dang-Quang Nguyen, Renwick and McGregor (2013) show that temperature increases in different regions of Viet Nam are consistent with El Niño, while variations in global rainfall are insignificant for this period and do not appear to be determinant. The previous chapter of the present report, based on daily temperature registration from 70 stations, shows a nationwide average increase of 0.89°C over 60 years (1958–2018), with a constant acceleration of the increase from one decade to the next.

It would be useful for climate historians to collect data from weather stations from the colonial period, to add this information to the models and scenarios of Vietnamese scientists and make them available to the various communities who might wish to work with them. Judging by the exploratory work we have conducted in this chapter — thanks to the GEMMES Viet Nam project — it would be quite feasible to link the data from the weather stations of the colonial period, from almost 1902 to 1954, with the contemporary series from 1961 to the present.

Numerous experiments in historical climate data rescue have been carried out around the world. Their main goal is to build good quality reference climate series (from "human archive" data), in order to produce "climate reanalysis". A "reanalysis" is a scientific method of reconstructing the state of the atmosphere in the past from past meteorological observations [4]. This work requires four preliminary steps: consulting the archives, digitising the data, checking their quality and making them available to the public via national and international databases. Data quality control is an essential step for transforming the historical information into a useful data for climatologists. In order to be considered reliable, these data have to respect numerous criteria. Météofrance's BD Clim database can be a good source of inspiration for setting up these criteria in a way suited to the case of Viet Nam[5]. Last but not least, we should em-

4. *Climate reanalysis*, Retrieved from https://www.ecmwf.int/en/research/climate-reanalysis.

phasize that even when the data are reliable, they are not very valuable if unaccompanied by metadata describing their sources and the conditions in which they were produced and collected. The production of metadata typically depends on the know-how of the historian, whose contribution is absolutely essential for climatologists to understand possible measurement biases and correct them as much as possible. This data standardisation work has been intensively implemented for the series in Europe and the United States (see Paul Edward, 2010).

On this basis, it would be easy for Vietnamese historians and climatologists to set up an interdisciplinary program of climatic data rescue, in order to build long reference climate series for Viet Nam. It is important, in this respect, to understand that the Central Meteorological Observatory in Phủ-Liễn, created by the French in 1902, is part of the centennial meteorological stations today recognised by the World Meteorological Organisation [6]. This recognition is a very good indication of the feasibility of such a project.

5. Conclusion

This brief overview of the sources, methods and issues of climate history shows that climate history in general, and in Viet Nam in particular, makes a decisive contribution: firstly, to tracing the history of climate change on a human scale; and secondly, to understanding the way in which societies have taken up climate issues. Without claiming to have covered all the primary and secondary sources available for this type of historical research, this chapter has already demonstrated the abundance of sources and their interest. It therefore invites the Vietnamese University to develop this type of approach, by encouraging young historians to invest in the field of climate and environmental history.

Several approaches to climate history exist. In this chapter we have identified at least two of them: the history of climate for what it says about past societies in the face of climate; the history of climate for what it says about past climates. Finally, we would like to refine these two categories by subdividing them into four distinct climate historiographies.

The first one is the history of the climate for the climate in the footsteps of Le Roy Ladurie. It aims to reconstitute past climates according to human accounts (human archives), and seeks a strong interdisciplinary approach with the historical climatology developed by climatologists from the natural archives of past climates. This is a first type of climate historiography, a first step to be developed, particularly if we want to get climatologists to work with historians.

The second type of historiography is more or less focused on studying the influences of climatic changes on the evolution of societies. For such a project to be possible, the first type of historiography must already be sufficiently advanced not to fall into a climatic determinism, without any serious scientific basis.

5. *Meteo France*. Retrieved from http://archivesduclimat.meteofrance.fr/

6. World Meteorological Organization, *What We do*. Retrieved from https://public.wmo.int/en/our-mandate/what-we-do/

Even if the results of this approach need to be consolidated, it already seems certain that violent and recurrent climatic events in the history of Viet Nam contributed to the outbreak of popular revolts and the overthrow of dynasties. This result is the historical confirmation that climate change has generated and will generate more and more political instability and social violence, which authors like Nordis and Gleditsch criticize the Intergovernmental Panel on Climate Change (IPCC) for not taking into account sufficiently in their scenarios [Nordis & Gleditsch, 2007].

The third type consists using the way political power acts on the climate and mitigates climatic disasters to infer information about cultural representations of the climate, the cosmos and a worldview — and also logics of thought, especially analogical thought that establishes a system of correspondence between elements that can appear separate in our current scientific culture. This kind of history of climate is already quite advanced in Vietnamese historiography. It should be pursued assiduously, because far from being dead, these thought patterns are very much alive and still strongly influence Vietnamese society and its relationship with the climate. Thus, if we want to understand how this society is capable of coping with the various phenomena of global warming that are already making themselves felt, ignoring these cultural facts — which to many seem out-dated and devoid of interest — would undoubtedly be to deprive ourselves of an important insight into the explaining individual and collective behaviour, hopes for change, the will to adapt, resilience, and even renunciation.

The fourth genre is a history of climate, focusing on how people react and adapt to climatic calamities. By examining the imperial annals, four ways of reacting can be identified, which can be summarized by four actions: praying, fleeing, rebelling, and building dykes. These four modes of action/reaction strike us as very limited, and we strongly suspect that this poverty is more due to a lack of sources or the way historians have examined them so far, than to historical reality. It is true that the Imperial Annals are a codified literary genre that leaves little room for the description of everyday Vietnamese life. However, this is not the case with all the sources we have cited, and it is certain that a "micro-history" of a village — in the XVIIIth century for example, compiled from well-chosen archival sources — would be likely to bring back valuable information on the individual and collective actions of rural Vietnamese society in the face of climatic calamities. No historian has yet exploited archives in this way, and it will undoubtedly be when Vietnamese climatologists turn to them to ask for it, that this genre will be able to flourish as it does already in many countries in the world.

For this report, a few lessons from the past should already be underlined: firstly, the recurrence of violent climatic events, and secondly the correlative constant concern of the political power for climatic issues. From this point of view, as historians, we want to underline the relative similarity between the past moral duty of rulers to act on climate and the contemporary situation requiring effective measures to be taken to combat global warming. In fact, this chapter's main lesson is perhaps this one: climate issues between the State and the people are not new to Viet Nam; they are part of the national history that the Imperial Annals allow us to trace back to at least the middle of the XIIIth century. This situation is not at all specific to Viet Nam. In their book, *Les Révoltes du Ciel (The Revolts of Heaven)*, climate historians Fabien Locher and Jean-Baptiste Fressoz

made it clear that it was only in the 19th and 20th centuries that modern science — by focusing on understanding climate phenomena to forecast, rather than intervene on them — taught societies and State power to renounce their will to act on the climate.

With the Anthropocene, this historical parenthesis has closed, and scientists and societies must reconnect with a not-so-distant past will to act on the climate (with very different methods; mitigation, carbon sequestration and geo-engineering — rather than calls for rain — are the new technologies of the power). Logically, since the same causes often produce the same effects, it seems likely that the failures of contemporary rulers to act on the climate could result in socio-political disturbances, just as they did in the past, thus encouraging governments to take their duties seriously.

To finish we would like to return to Emmanuel Le Roy Ladurie. In 2015, almost half a century after the publication of *History of the climate since the year 1000*, a journalist asked him whether he subscribed to the thesis of the anthropic origin of global warming and the concept of the Anthropocene. Ladurie's answer is that of a man of culture. He refers to Plato, to the harmonies and correspondences between macro- and microcosms that we mentioned in the introduction to this first part.

> *"In the Gorgias, Plato evokes the need for a harmonious balance between heaven, earth, gods and men, who together form a community. According to him, this community, called Kosmos by the ancient sages, must, in order to function, be bound together by friendship, love, respect for temperance, and a sense of justice, and not by disorder and disruption. However, the breakdown of this balance is obvious. Some have said that it goes back to the intervention of agriculture, but the real disruption of the climate begins, for me, with the industrial revolution. Very quickly, we were able to see this reality with the retreat of the glaciers, which marked the gradual breakdown of the pact between man and nature."*
>
> Emmanuel Le Roy Ladurie,
> *L'Express*, 2 February 2015

As we have seen, it is also in terms of the cosmographic balance between Heaven and Earth that the relationship between man and climate has most often been posed throughout the history of Viet Nam. We believe that combining Plato, Confucius and men of culture is a key requirement to build the dialogue between peoples necessary for global climate diplomacy; we believe that without this cultural dialogue, scientific evidence for climate change and economic calculations of its impact will never result in effective policies to manage climate as a common global resource, and thus remain collectively below the +2°C in 2100. This is also one of the key ideas that this chapter would like to convey to readers and policy makers: building international climate diplomacy requires bringing people's conceptions of climate closer together, while remaining fully aware of their different cultural underpinnings.

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Climate change in Viet Nam
Impacts and adaptation

A COP26 assessment report
of the GEMMES Viet Nam project

This COP26 Report of the GEMMES Viet Nam project was prepared by a team led by Senior Economist Etienne Espagne [AFD], in close cooperation with the General Director of the Department of Climate Change of the Ministry of Natural Resources and the Environment The Cuong Tang [MoNRE].

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