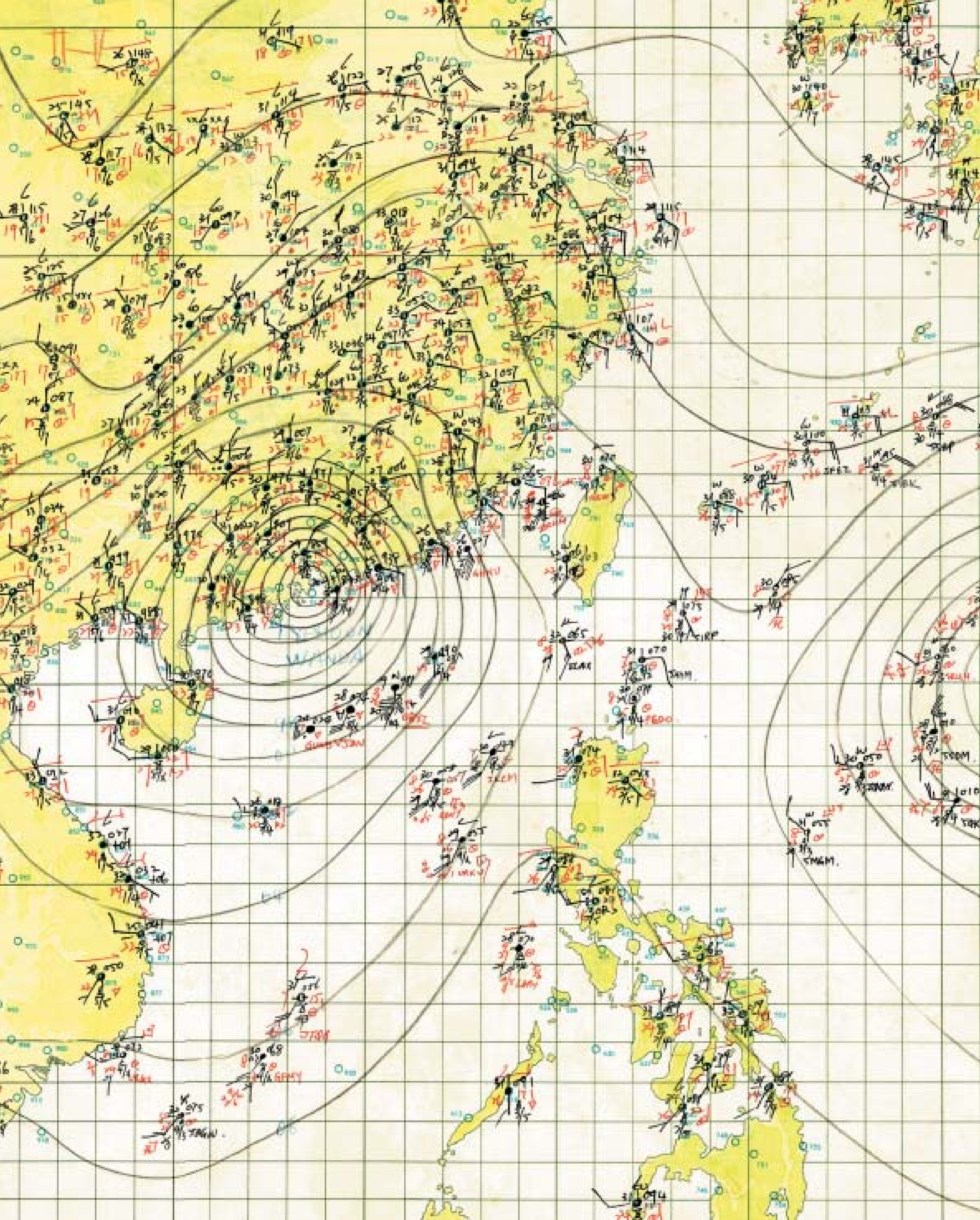
# *Part II*
# 下篇

## Ushering in a New Era

## 開創新天地



# 3

# Establishment and Early Services of the Observatory

# 天文台的創立及其早期的氣象服務

One of the deadliest typhoons of Hong Kong history — Typhoon Wanda, 1962

香港歷年來傷亡最嚴重的颱風之一 —

1962 年颱風溫黛

Hong Kong's climate and meagre natural resources should have prevented it from developing into the important economic centre it is today. In the latter half of the nineteenth century, this hilly island's only asset was its favourable geographical position. With the increase in the number of trading vessels coming to the East for trade, the Hong Kong government took the opportunity to set up an Observatory to provide tailor-made services for the marine communities. This helped to gradually shape Hong Kong into a leading entrepôt by the end of the nineteenth century.

## The Founding of the Observatory

In terms of the nature of its service and the scale of its organisation, the Observatory in 1883 was markedly different from what it has developed into today. In response to the needs at the time when the Observatory was first established, its principal tasks were to provide a time service and meteorological information on the South China Sea. Weather forecasting was not considered a key mission.

*Fig. 3.1 Founded in 1883, the original headquarters of the Observatory is still in excellent condition. It was declared a historic monument in 1983. Courtesy Hong Kong SAR Information Services Department*

*圖 3.1 創立於1883年的天文台總部全貌，現仍保存完好，1983 年該建築物被列為歷史建築。香港特別行政區政府新聞處檔案*





香港的自然氣候及資源分佈，根本不足以讓香港發展成為國際經濟重鎮。在十九世紀後半期，這個嶙峋的小島，唯一可取的地方是其優越的地理位置。因此，隨著東來貿易船隻數量的增加，香港政府因時制宜成立一個專為航海人士服務的天文台，逐漸建立香港在十九世紀末期貿易轉口港的領導地位。

## 天文台的誕生

創立於 1883 年的香港天文台，無論是服務性質抑或是組織規模，均與二十一世紀的天文台有頗大的差別，而天文台成立，以報時及提供南中國海氣象資訊為其首要的任務，並沒有把天氣預報列入重要工作議程，這個創台的目的，是因應著當時的環境需要。

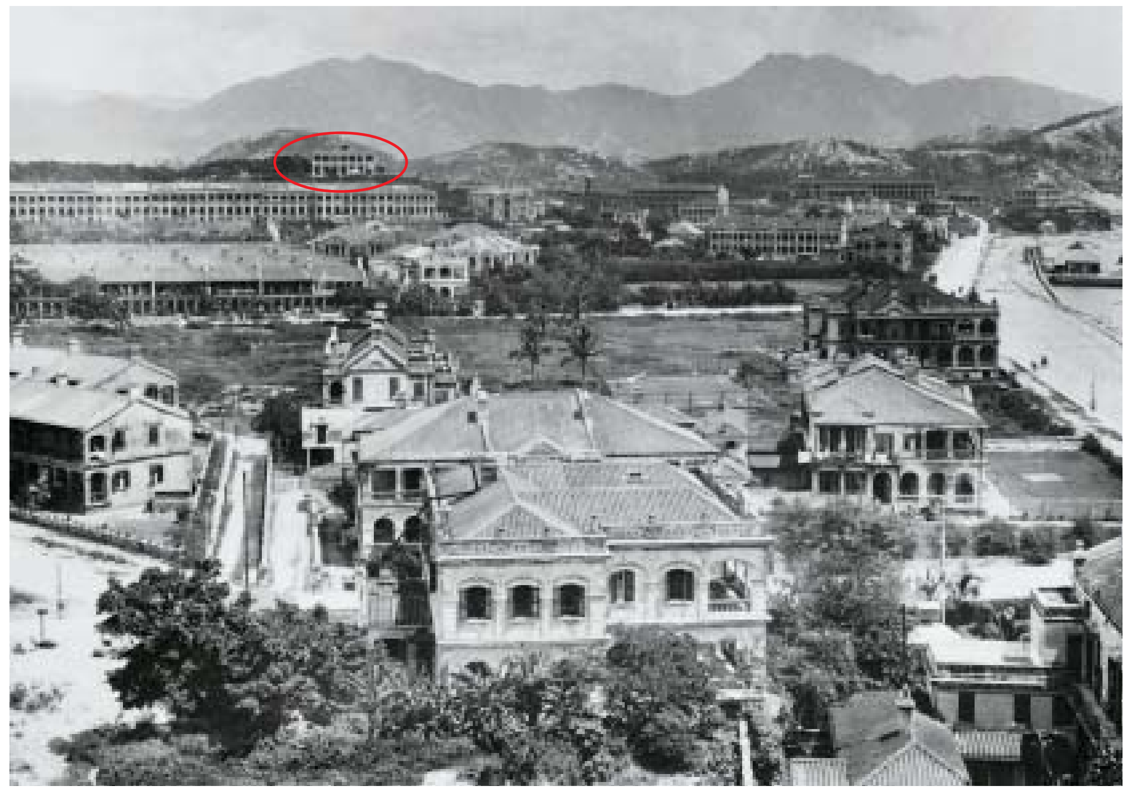


*Fig. 3.2 The Observatory can be seen at the top left of the photograph. Located at Mount Elgin, the Observatory was the highest building in Tsim Sha Tsui in the early twentieth century (1908). Courtesy Hong Kong Museum of History*

*圖 3.2 左上方最高的建築物為天文台。位於伊利近山的天文台，在二十世紀初為尖沙咀區的最高點 (1908 年)。香港歷史博物館館藏*

On 5 October 1877, two years before the release of the proposal drafted by the Kew Committee of the Royal Society to set up an observatory in Hong Kong, the Surveyor General, John M. Price, head of the Survey Department made recommendations to the then Acting Colonial Secretary, Cecil C. Smith, for the establishment of the Observatory. This is the earliest document on the setting up of the Hong Kong Observatory. The document shows that Price had gone to great lengths to provide justifications for establishing the Observatory, and had concrete ideas about the size, construction costs and modes of its operation.[76]

In his proposal, J. M. Price emphasised the importance of providing an accurate time service for the marine communities. According to his surveys, over 1,500,000 tons of sea freight stayed in or passed through Hong Kong in 1876. Most of these ships set sail from England, passing through the Suez Canal or the Cape of Good Hope, then reaching Hong Kong before arriving at mainland China. During the long journey, ships had to pass through different time zones. Having suffered numerous temperature changes, the chronometer on board would gradually lose its accuracy, and consequently determining the longitude and latitude of the ship was no longer an easy task. Since accurate knowledge of time was essential in determining a ship's position, J. M. Price felt that, as an important entrepôt, it was imperative for the Hong Kong government to establish an organisation to provide an accurate time service. This would help the mariners to calibrate their chronometers onboard and to plan their voyages accordingly.

If the main task of the Observatory was to provide an accurate time service, with meteorological observations playing a secondary role, then the organisation should also be structured on this premise. Therefore the proposal submitted by J. M. Price made quite detailed recommendations on the methods of providing time services, including the use of a time ball which was very popular in Europe at that time. Each day, at a stipulated time, a time ball was dropped on elevated ground where it could be seen by ships in the harbour. This served as a primary means for disseminating time to the public and for ocean-going ships and trading fleets to set their chronometers for navigation.

The basic facilities of the Observatory were geared towards the provision of an accurate time service. Essential instruments included a zenith telescope,[77] a transit circle, a sidereal clock with electro-chronograph register, equipment for connecting the Observatory to the signal station, and time ball equipment. As far as manpower was concerned, a competent professional astronomer was





*Fig. 3.3 The newly constructed nine-storey Centenary Building to the right of the old headquarters. By 1983, the Observatory was surrounded by tall buildings. Courtesy Hong Kong SAR Information Services Department*

*圖 3.3　1983 年的天文台，左面建築物為 1883 年的總部，右面為 1983 年新建成的百週年紀念大樓，天文台四周已被高樓大廈包圍。香港特別行政區政府新聞處檔案*

1877年10月5日，即1879年英國皇家學會基爾委員會 (Kew Committee, Royal Society) 發表香港天文台成立草擬書的前兩年，本港的測量署署長派斯 (John M. Price) 向當時的代布政司史密夫提出設立天文台的建議，是目前可看到最早有關天文台創台的文獻。派斯對創立天文台的意義、規模、興建的費用及運作的方法，已具備相當慎密的構思。[76]

在這份建議書中，派斯力陳建立天文台向航海人士提供準確報時服務的重要性。根據他的調查， 1876 年留港或過港的船隻超過 150 萬噸，而這些船隻大多是從英國出發，繞道蘇彝士運河或非洲好望角，經香港往中國大陸。在漫長的路程中，船隻抵港前必須途經不同的時區，氣溫幾經轉變，船上的航海時計 (chronometer) 已漸漸喪失其準確性，船隻要知道其身處的經緯度，並不是一件容易的事，而準確的時間又是確認船隻方位不可或缺的依據，故派斯認為香港作為一個重要的貿易中轉站，政府實有必要設立一所可以提供準確報時服務的機構，協助航海人士調準船隻上的航海時計，計劃船隻在海上的旅程。

a prerequisite. It was estimated that the annual salary of the astronomer would be around £500 (approximately HK$2,667). Including costs of instruments, the set-up costs amounted to about £3,000 (HK$16,000). For the start-up capital, the government decided to follow the practice of the lighting dues imposed on ships in 1877 and charge the ships a levy for the time service. Based on the tonnage of ships passing through Hong Kong in 1876, an income of £3,279 (HK$17,490) would be raised for a time service charge of one cent per ton. If the charge was set to half a cent per ton, the income derived would be £1,639 (HK$8,742). This sum would be enough to defray the recurrent expenses of the Observatory for the whole year and the start-up costs would be recouped within five years. After that, the government could also use the income from the time service to buy advanced meteorological instruments to develop meteorological observation work. J. M. Price believed that ocean-going vessels would be willing to pay for such a service, as it would obviate the need to manually dismantle the chronometers and send them to specialist companies for calibration upon arrival in Hong Kong (the best-known of these companies in 1877 was Messrs G. Falconer & Co.). This would not only reduce the cost of calibration, but would also avoid damage to chronometers during transit.

*Fig. 3.4 Small boats lined the northern coast of Hong Kong. Ocean-going vessels were rare in the late nineteenth century. Courtesy Dr Tong Cheuk-man*

*圖 3.4 十九世紀末的港島沿岸，舟楫處處。遠洋輪船，數量寥寥可數。唐卓敏醫生珍藏*






*Fig. 3.5 The early twentieth century Victoria Harbour was full of warships, ocean-going vessels and fishing boats (1904). Courtesy Dr Tong Cheuk-man*

*圖 3.5 二十世紀初的維港，戰船、遠洋輪船與漁船互相輝映 (1904 年)。唐卓敏醫生珍藏*

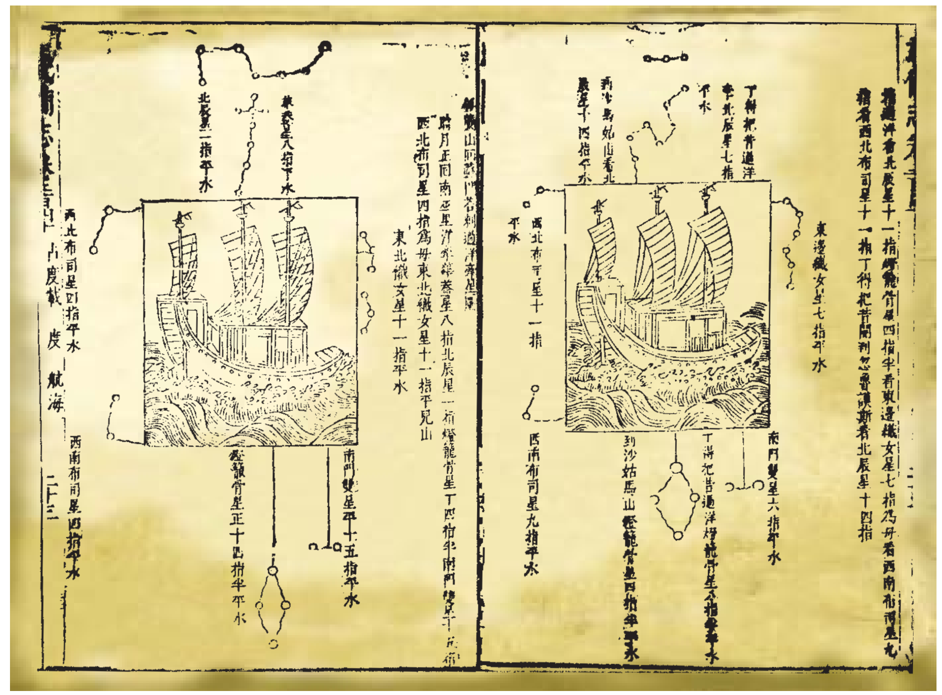


*Fig. 3.6 The 'astronavigation chart' in* Wubei zhi *(Military Gazette) is a navigation guide of the mid-fifteenth century. Cf. Mao Zhiyi,* Zhenghe hanghai tu *(Navigation Chart of Zhenghe), cited by Zhongguo shehui kexueyuan, kaogu yanjiu suo ed.,* Zhongguo gudai tianwen wenwu tuji *(Pictorial Collections of Ancient Astronomical Relics), Beijing, Wenwu chubanshe, 1978, p. 225.*

*圖 3.6 《武備志》中的〈過洋牽星圖〉，是十五世紀中期以恒星導航的紀錄，方法是用牽星板觀測所在地恒星距水平的高低，求所在地的緯度。參閱明茅之儀輯，天啟年間 (1621–1627)《鄭和航海圖》刻本。中國社會科學院考古研究所編，《中國古代天文文物圖集》，北京，文物出版社，1978 年，頁 225。*

J. M. Price also believed that the establishment of the Hong Kong Observatory could centralise the piecemeal meteorological observations then performed by various departments. He suggested the construction of a meteorological building at Mount Elgin in Kowloon (the present-day headquarters of the Hong Kong Observatory). As it was located on high ground, it would facilitate the hoisting of signals and the collection of meteorological information.[78]

On 30 October that year, 25 days after J. M. Price made his recommendations to the Acting Colonial Secretary, Admiral Alfred P. Ryder also wrote to the Acting Colonial Secretary explaining clearly the importance of setting up the Observatory. His stance was identical to that of J. M. Price, namely, that the principal role of the Observatory was to provide services for ocean-going vessels.[79] He also indicated that an observatory that could provide meteorological information on the South China Sea was indispensable for the safety of ships during the typhoon season. Even on days of calm weather, the Observatory could ensure navigational safety along the southeastern coast of China by the provision of an accurate time service to reduce accidents. This is because a one-minute error in the onboard chronometer would result in an error of about 15 miles in the ship's actual position. Since sea routes between China and Hong Kong usually hugged the coastline, errors in chronometers could easily lead to shipwrecks by causing the ships to run aground. Thus the time and wind reporting services of the Observatory were very important for the safety of mariners.

A. P. Ryder did not give concrete proposals on methods of meteorological observation, but his proposal on the time service was coincidentally the same as that of J. M. Price. Both felt that the time ball was the ideal method of disseminating the time signal. A. P. Ryder further suggested that the time ball be dropped at 2 PM. In addition to the time ball system, he also recommended the establishment of a lighthouse and an automatic tide gauge on Waglan Island to provide a night lighting service for mariners and to measure the high and low tides respectively. His ideas complemented those of J. M. Price, providing strong arguments for the setting up of the Observatory.

The draft report on the establishment of an observatory in Hong Kong was devised in 1879 by the vice-chairman of the Kew Committee of the Royal Society, Warren de la Rue, and compiled by H. S. Palmer in 1881. Although it was long regarded as the blueprint for the founding of the Observatory in 1883,[80] it was actually merely a revision of the recommendations made by J. M. Price and A. P. Ryder. There are three reasons to back up this argument.





如果新的天文台以報時服務為本，氣象觀測為輔，天文台的組織規模，就必須以報時工作為基礎。因此，派斯的創台建議書，圍繞著報時方法作了頗詳盡的建議：如參考當時在歐洲相當流行的降時間球的報時法， 每日於指定時間在港口較易為船隻眺望到的高地，由專人將時間球下降以說明時間，為遠洋輪船及貿易艦隊提供經度的依據，讓船隻釐定本身的方位。

至於天文台的基本設備，必須為準確報時做好準備，故建議購置的儀器包括了天文望遠鏡、[77] 中星儀、恆星計時器，聯繫天文台與報時訊號站的儀器，以及降時間球的儀器等器材。而人才方面，一位專業的皇家天文學家，是不能缺少的，估計該專家的薪金每年約需 500 英鎊 (折合約 2,667 港元)，連購買儀器在內，成立費用估計約共需3,000英鎊 (折合約16,000港元)。創辦資金方面，政府可以沿用1877年向船隻徵用照明費的方法，向船隻徵收報時費。倘政府按船隻噸位，每噸徵收一仙報時費，以 1876 年經港船隻噸位為計算基礎，收入應有 3,279 英鎊 (折合約17,490港元)；如政府向船隻徵收每噸半仙，則政府可收取1,639英鎊 (折合約8,742港元)，預計可足夠支付新機構全年的經常支出，並可在5年內收回創辦成本，而政府往後更可利用所收取的計時費，購買先進的氣象探測儀器，發展氣象觀測。派斯相信遠航輪船願意為該項服務支付費用，因船隻不再需要在抵港後，利用人手從船上拆下航海時計，送到專門調校時間計的公司校對時間 (1877年時，以弗康納公司 [Messrs G. Falconer & Co.] 的服務最著名)。這樣既可減少調校費用，也可避免航海時計在運送途中因被碰撞而損壞。

派斯又認為天文台的成立，可以把當時不同政府部門所進行的零散氣象監測工作統一管理。他更建議在九龍半島的依利近山 (Mount Elgin，即天文台總部現址) 興建氣象局，因該處地勢較高，無論在發放訊號抑或收集氣象資料，都能達到傳遞信息的功效。[78]

同年 (1877年) 10月30日，即在測量署署長向代布政司建議設立天文台的25天後，海軍上將雷特 (Alfred P. Ryder) 亦致函代布政司闡述設立天文台的重要性，他的立場明顯地與派斯一致，認為創立天文台的目的最主要是為遠航輪船服務。[79] 他認為一所提供南中國海氣象觀測資料的天文台，在颱風吹襲期間是保障區內船隻安全必不可少的機構，而在平日它也可提供保障船隻在中國東南沿岸航行安全的服務，例如報導準確的時間，以減少船隻意外。根據雷特估計船隻航海時計一分鐘的誤差，會導致實際航行距離誤差15哩，而來往香港與中國的船隻，大多沿海岸線航行，航海時計的誤差可使船隻觸礁。天文台的報時及報風服務，是航海人士的重要資訊。

1. Of the three major duties of the Observatory as emphasised by the Royal Society, the time service was ranked first in terms of importance, while meteorological observations and geomagnetic services were only areas for future development. Here the Royal Society's recommendations follow precisely those of J. M. Price's report — his major reasons for setting up the Observatory were:

- using astronomical observations to calculate local time, and to drop the time ball once each day to report time to the public;
- using instruments to conduct meteorological observations, and to provide information on monsoons and typhoons off the seas of China; and
- making geomagnetic measurements.

2. Most of the resources proposed for the establishment of the Observatory were allocated to the time service, just as suggested by J. M. Price. A total of eight instruments for the time service were suggested in the list of necessary acquisitions. Four of them had been included in J. M. Price's recommendations. The items not covered by J. M. Price's list were a mean solar clock, a pair of chronometers, a collimating telescope, and a distant meridian mark.

3. The draft report further discussed the technical details of the time ball service, such as securing the Marine Police Station at Tsim Sha Tsui as the place to drop the time ball, and defining the size and colour of the time ball — 8 to 9 inches in diameter and painted white and bright red. Those ideas were based on the suggestions made by J. M. Price.

Although H. S. Palmer's comprehensive report on the proposed establishment of an observatory had taken into account the needs of Hong Kong, the proposed costs of establishment and maintenance expenses[81] exceeded the financial capability of the government. This report was criticised by the first director of the Observatory, William Doberck, as not complying with economic principles.[82] Indeed the actual level of running expenses was quite different from that suggested by the report, as shown in Tables 3.1 and 3.2.



雷特沒有就氣象監測方法作具體提議，但其所建議的報時方法卻巧合地與派斯一樣，認為利用時間球報時是最理想的方式，而他更進一步提議降球時間為下午2時。除建議設立時間球報時系統外，他還建議於橫瀾島設立燈塔及自動測潮計，測量潮汐漲退及提供夜間照明，方便航海人士。雷特的建議，可謂補充了測量官署署長派斯的意見，使設立天文台的目的及功能更明顯，為創立天文台提供了堅實的理據。

1879年經英國皇家學會基爾委員會 (Kew Committee)副主席雷華朗(Warren de la Rue)提出，1881年由龐馬 (H. S. Palmer) 綜合的天文台建台草擬書，一直被視為是1883年創台的藍本，[80] 其實該報告只是香港測量署署長派斯及雷特上將天文台創立建議書的修訂本。持此論據原因大致有三：

1. 該學會所強調建台的三大任務，報時服務被列為創台初期的首要任務，氣象觀測及地磁服務只是未來發展的方向，均為派斯的建議書的延續，從其草擬的建台重點可引證此論據：

- 利用天文觀測，計算本地時間，每天降時間球一次向公眾報時；
- 利用儀器從事氣象觀測，並提供有關中國海季候風及颱風訊息；
- 進行地磁觀測。

2. 草擬建台的大部分資源仍按派斯原建議放在時間服務上，擬購計時器材的數量多達8項，其中有4項已在派斯早前的建議書中提及，新提議購買的儀器包括一個平太陽時鐘 (mean solar clock)、一對恆星及太陽計時器、一具瞭望鏡及一具長距離子午刻度儀 (distant meridian mark) 補充了派斯的不足。

3. 草擬書進一步落實時間球的降球技術性問題，如接納以尖沙咀警署為放時間球的地點、提議時間球的體積及顏色 —— 直徑8至9吋漆上白及鮮紅色的球體，但構思仍以派斯的建議為基礎。

雖然龐馬少校 (Major H. S. Palmer) 綜合的氣象台建議主要參考了本港的需要，但其提議的創立費及維修費，[81] 並不符合當時香港政府的經濟能力，甚至被第一任台長杜伯克 (William Doberck) 指為不合乎經濟原則。[82] 從建議書中提及的設備和經常支出經費草案與建台後的實際支出比較，的確有頗大的差距。

**Table 3.1** Budget for the Establishment of the Observatory — H. S. Palmer's Proposal (1881)[83]

(£1 = HK$5.334)

| Item | £ | HK$ |
|---|---|---|
| Astronomical apparatus | 500 | 2,667 |
| Meteorological apparatus | 397 | 2,117 |
| Magnetical apparatus | 424 | 2,262 |
| Time ball apparatus | 400 | 2,133 |
| Tide gauges (2) | 145 | 773 |
| Two Robinson's anemometers, for Victoria Park and Cape d'Aguilar | 12 | 64 |
| Freight and insurance | 100 | 533 |
| Main Observatory building and out-houses | 2,418 | 12,900 |
| Furniture and fitments | 94 | 500 |
| Magnetic basement | 844 | 4,500 |
| Expenditure on the grounds and approaches, etc. | 300 | 1,600 |
| Telegraph line to the time ball | 47 | 250 |
| Connecting the Observatory with the Kowloon-Yau Ma Tei Telegraph Line, and cost of speaking-instrument, etc. | 47 | 250 |
| Miscellaneous erections for the time ball, weather signals, tide gauges, etc. | 562 | 3,000 |
| Lamps, observing seats, etc. | 10 | 51 |
| Total | 6,300 | 33,600 |

Source:
*The Hong Kong Government Gazette,* 'On the Proposal to Establish a Physical Observatory at Hong Kong', 3 September 1881, p. 810.

**Table 3.2** Budgeted Recurrent Expenditure of the Observatory — H. S. Palmer's Proposal (1881)

| Item | £ | HK$ |
|---|---|---|
| Salary of director | 675 | 3,600 |
| Salary of first assistant | 270 | 1,440 |
| Salary of second assistant | 169 | 900 |
| Salary of first clerk | 225 | 1,200 |
| Salary of second clerk | 169 | 900 |
| Salary of time ball assistant | 34 | 180 |
| Salary of caretaker | 34 | 180 |
| Salary of gardener | 18 | 96 |
| Salary of coolies (2) and watchmen (2) | 63 | 336 |
| Stationery, printing and office expenses | 56 | 300 |
| Fuel | 19 | 100 |
| Lighting and chemicals | 94 | 500 |
| Incidental charges for instruments, etc | 50 | 268 |
| Total | 1,876 | 10,000 |

Source:
*The Hong Kong Government Gazette,* 'On the Proposal to Establish a Physical Observatory at Hong Kong', 3 September 1881, p. 810.



**表 3.1** 龐馬建議書有關香港天文台創台財政預算草案 (1881 年)[83]

(1 英鎊 = 5.334 港元)

| 項目 | 英鎊 | 港元 |
|---|---|---|
| 天文觀測儀器 | 500 | 2,667 |
| 氣象觀測儀器 | 397 | 2,117 |
| 地磁量度器 | 424 | 2,262 |
| 時間球 | 400 | 2,133 |
| 兩套潮汐漲退計 | 145 | 773 |
| 兩套風速風向計 (分別放於太平山及鶴咀) | 12 | 64 |
| 儀器運輸及保險 | 100 | 533 |
| 天文台大樓及轄下建築 | 2,418 | 12,900 |
| 傢俱設備 | 94 | 500 |
| 地磁地下室 | 844 | 4,500 |
| 其他地勤雜支 | 300 | 1,600 |
| 聯繫天文台與時間塔電路 | 47 | 250 |
| 聯繫天文台與油麻地電路及廣播工具 | 47 | 250 |
| 建立氣象訊號系統儀器 | 562 | 3,000 |
| 電燈、觀測台 | 10 | 51 |
| 總計 | 6,300 | 33,600 |

資料來源：
*The Hong Kong Government Gazette,* 'On the Proposal to Establish a Physical Observatory at Hong Kong', 3 September 1881, p. 810.

**表 3.2** 龐馬建議書有關香港天文台經常支出預算草案 (1881 年)

| 項目 | 英鎊 | 港元 |
|---|---|---|
| 天文台台長薪金 | 675 | 3,600 |
| 首席助理薪金 | 270 | 1,440 |
| 第二助理薪金 | 169 | 900 |
| 首席文員薪金 | 225 | 1,200 |
| 第二文員薪金 | 169 | 900 |
| 時間球管理員薪金 | 34 | 180 |
| 管理員薪金 | 34 | 180 |
| 園林護理員薪金 | 18 | 96 |
| 兩名苦力及兩名警衛薪金 | 63 | 336 |
| 文具、辦公室雜支 | 56 | 300 |
| 燃油 | 19 | 100 |
| 照明及化學品 | 94 | 500 |
| 雜支 | 50 | 268 |
| 總計 | 1,876 | 10,000 |

資料來源：
*The Hong Kong Government Gazette,* 'On the Proposal to Establish a Physical Observatory at Hong Kong', 3 September 1881, p. 810.

The budgeted recurrent expenditure in H. S. Palmer's report was more than twice the actual level. The actual costs for the construction of the Observatory's main building and installation of the time ball equipment amounted to HK$18,680 dollars only,[84] a sum which was considerably lower than H. S. Palmer's budgeted sum of HK$33,600. The detailed expenditure on the establishment of the Observatory can be seen in the following table.

**Table 3.3** Hong Kong Observatory Expenditure (1883–1884)

(Unit: HK dollar)

| Item | 1883 | 1884 |
|---|---|---|
| Salary of government astronomer | 2,400 | 2,400 |
| Salary of assistant | 1,200 | 1,200 |
| Salary of second assistant | – | 480 |
| Salary of clerk | – | 480 |
| Salary of office coolie | – | 96 |
| Salary of watchman | – | 120 |
| Salary of two chair coolies | – | 144 |
| Total | 3,600 | 4,920 |

Sources:
*Hong Kong Blue Book 1884,* Hong Kong, Noronha & Co., 1885, I 42.
*Hong Kong Blue Book 1885,* Hong Kong, Noronha & Co., 1886, I 42.

The greatest contribution made by H. S. Palmer's draft report lay not in the proposal to establish the Observatory, but in his advocacy to carry out meteorological, geomagnetic and tide measurements. Due to financial restraints, such operations could not be performed soon after the establishment of the Observatory. But this was the main direction taken by the Observatory when it expanded its scope of service afterwards, making meteorological observations much more useful for scientific research.

## Naming of the Observatory

As time service rather than meteorological observations was the prime mission of the new organisation, it could certainly not be described as a meteorological agency. However, the Chinese translation of the term 'observatory' should be '*guanxiangtai*'. Was '*guanxiangtai*' a general term for the traditional Chinese institutes responsible for meteorological matters?

Among various traditional Chinese institutes making meteorological observations, astronomy was but one small part of the meteorological department. Its work also differed from that performed by the Hong Kong



龐馬建議書有關天文台經常支出的預算較實際支出高了一倍有多，1884年興建天文台大樓及設置時間球的裝備亦只支出了18,680港元，[84] 與龐馬建議書財政預算的33,600港元有頗大的差距，有關天文台創台的實際支出細目可參閱表 3.3 。

**表 3.3** 香港天文台實際財政支出 (1883–1884 年)

(單位：港元)

| 項目 | 1883 | 1884 |
|---|---|---|
| 天文台台長年薪 | 2,400 | 2,400 |
| 首席助理 | 1,200 | 1,200 |
| 第二助理 | – | 480 |
| 文員 | – | 480 |
| 辦公室雜役 | – | 96 |
| 護衛 | – | 120 |
| 兩名轎夫 | – | 144 |
| 總計 | 3,600 | 4,920 |

資料來源：
*Hong Kong Blue Book 1884,* Hong Kong, Noronha & Co., 1885, I 42.
*Hong Kong Blue Book 1885,* Hong Kong, Noronha & Co., 1886, I 42.

龐馬的創台草擬最大的貢獻，不在首創建台，而在其擬建的氣象觀測部、地磁部及潮汐觀測部，礙於經費不足，這幾個部門沒有馬上在天文台建台初期成立，但卻成了天文台日後擴展服務發展的主要方向，使天文台的氣象觀測更具科學研究價值。

## 天文台的命名

新的機構既然以報時為主，氣象觀測為輔，當然不能稱為氣象台，但按英文「observatory」的意思，中文名稱應翻譯為觀象台，到底天文台是不是中國傳統觀測氣象機構的統稱？

其實在眾多中國傳統氣象觀測的機構中，天文一科只屬氣象部門的一小部分，其工作亦與 1883 年創立的香港天文台不同。據《六家詩名物疏》記載，中國最早觀測天文的機構，夏 (約公元前21世紀至公元前16世紀) 稱清臺、殷 (約公元前 16 世紀至公元前 11 世紀) 稱為神臺、周 (約公元前 11 世紀至公元前 771 年) 稱為靈臺，[85] 主要功用在觀測日月星辰之行宿，掌歲月日星辰之位。[86] 周朝時觀測天文與四時變化的工作分由三個機構執行 —— 靈臺以觀天文；時臺以觀

Observatory established in 1883. According to *Liujia shiming wushu*, the earliest astronomical institute was the one set up in the Xia Dynasty (about twenty-first century BC to sixteenth century BC), called *qingtai*. The one set up in the Yin Dynasty (about sixteenth century BC to eleventh century BC) was known as *shentai*. During the Zhou Dynasty (about eleventh century BC to 771 BC), it was named *lingtai*.[85] Their main tasks were to observe the positions of the sun, the moon and the stars in the zodiac mansions.[86] In the Zhou Dynasty, three separate departments were responsible for observing astronomical matters and the changes of the four seasons. They were: the *lingtai* in charge of astronomy, the *shitai* in charge of observing the changes of the four seasons, and the *youtai* in charge of observing birds, animals and fish. The *lingtai* was also known as the platform of the 'Son of Heaven', the emperor. It was used for paying respect to Heaven and the people, and for making preparations for and taking precautionary measures against disasters. It was the place where upright kings worshipped Heaven.[87] Even dukes and princes were not allowed to observe celestial bodies.[88] There was a perceived close relationship between astronomical observations and divination: the rulers believed that foreknowledge of astronomical phenomena was the key to determine the rise and fall of a nation. Thus, ordinary people were barred from taking part in astronomical observations.

Until the Tang Dynasty (AD 618–907), the institute responsible for observing astronomical phenomena was called *sitiantai* (Terrace for Managing Heaven). In AD 758, it was renamed as *sitianjian* (Imperial Astronomy Office).[89] Despite the change in name, the nature of its work remained largely the same: to perform astronomical observations, to verify calendar enumeration, and to investigate abnormal celestial and climatic phenomena.[90] In the Song Dynasty, the above tasks were performed by various smaller departments: the *sitiantai*, *taishiju* (Bureau for Calendar Drawing), *tianwenyuan* (Institute for Astronomy), *zhongguyuan* (Institute for Bells and Drums), *yinlisuo* (Institute for Calendar Printing), *ceyan hunyi kelousuo* (Institute for Testing Armillary Spheres and Clepsydras), *hanlin tianwenyuan* (Astronomy Institute of the Imperial Academy) and *hetai* (General Office).[91] During the Yuan and Jin Dynasties, the government followed the Tang system of using *sitiantai* to take command of the astronomical observation work.[92] In the third year of the reign of the Ming Emperor Hongwu (AD 1371), *sitianjian* was renamed *qintianjian* (Imperial Astronomy Office), although the nature of work remained largely unchanged.[93] The Qing Dynasty continued to use the name *qintianjian*, which was responsible for time service, weather observations and forecasting, and advising courses of action based on interpretations of astronomical phenomena. Under its jurisdiction were sections





四時施化；囿臺以觀鳥獸魚鱉。而靈臺又稱天子之臺，用以尊天、重民、備災、禦朗、豫防未然，是王者嘗承順天地禦詳陰陽的地方，[87] 故諸侯不得觀天文。[88] 可見天文觀測與占示未來有極密切的關係，統治者相信預知天象是決定國家的興亡的關鍵，故普通人不得參與天文觀測。

及至唐代 (公元618–907年) 觀候天象之所稱為司天臺，乾元元年改稱司天監，[89] 其工作大抵與前相約，包括掌察天文、稽曆數、凡日月星辰風雲氣色之異。[90] 宋代負責觀測天象的機構更細分為司天臺、太史局、天文院、鐘鼓院、印曆所、測驗渾儀刻漏所、翰林天文院及合台。[91] 元、金兩朝仍沿用唐制以司天臺統領天文觀測工作。[92] 明洪武三年 (公元1371年) 始將司天監改稱為欽天監，其

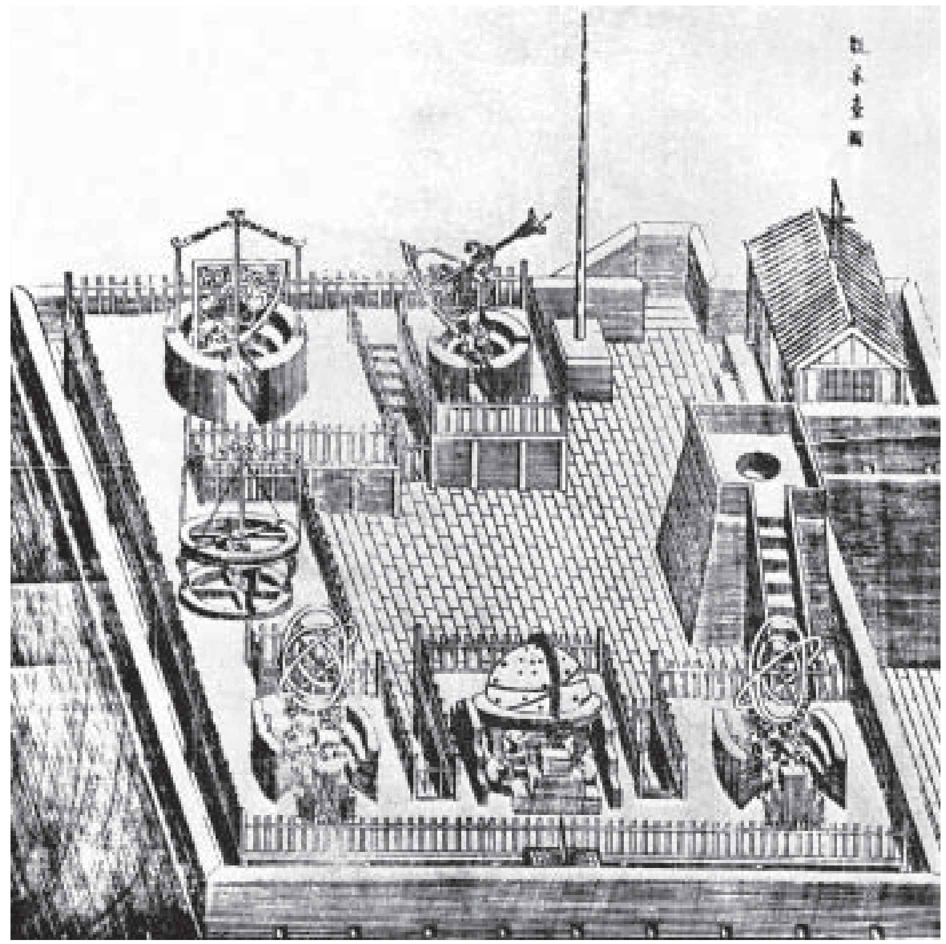


*Fig. 3.7 An observatory in the early Qing Dynasty. Cf.* Lingtai yixiang zhi *(A History of Strange Omen Observations), Qing Kangxi block-printed edition, cited by* Zhongguo gudai tianwen wenwu tuji, *1978.*

*圖 3.7 清康熙刻本《靈台異象志》中的清初觀象台。參閱《中國古代天文文物圖集》，1978 年。*

*Fig. 3.8 The astronomical observatory located in Gaocheng town of Dengfeng county, Henan province, is the earliest astronomical monument in China. Built in the early Yuan Dynasty (1279), the lookout is 9.46-metre-high with a 31.19-metre-long measuring ruler. Courtesy Hong Kong Science Museum*

*圖 3.8 河南登封縣告成鎮的古代天文觀星台，建造於元至元年(1279年)。臺高9.46公尺，量天尺長31.19公尺，是中國現存最早的天文臺建築。香港科學館館藏*

*Fig. 3.9 The 6-metre-tall Star Lookout at Shui Long Wo in Sai Kung, Hong Kong, is an imitation of the ancient astronomical observatory in Gaocheng town, Henan province (April 2003). Photograph by Ms Lau Chung-yan*

*圖 3.9 位於香港西貢水浪窩的觀星台。台高6公尺，仿照河南省登封縣告成鎮古代天文觀測台建造 (2003 年 4 月) 。劉頌欣小姐攝*



*Fig. 3.10 A view of the ancient observatory in Beijing (2002). Courtesy Hong Kong Science Museum*

*圖 3.10 北京古天文台全貌 (2002 年)。香港科學館館藏*

*Fig. 3.11 A close shot of the ancient observatory in Beijing (2002). Courtesy Hong Kong Science Museum*

*圖 3.11 北京古天文台近景 (2002 年) 。香港科學館館藏*


*Fig. 3.12　A sketch of an astrograph. Cf. Liu Tuo, Meng Bai, Qingdian banhua huikan (Collection on Imperial Engraved Pictures of the Qing Dynasty), Volume 8, Beijing, Xueyuan chubanshe, 1998, p. 218.*

*圖 3.12　天體儀草圖。參閱劉托、孟白，《清殿版畫匯刊》，卷八，北京，學苑出版社，1998 年，頁 218。*

dedicated to hemerology, astronomy and clepsydras.[94] With the Republican Revolution of 1911, the Nationalist government changed *qintianjian* to *zhongyang guanxiangtai* (Central Observatory) with the specific duties of making astronomical observations, drawing up commoners' calendars and appraising meteorological apparatus. The Central Observatory consisted of four sections:





*Fig. 3.13　An astrograph. Courtesy Hong Kong Science Museum*

*圖 3.13　天體儀。香港科學館館藏*

功能亦沒多大改變。[93] 清朝仍沿用欽天監稱謂，專職測候推步之法，占天象以授人時，轄時憲科、天文科、漏刻科。[94] 1911 年辛亥革命後，國民政府將清朝的欽天監改名中央觀象台，專責觀測天文、編 (算) 民用曆書、鑑定觀象用器械。中央觀象台分為四科：天文科、曆算科、氣象科及磁力科。[95] 綜觀中國各朝專司氣象及天文觀測的機構，可見天文科或天文院只是傳統中國氣象台其中的一部門，只負責觀測天象，而觀象台則兼管曆法的制定、授時及地磁觀測。

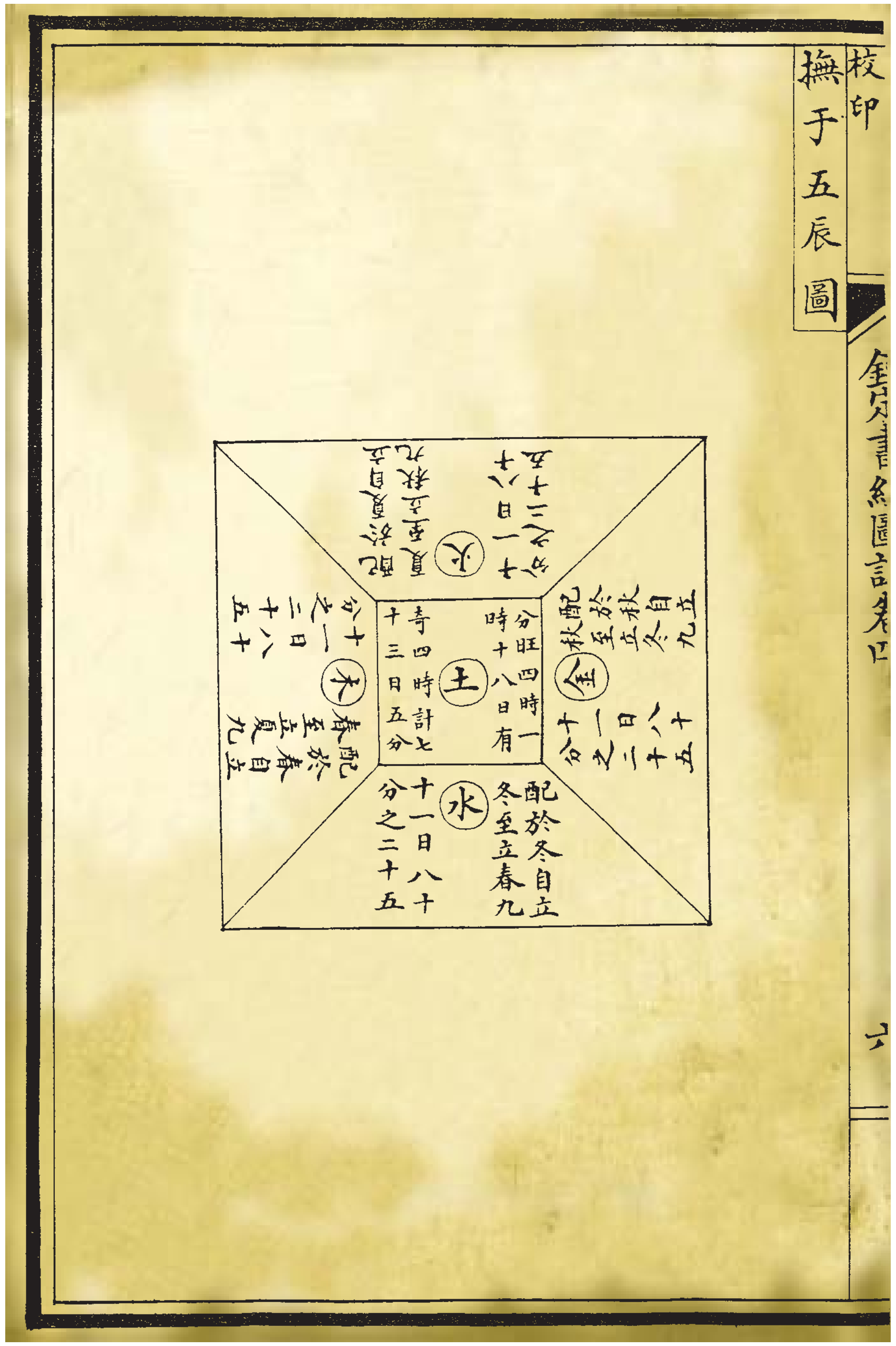



*Fig. 3.14　The five-element chart. Cf. Liu Tuo, Meng Bai, Qingdian banhua huikan, Volume 15, p. 111.*

*圖 3.14　撫于五辰圖。參閱劉托、孟白，《清殿版畫匯刊》，卷十五，頁 111。*





*Fig. 3.15　Zodiacal theodolites. Courtesy Hong Kong Science Museum*

*圖 3.15　黃道經緯儀。香港科學館館藏*

在1883年創立的天文台，無論是中文名稱抑或功能，均與由法國天主教耶穌會於 1872 年建立，被視為南中國海西方氣象觀測重鎮的上海徐家匯天文台極為相似。[96] 上海徐家匯天文台建台早期以天文觀測、氣象觀測、地磁紀錄及報時為主要工作，[97] 是十九世紀末期歐洲人獲取南中國海氣候資訊的重要基地。1883年由香港政府因應時勢創辦的天文台，服務也是以報時及氣象觀測為主，故在命名時極有可能參考上海徐家匯天文台的中文名稱，以「天文台」作為新機構的命

astronomy, calendar calculations, meteorology and magnetism.[95] A comprehensive survey of the organisations in charge of astronomical and meteorological observations in different dynasties reveals that astronomy was only one of the sections of the traditional Chinese meteorological agency, working solely with astronomical observations. In contrast, a *guanxiangtai* (observatory) had the additional responsibilities to formulate the calendar, provide a time service and to make geomagnetic measurements.

In terms of its Chinese name and functions, the Hong Kong Observatory, established in 1883, closely resembles Shanghai's Xujiahui *tianwentai* (Xujiahui Observatory), an important installation set up by the Catholic Jesuit Society in 1872 to carry out meteorological observations of the South China Sea.[96] In its early years, the Xujiahui Observatory was principally concerned with making astronomical and meteorological observations, geomagnetic measurements, and rendering a time service.[97] In the late nineteenth century, the Xujiahui Observatory was an important base for the Europeans to obtain meteorological information on the South China Sea. In 1883 the Hong Kong government established an 'observatory' to meet the needs of the time and focused on time service and meteorological observations. The new organisation thus adopted the Chinese name of its Shanghai counterpart, *tianwentai* (astronomical observatory), and not the name of *qixiangtai* (meteorological institute). The name *tianwentai* not only reflected the nature of its work, but also differentiated it from the Chinese official meteorological agencies of that time. From its inception, the Hong Kong Observatory had established close ties with the Shanghai Xujiahui Observatory, with regular exchanges of meteorological information.

## Initiation of Preparatory Work

Even though time service was the principal mission of the Hong Kong Observatory, such a service did not commence until 1 January 1885 because of considerable preparatory work.[98] Although the first director of the Observatory, titled Government Astronomer, was appointed in March 1883, meteorological observation work did not begin until 1884. In 1883, the Director visited various major cities in China, including Shantou, Xiamen, Shanghai, Zhenjiang, Jiujiang, Hankou, and the islands and lighthouses along the coast of China, with the intention of understanding the weather conditions and observation methods of the coastal cities. After this fact-finding trip, the Director returned to Hong Kong to take command of the meteorological



名，而棄「氣象台」不用，除可反映其工作性質外，更使其中文名稱有別於當時中國官方氣象觀測機構。香港天文台自此與上海徐家匯天文台建立了緊密的聯繫，定期交換氣象訊息，互相借用及印證資料。

## 初具規模

雖然報時服務是天文台成立的首要任務，但由於準備需時，本港真正的報時服務要到1885年1月1日才正式開始。[98] 香港天文台台長於1883年3月就職後，也沒有馬上在港展開氣象監測工作，該項工作要到1884年才正式開展。1883年年間，台長分別到訪中國各大城市包括汕頭、廈門、上海、鎮江、九江及漢口等中國沿海城市，旨在了解中國沿岸氣候狀況及參考各地測量氣候的方法。在參考了各地的氣象探測方法後，香港天文台台長便回港，並着手統籌各政府部門的氣象探測工作及統一觀測方法，如把日常氣象觀測時間固定為上午10時、下午4時及下午10時；分配燈塔氣象觀測輪班次數至每3或4小時一次；規定監測氣象的儀器，如氣壓計、溫度計、濕度計、量雨計及風向儀等的使用及紀錄的使用守則；統一描述天氣特徵術語的定義及提供較詳細的說明。[99] 天文台台長憑個人經驗，劃一氣象紀錄製定的格式，使1884年以後的氣象資料更具連貫性，這種嚴格規定，亦同時否定了1884年以前的氣象資料，台長甚至指其無用及不正確，因此有關1884年以前的氣象紀錄甚少被引用。

# 航海的守護者

保障船隻在海上航行的安全，向遠洋輪船提供海上氣象資料，是天文台成立以來最早開展的工作。

## 海洋氣象資訊中心

1883年成立之初，天文台首先開展與世界各地的氣象台，包括馬尼拉、廈門、福州、上海、華特胡士托 (Vladivostock) 及長崎建立緊密的聯繫，定期交換氣象消息。天文台更徵得大東電報局 (Eastern Extension Telegraph Co.)、澳中電報公司 (Australia and China Telegraph Co.) 及大北公司 (Great Northern Co.) 的合作，免費提供氣象消息傳送服務。[100]

observation work performed by various government departments and to unify the observation methods. For example, the times for making daily meteorological observations were fixed at 10 AM, 4 PM and 10 PM while the frequency of making meteorological observations at the lighthouses was fixed at once every three or four hours. Recording and operational procedures for the meteorological equipment were developed for barometers, thermometers, hygrometers, rain gauges and anemoscopes. The terminologies used to describe the characteristics of meteorological observations were also defined and given more detailed explanations.[99] Based on his experience, the Director unified the format of meteorological recording to ensure the consistency of meteorological data since 1884. Such strict requirements also negated those meteorological data recorded before 1884. The Director even went as far as suggesting that those data were useless and inaccurate. As a result, the pre-1884 meteorological records were rarely referred to.

# Guardian of Seafarers

Ensuring navigational safety and providing marine meteorological data for ocean-going vessels were the principal tasks of the Observatory.

## Marine Meteorological Information Centre

Soon after its establishment in 1883, the Observatory started to build up close ties and exchange meteorological information on a regular basis with its counterparts in various parts of the world, including Manila, Xiamen, Fuzhou, Vladivostok and Nagasaki. The Observatory was also able to enlist the co-operation of Eastern Extension Telegraph Co., Australia and China Telegraph Co., and Great Northern Co. to provide a meteorological message transmission service free of charge.[100]

In 1884, the Observatory began to collate meteorological information collected from various sources and compiled it into booklets. The booklets were distributed to various government departments such as the Harbour Master's Office, the Survey Department, the Medical Department, the British Army and the Royal Navy in Hong Kong, and the Chinese Maritime Customs. Occasionally, the Observatory also attended to specific enquiries from individual vessels. However, owing to the lack of manpower, this service was not widely promoted.





1884年天文台開始將從各地蒐集到的氣象資料綜合整理印製成小冊子，供應與各政府部門，如船政署、測量署、醫務署、軍部、海軍及中國海關使用。偶爾亦會照顧個別艦隻的查詢，但礙於人手關係，是項服務仍未全面被推廣。而颱風在南中國海的活動情況，如颱風季節的氣候、一些受颱風直接吹襲的城市包括東京、西貢、菲律賓等地的天氣狀況，是早期的氣象資料重點所在。1886年天文台開始發行專供航海人士使用的《東海颱風規律》(*The Law of Storms in the Eastern Seas*)，報導南海颱風的動態。[101] 1887年天文台利用從電報局接收到的氣象資料製成《中國沿岸氣象紀錄》(*China Coast Meteorological Register*) 小冊子，報導南海區內每天天氣狀況。[102] 1890年《中國沿岸氣象紀錄》所紀錄的地區多達16個，包括有：華特胡士托、東京、長崎、上海、福州、廈門、開屏、汕頭、太平山、廣州、澳門、海口、開封、婆羅乃、馬尼拉及賽歷占士角 (Cape Sairit James)等城市。[103] 1893年《中國沿岸氣象紀錄》增加發行量，小冊子除可供政府部門及軍部參閱外，更於船政署派發供船艦使用，[104] 該刊物於1902年後改為日刊，在每天早上派發，免費送贈與各船公司，[105] 但由於供不應求，1914年該小冊開始轉為公開發售，定價為港幣10元。[106]

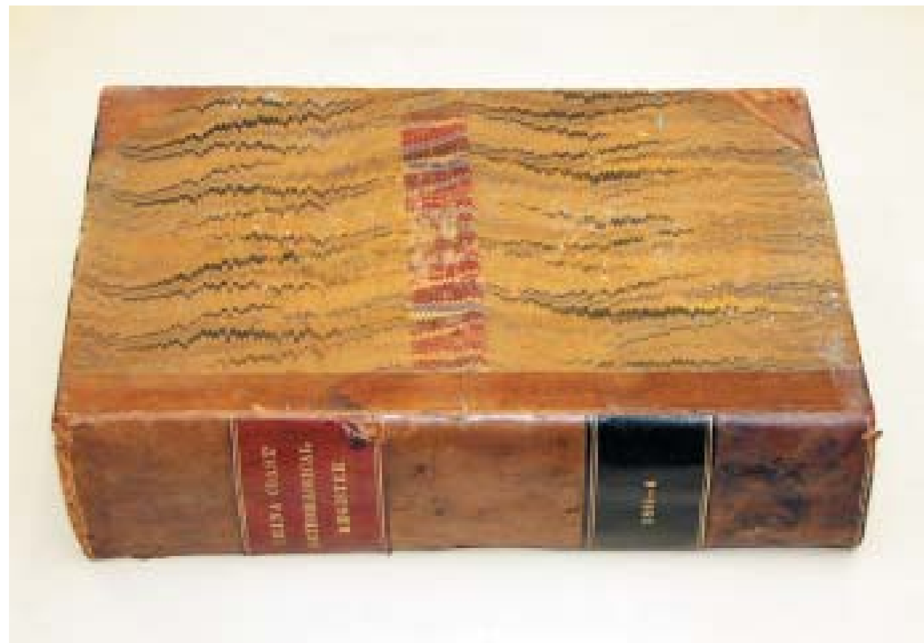


*Fig. 3.16 The Observatory published* China Coast Meteorological Register *to report the weather conditions in the South China Sea. Courtesy Hong Kong Observatory*

*圖3.16 天文台於1887年出版的《中國沿岸氣象紀錄》報導南中國海的天氣狀況。香港天文台檔案*

In the early days, climate information during the typhoon season and the weather conditions of those cities directly affected by typhoons, including Tokyo, Saigon and the Philippines, were the key meteorological data concerning typhoon conditions in the South China Sea. From 1886, the Observatory started issuing *The Law of Storms in the Eastern Seas*, a publication used specifically by mariners, which reported on typhoon conditions in the South China Sea.[101] In 1887, using meteorological data received from the telegraph companies, the Observatory published a booklet titled *China Coast Meteorological Register*[102] to report on the daily weather conditions of the South China Sea. By 1890, this booklet provided information on 16 cities or regions including Vladivostok, Tokyo, Nagasaki, Shanghai, Fuzhou, Xiamen, Kaiping, Shantou, Victoria Peak, Guangzhou, Macau, Haikou, Kaifeng, Borneo, Manila and Cape Sairit James.[103] In 1893, the government increased the print run of *China Coast Meteorological Register*. The booklets were distributed not only to government departments and the military, but also to ships through the Harbour Master's Office.[104] By 1902 this register had become a daily publication, and was distributed to shipping companies free of charge.[105] As demand outstripped supply, it was made available to the public at HK$10 a copy in 1914.[106]

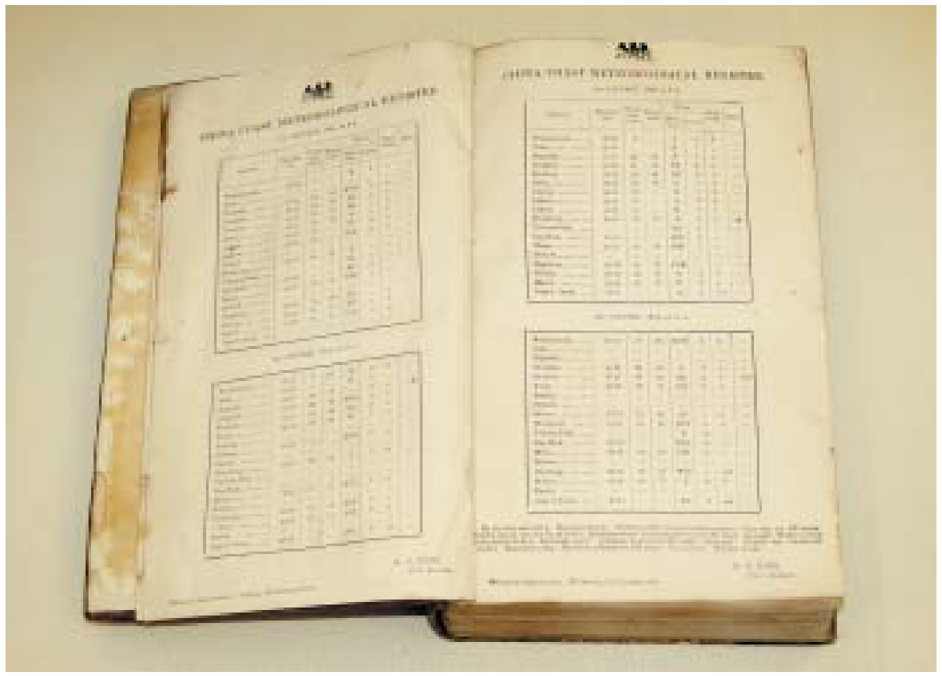
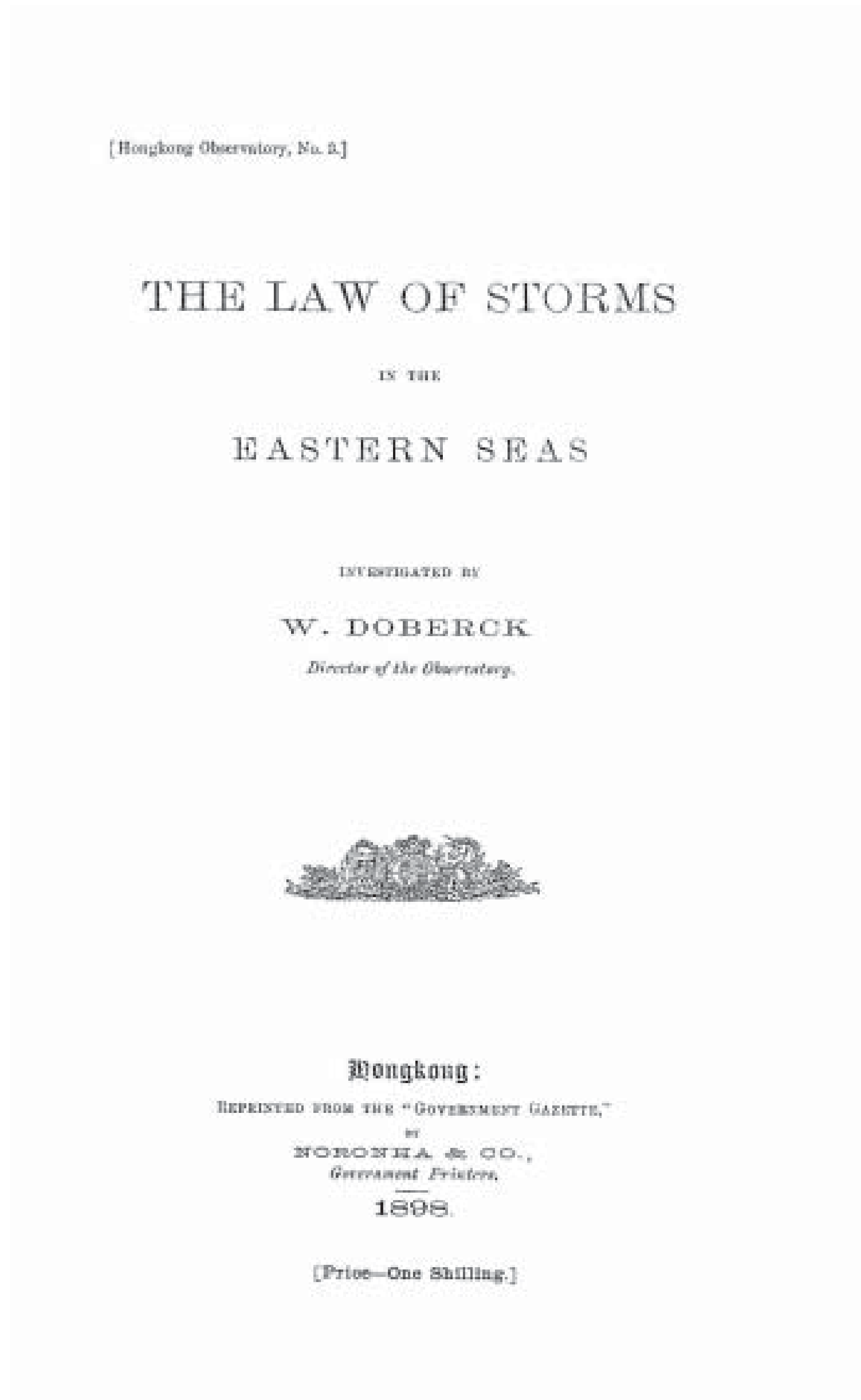


*Fig. 3.17 Weather conditions of 16 cities (18 locations) were reported in the* China Coast Meteorological Register. *Courtesy Hong Kong Observatory*

*圖 3.17 《中國沿岸氣象紀錄》報導本港及鄰近地區 16 個城市 (共 18 個地點) 的氣候狀況。香港天文台檔案*







[Hongkong Observatory, No. 3.]

THE LAW OF STORMS

IN THE

EASTERN SEAS

INVESTIGATED BY

W. DOBERCK

*Director of the Observatory.*

Hongkong:

REPRINTED FROM THE "GOVERNMENT GAZETTE,"

BY

NORONHA & CO.,

*Government Printers.*

1898.

[Price—One Shilling.]

*Fig. 3.18 Published since 1886,* The Law of Storms in the Eastern Seas *reported storm conditions in the neighbouring regions. Courtesy Hong Kong Observatory*

*圖 3.18 天文台於 1886 年開始發行《東海颱風規律》，報導鄰近海域暴風狀況。香港天文台檔案*

Since 1888, the meteorological data collected by the Observatory had come mainly from 40 observation stations across the world. From such data, the Observatory tried to prepare pilot charts to provide information on wind directions, weather conditions and air pressures at the various longitudes and latitudes. When used together with the guidelines given by *The Law of Storms in the Eastern Seas*, these charts were very valuable as navigators could, during the typhoon season, avoid entering the typhoon-active areas.[107] From 1909 onwards, the Observatory started to prepare daily meteorological charts and posted them up at popular public assembly spots like the Harbour Master's Department, Blake Pier and the cross-harbour ferry piers for public reference.[108]

Ships were both the main users and providers of meteorological information. From 1888 onwards, the Observatory began collecting the logbooks of the ships arriving from abroad and analysed the weather conditions of adjacent sea areas of Hong Kong. Initially only a few dozen ships provided such information; but by 1891 the number increased to over 200.[109] In the following year, the Observatory started collecting the meteorological records of ships sailing within the region and compiled reports after taking into account of the meteorological conditions at various longitudes and latitudes.[110] The amount of data collected through ships grew quickly; by the early twentieth century, the volume of such meteorological observation data had exceeded 20,000 observation-days — a valuable source in understanding the weather conditions of South China.

## Raising the Quality and Quantity of Marine Meteorological Information

The method of collecting meteorological information from the logbooks of ocean-going vessels and data supplied by other cities changed in 1910.[111] From that year onwards, the Observatory began to receive meteorological data from British naval fleets via wireless telegraphy. Meteorological messages were received at higher frequencies. On 15 July 1915, through the wireless telegraphy station set up by the Observatory at Cape d'Aguilar, ships in the neighbouring waters could receive weather reports from the Observatory at 1 PM every day. If necessary, the frequency of weather reports could be increased during the typhoon season. To facilitate data exchange, the Observatory adopted a six-digit alphanumeric code for the transmission and reception of data with Taiwan,





1888 年起天文台所蒐集的氣象資料主要來自 40 個分佈於世界各地的氣象站，天文台嘗試利用蒐集到的資料製成航海氣象圖 (pilot chart)，提供有關風向、天氣、各經緯度的氣壓狀況等資料，配合《東海颱風規律》的指引，航海人士在颱風季節內可盡量避免進入颱風強勁的區域，有極高的導航價值。[107] 1909年起天文台開始每天繪製天氣圖，張貼於船政署、卜公碼頭 (Blake Pier) 及渡海小輪碼頭幾個公眾聚集的熱點，供市民參考。[108]

船艦是早期天文台主要的服務對象，但同時也是氣象消息的供應者。自1888年起，天文台開始蒐集來自外地船隻的航海日誌，分析香港鄰近海域的氣候狀況，起初提供消息的船艦只有數十艘，1891年開始增至200多艘，[109] 1892年天文台開始蒐集在區內船隻的氣象紀錄，參考各經緯度的氣象狀況加以整理再作報導。[110] 由於天文台透過船艦蒐集到的消息與日俱增，在二十世紀初船艦海上氣象觀測資料多達二萬多天，是了解南中國的氣候狀況的寶貴資料。

*Fig. 3.19 The Waglan Island Lighthouse started to operate in 1893 to provide navigation guidance (1983). Courtesy Hong Kong SAR Information Services Department*

*圖 3.19 1893 年，政府於香港東南面的橫欄島設立燈塔，為輪船護航 (1983年)。香港特別行政區政府新聞處檔案*

Indonesia, Macau, the Philippines and the Xujiahui Observatory in Shanghai. A simpler system (with A-type code) was used for communications with Xiamen, Labuan and Weihaiwei.[112]

On the other hand, the Observatory standardised the format for reporting marine meteorological data by ships. The information had to include the name of the ship, its position and times of observations. Meteorological observations had to include atmospheric pressure, temperature, wind direction and speed, etc., while the times of observation were fixed at 6 AM and 2 PM each day. The Observatory summarised the collected data and then broadcast the daily weather reports at 1 PM via the wireless telegraphy station situated at Cape d'Aguilar. Occasionally the scheduled observation and weather report broadcasting times had to be suspended due to external factors. For example, between 1 November 1915 and 30 April 1916, observations by ships were only broadcast at 6 AM each day.[113]

Since the establishment of wireless telegraphy stations, most of the ships made use of radio waves to transmit marine meteorological information to the Observatory. The importance of ship logbooks as a source of reference was gradually superseded. The Observatory gradually increased the frequency of broadcasting weather reports via wireless telegraphy. In 1919, the broadcasting frequency of weather reports was increased to two times a day, at 1 PM and 5 PM. In 1923, the frequency was increased further to three times a day, with the third report being broadcast at 7 PM. On 25 December 1924, with the addition of another report at midnight, the number of reports per day came to four. In 1926, aided by advancement of transmission technology, the Observatory began sending current day weather reports to 26 cities in the Far East in addition to broadcasting weather information to the neighbouring waters.

Soon after its inception, the Observatory consolidated the marine meteorological data obtained from the logbooks of ocean-going ships and the communications with neighbouring regions. These data were then disseminated to the maritime communities. This service greatly reduced the risk of marine navigation in the region. As such information was particularly important during the typhoon season, the early stages of the service mainly focused on typhoon-related information. With the increase in efforts of the Observatory in compiling the marine meteorological data, the service gradually improved to include reports of daily weather as well. Technological advancements also facilitated the increase of reporting frequency from once every day to four times a day. The medium of communication also changed from written reports to wireless



## 提升海洋氣象資料的質與量

透過其他城市的氣象資料及遠洋輪船的航海日誌紀錄，以獲取區內氣候消息的方法，在1910年以後有所改變，是年天文台開始利用無線電接收到英國海軍艦隊的氣象觀測資料，[111] 而從無線電蒐集到的氣象消息，次數也愈來愈頻密。1915年7月15日天文台於鶴咀設立無線電通訊站，鄰近海域的船隻可於每天下午1時接收到由天文台發放有關每天天氣的報告，凡遇颱風季節，天氣報告時間亦會隨需要而增加。為方便資料傳送，天文台開始採用6個字母的電碼接收及發放台灣、印尼、澳門、菲律賓及上海徐家匯的氣象資料，而另一套較簡單的A式電碼，則應用於廈門、納閩 (Labuan) 及威海衛等地區。[112]

另一方面，天文台亦統一各船隻所提交的海上氣象資料的報導格式，包括船隻本身的資料，如船隻的名稱、位置、觀測時間，而氣象觀測的內容必須量度氣壓、溫度、風向和風力等資料，船隻觀測的時間更定為每天的上午6時及下午2時，天文台會將蒐集到的資料綜合，並透過鶴咀無線電通訊站於每天下午1時發

*Fig. 3.20 A weather station and wireless communication equipment housed on Waglan Island (1973). Courtesy Hong Kong SAR Information Services Department*

圖 3.20　橫欄島上現設有氣象站及無線電通訊器材 (1973年)。香港特別行政區政府新聞處檔案

*Fig. 3.21 The radio station on Pratas Shoal in the early twentieth century. Courtesy Hong Kong SAR Public Records Office*

*圖 3.21 二十世紀初位於東沙島的廣播站。香港特別行政區歷史檔案館館藏*

*Fig. 3.22 Mariners at sea reporting weather conditions to the Observatory (1983). Courtesy Hong Kong SAR Information Services Department*

*圖 3.22 船員向天文台報導海洋天氣概況 (1983 年)。香港特別行政區政府新聞處檔案*





*Fig. 3.23 The Observatory received about 6,000 weather reports each day by wireless transmission in 1965. Courtesy Hong Kong SAR Information Services Department*

*圖 3.23 天文台在 1965 年間每天透過無線電電訊接收約 6,000 份天氣報告。香港特別行政區政府新聞處檔案*

*Fig. 3.24 Sailors learning to use weather instruments on board vessel SS Shing Wing. Courtesy Hong Kong SAR Information Services Department*

*圖 3.24 成榮號的船員正在學習使用觀測天氣器材。香港特別行政區政府新聞處檔案*

telegraphy, and from reporting by the use of texts to graphic representations. Through continuous improvements in both the quantity and quality of the marine meteorological services, Hong Kong became the key marine meteorological information centre of the South China Sea. The fulfilment of the needs of the trading vessels helped to shape Hong Kong to become a strategic trading place in the Pacific Ocean.

# New Time Services

## Use of the Time Ball

Following the practice of the provision of a time service in European countries, a time ball was dropped at a given time each day in Tsim Sha Tsui to report time. This practice began on 1 January 1885 and continued until its abolition on 1 July 1933.

The reporting of time using a time ball relied mainly on a spring which connected the ball to the clock. Each day at a given time, the ball was electrically lowered to report time. To ensure an accurate time service, besides an accurate time measurement apparatus, it also required a seamless co-ordination between various integral parts of the whole process, namely, the placement of the time ball, the equipment recording the time of dropping the time ball, and the electrical circuitry connecting the Observatory and the time ball tower. In the early days, the Observatory mainly used the standard mean time clock which observes the positions of the earth and the sun to take time measurements during the day. At night, a sidereal clock for observing the position of stars and the earth was used to adjust the time. The instruments used came mainly from Europe. As it took time to transport, install and test the instruments, the Observatory could not commence the time service at its inception in 1883, but had to wait until 1 January 1885. Since the operation began, the mean annual error was kept to under 0.2 seconds. Such a high standard of accuracy was achievable because of the introduction of various time measurement instruments, such as the standard clock with mercurial compensation, the astronomical clock, as well as other astronomical instruments.

In the latter years of the nineteenth century, owing to insufficient manpower and technological inadequacy, the government did not have sufficient resources to provide a continuous time service all year round. Therefore, from 1885 to October 1891, the time service was only available



放氣象報告。當然天文台所計劃的觀測天氣時間及報告天氣時間偶爾亦會受外在因素影響而中斷，如 1915 年 11 月 1 日至翌年 4 月 30 日，船隻在海上的氣象觀測就只能在每天的早上 6 時進行。[113]

自從建立無線電傳送站以後，船隻大多借助無線電電波把海上氣象消息傳送到天文台，而船隻航海日誌的參考價值也漸漸被取代，天文台借助無線電發佈天氣消息的次數亦逐漸增加。 1919 年每天天氣狀況的報告，播放次數增至兩次，即下午1時及下午5時；1923年增至每天三次，包括晚上7時的天氣報告；1924 年 12 月 25 日再增加午夜天氣報告，每天天氣報告的時間共有四次。 1926 年在傳送技術改良後，天文台除可向鄰近海域發佈天氣消息，更可向26個遠東地區的城市傳送當天天氣報告。

天文台在成立初期，透過與區內各城市的通訊及遠洋輪船的航海日誌紀錄，將香港鄰近地區海上的氣象資料蒐集及整理，然後發佈給航海人士使用，大大地減低區內船隻航行的風險。這些資料在颱風季節尤其重要，所以天文台早期的海上氣象資料，集中報導颱風消息。在天文台的努力下，海洋氣象資料的編排及印製，逐漸從報導颱風消息改良為每天天氣報告。隨著科學技術的進步，有關報告更從每天一次，增至四次，傳送的方法亦由書面報導變為無線電傳送，由文字報導演變為圖表，無論數量抑或質量，亦盡量做到精益求精，使香港成為南中國海氣象資料的匯集中心，滿足往來貿易的船隻，促使香港成為太平洋的貿易重鎮。

# 嶄新的報時服務

## 時間球報時

天文台參照歐洲國家的報時方法，每天指定時間於尖沙咀降下時間球報時，1885 年 1 月 1 日開始實施，一直沿用至 1933 年 7 月 1 日才正式被取消。

時間球的報時方法主要是利用彈簧將球體與時鐘連接，每天於指定的時間，借助電力降下球體，以示時間。為確保能準確地報導時間，不但測量時間的儀器必須準確無誤，聯繫天文台與時間塔的電線網絡、紀錄降球時間的設備，以及擺放時間球的地方都必須緊密配合，方能保證報導時間無誤。天文台測量時間的方法，早期日間主要是用平時鐘 (mean time clock) 觀測地球與太陽的位置，晚間則用恆星時鐘 (sidereal clock) 觀測恆星與地球位置來釐定時間。儀器主要來自歐洲，由於運送、安裝及測試需時，故天文台未能在 1883 年創台後馬上提供報時服務，而要等到1885年1月1日才正式開始。自實施時間球報時以來，每年報

*Fig. 3.25 This Time Ball Tower was in use from 1 January 1885 to 1907. Initially, the time ball was dropped at 1 PM on working days. The tower was located at the present Ocean Terminal in Tsim Sha Tsui. Courtesy Hong Kong Museum of History*

*圖 3.25 由1885年1月1日至1907年使用的時間塔，最初只於工作天的下午1時正降球，該時間塔位於現址尖沙咀海運大廈。香港歷史博物館館藏*

*Fig. 3.26 A distant view of the Time Ball Tower and the Marine Police Station at Tsim Sha Tsui (1890). Courtesy Hong Kong Museum of History*

*圖 3.26 建成於1885年的時間塔遠景，其右為水警總部(1890年)。香港歷史博物館館藏*





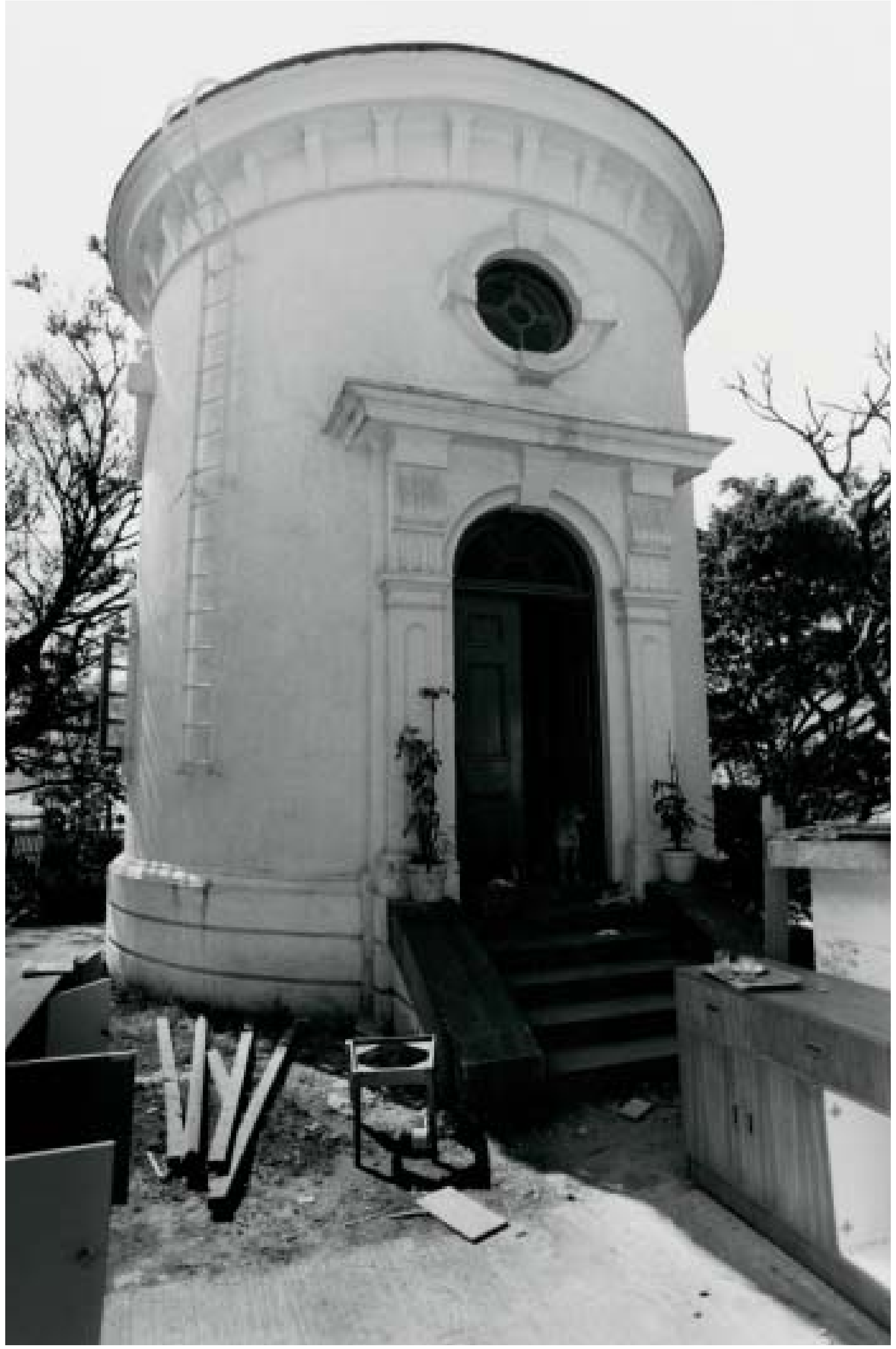


*Fig. 3.27 A more recent view of the Time Ball Tower (15 February 1977). Courtesy Hong Kong SAR Public Records Office*

*圖 3.27 建成於1885年的時間塔近貌(攝於1977年2月15日)。香港特別行政區歷史檔案館館藏*

*Fig. 3.28 The Time Ball Tower on Signal Hill was in use between 1908 and 1933. Courtesy Hong Kong SAR Public Records Office*

*圖 3.28 位於尖沙咀訊號山1908年至1933年使用的時間塔。香港特別行政區歷史檔案館館藏*

on working days. From November 1891 to 1902, the time service was extended to Sundays.[114] Between 1903 and 1912, hampered by insufficient resources, the service had to revert to working days. A daily time service all year round could only be provided from 1913 onwards.[115] Thus, from the late nineteenth century to the early years of the twentieth century, the time service was only provided for around 300 days each year. On 1 January 1920, the frequency of the time service was increased from one (at 1 PM on each working day) to two (at 10 AM and 4 PM on working days; at 10 AM and 1 PM on Saturdays; and at 10 AM on Sundays and public holidays). With these changes, the frequency of time service increased to more than 600 times per year.[116]

Failures and errors in reporting time by the time ball occurred several times every year. The main causes were bad weather, breakdowns of the communications system which prevented the Observatory headquarters from transmitting time information to the time ball tower, mechanical failures of the time ball, malfunctioning of the springs that connected the time ball, the relocation of the time ball tower, maintenance, sick leave and leave of absence taken by the time ball assistant, human mistakes, etc. The service records statistics of the time ball are tabulated in Table 3.4.



時的平均誤差能維持在低於0.2秒以下，這都歸功於天文台不斷引進多種測定時間的器材，如水銀補償式標準時鐘 (standard clock with mercurial compensation)、天文時鐘 (astronomical clock)及各種觀測天文器材，確保時間的準確性。

在十九世紀末期，由於技術水平及人手不足，政府根本沒有足夠的資源提供全年無休止的報時服務，因此1885年至1891年10月，報時服務只在工作日執行。1891年11月至1902年期間，報時服務曾增至在工作日及星期日執行；[114] 礙於資源不足，1903至1912年又恢復只在工作日報時的服務。全年365天的報時服務要到1913年天文台才開始全面實施。[115] 因此十九世紀末二十世紀初，全

*Fig. 3.29 A recent view of the Time Ball Tower on Signal Hill (26 June 1989). Courtesy Hong Kong SAR Information Services Department*

*圖 3.29 尖沙咀訊號山時間塔近貌 (1989年6月26日)。香港特別行政區政府新聞處檔案*

**Table 3.4** Time Ball Service Record Statistics (1886–1932)

| Year | Mean Annual Error Rate (sec) | Major Reasons for Failure in Dropping the Time Ball | | | | | Annual Number of Time Ball Drops |
|---|---|---|---|---|---|---|---|
| | | Weather | Repairs and Maintenance | Leave Taken by Personnel | Damage | Others | |
| 1886 | 0.25 | – | – | 9 days | – | – | 292 |
| 1887 | 0.18 | – | – | – | – | – | 301 |
| 1888 | 0.18 | 4 days (thunderstorms) | 3 days | – | 1 day | – | 296 |
| 1889 | 0.17 | 3 days (thunderstorms) | 9 days | 1 day | 6 days | – | 284 |
| 1890 | – | 1 day (strong winds) | – | 210 days | – | – | 130 |
| 1891 | – | – | 3 days | 6 days | 14 days | – | 289 |
| 1892 | – | 2 days (thunderstorms) | 3 days | – | 2 days | 1 day (forgot to bring keys) | 345 |
| 1893 | – | 6 days (thunderstorms, gale force winds) | 1 day | 1 day | 1 day | 1 day | 343 |
| 1894 | – | 4 days (strong winds) | – | – | – | 3 day | 347 |
| 1895 | 0.13 | 1 day (gale force winds) | 1 day | 4 days | – | 1 day (forgot to bring keys) | 341 |
| 1896 | 0.16 | 4 days (thunderstorms, strong winds, hurricane force winds) | – | – | – | – | 347 |
| 1897 | 0.15 | – | 13 days | – | – | – | 332 |
| 1898 | 0.14 | 2 days (gale force winds) | – | – | – | 1 day (dereliction of duty by staff) | 351 |
| 1899 | 0.13 | – | 1 day | – | – | 1 day (forgot to bring keys) | 340 |
| 1900 | 0.12 | 1 day (gale force winds) | – | – | 3 days | 1 day (forgot to bring keys) | 348 |
| 1901 | 0.13 | – | – | 5 days | – | – | 286 |
| 1902 | 0.12 | 2 days (bad weather) | 2 days | – | – | – | 293 |
| 1903 | 0.12 | 2 days (thunderstorms, hurricane force winds) | 2 days | – | – | 2 days (electrical short circuit) | 296 |
| 1904 | 0.14 | 1 day (hurricane force winds ) | 8 days | – | – | – | 293 |
| 1905 | 0.26 | 9 days (thunderstorms, gale force winds) | 2 days | – | 1 day | – | 292 |
| 1906 | NA | 3 days (storm force winds, hurricane force winds) | 10 days | – | – | – | 287 |
| 1907 | 0.15 | 1 day (hurricane force winds) | – | – | – | 32 days (the move to Signal Hill) | 281 |





*Fig. 3.30 A view of Tsim Sha Tsui in 1910. The Time Ball Tower at the top of Signal Hill can be seen in the top right of the photograph. Courtesy Hong Kong Museum of History*

*圖 3.30 1910 年代尖沙咀全景，右上角小丘為信號山上的時間塔。香港歷史博物館館藏*

*Fig. 3.31 A crystal-controlled timing system of the Observatory installed in 1966. Courtesy Hong Kong SAR Information Services Department*

*圖 3.31 天文台於 1966 年安裝的一套石英報時系統。香港特別行政區政府新聞處檔案*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1908 | 0.18 | 4 days (gale force winds, hurricane force winds) | – | – | – | – | 292 |
| 1909 | 0.17 | 2 days (gale force winds) | – | – | 2 days | – | 296 |
| 1910 | 0.15 | 2 days (hurricane force winds) | 12 days | – | – | – | 285 |
| 1911 | 0.15 | 5 days (hurricane force winds | 2 days | – | – | – | 291 |
| 1912 | 0.18 | 2 days (gale force winds) | – | – | – | – | 300 |
| 1913 | 0.20 | 1 day (windy) | – | – | – | – | 354 |
| 1914 | 0.19 | 1 day (strong winds) | – | – | – | – | 362 |
| 1915 | 0.19 | 1 day (strong winds) | – | – | – | – | 365 |
| 1916 | 0.14 | – | 6 days | – | – | – | 359 |
| 1917 | 0.13 | – | 14 days | – | – | – | 347 |
| 1918 | 0.14 | 1 day (windy) | 1 day | – | – | – | 353 |
| 1919 | 0.15 | 3 days (windy) | 17 days | – | – | – | 334 |
| 1920 | 0.18 | 8 times (windy; repairs) | – | – | – | – | 651 |
| 1921 | 0.18 | 3 times (windy) | – | – | – | – | 657 |
| 1922 | 0.13 | 4 times (windy) | – | – | – | – | 653 |
| 1923 | 0.17 | 9 times (gale force winds) | – | – | – | – | 658 |
| 1924 | 0.19 | 1 time (windy) | – | – | – | – | 649 |
| 1925 | 0.15 | 2 times (windy; thunderstorms) | – | – | – | – | 664 |
| 1926 | 0.12 | 4 times (windy) | – | – | – | – | 655 |
| 1927 | 0.12 | 4 times (windy) | – | – | – | 1 day (electrical short circuit) | 659 |
| 1928 | 0.12 | – | – | – | – | 196 days (the move of the time ball to Signal Hill) | 365 |
| 1929 | 0.11 | 1 time (gale force winds) | – | – | – | 2 times (electrical short circuit) | 658 |
| 1930 | 0.12 | – | – | – | – | 2 times (electrical short circuit) | 661 |
| 1931 | 0.11 | 3 times (gale force winds) | – | – | – | 1 time (electrical short circuit) | 660 |
| 1932 | NA | 2 times (gale force winds) | – | – | – | 1 time (electrical short circuit) | 659 |

Sources:

Claxton, T. F., 'Report of the Director of the Royal Observatory, Hong Kong', for the years 1912–1914, *Hong Kong Administrative Reports*, Appendix E, Hong Kong, Noronha & Co., 1913–1915.

Claxton, T. F., 'Report of the Director of the Royal Observatory, Hong Kong', for the years 1915–1931, *Hong Kong Administrative Reports*, Appendix F, Hong Kong, Noronha & Co., 1916–1932.

Doberck, W., *Observations and Researches Made at the Hong Kong Observatory in the Years 1886–1896,* Hong Kong, Noronha & Co., 1887–1897.



年報時次數只有約300天；而每天一次的報時 (每個工作天的下午1時) 在1920年1月1日增加至每天兩次 (工作天上午10時及下午4時，而星期六則改在上午10時及下午1時，星期天及公眾假期的報時服務則會在上午10時執行)，而全年報時的次數亦增至每年600多次。[116]

由於種種原因，以時間球報時偶然會出現失誤。惡劣天氣、報時站與天文台總部的電訊系統故障導致天文台無法將時間傳送至時間塔、時間球本身的機件故障、連接時間球的彈簧故障、時間塔維修或遷徙、報時人員病假、事假、人為疏忽等種種因素都會導致失誤。有關時間球每年報時服務實況可參閱表3.4。

**表3.4** 時間球報時紀錄統計 (1886–1932年)

| 年份 | 全年平均誤差 (秒) | 導致降球失敗主要原因 | | | | | 全年降球總次數 |
|---|---|---|---|---|---|---|---|
| | | 天氣關係 | 維修 | 員工休假 | 損壞 | 可考的其他因素 | |
| 1886 | 0.25 | – | – | 9天 | – | – | 292 |
| 1887 | 0.18 | – | – | – | – | – | 301 |
| 1888 | 0.18 | 4天 (雷暴) | 3天 | – | 1天 | – | 296 |
| 1889 | 0.17 | 3天 (雷暴) | 9天 | 1天 | 6天 | – | 284 |
| 1890 | – | 1天 (強風) | – | 210天 | – | – | 130 |
| 1891 | – | – | 3天 | 6天 | 14天 | – | 289 |
| 1892 | – | 2天 (雷暴) | 3天 | – | 2天 | 1天 (忘記鑰匙) | 345 |
| 1893 | – | 6天 (烈風及雷暴) | 1天 | 1天 | 1天 | 1天 | 343 |
| 1894 | – | 4天 (強風) | – | – | – | 3天 | 347 |
| 1895 | 0.13 | 1天 (烈風) | 1天 | 4天 | | 1天 (忘記鑰匙) | 341 |
| 1896 | 0.16 | 4天 (颱風、強風及雷暴) | – | – | – | – | 347 |
| 1897 | 0.15 | – | 13天 | – | – | – | 332 |
| 1898 | 0.14 | 2天 (烈風) | – | – | – | 1天 (員工失職) | 351 |
| 1899 | 0.13 | – | 1天 | – | – | 1天 (忘記鑰匙) | 340 |
| 1900 | 0.12 | 1天 (烈風) | – | – | 3天 | 1天 (忘記鑰匙) | 348 |
| 1901 | 0.13 | – | – | 5天 | – | – | 286 |
| 1902 | 0.12 | 2天 (天氣惡劣) | 2天 | – | – | – | 293 |
| 1903 | 0.12 | 2天 (颱風及雷暴) | 2天 | – | – | 2天 (電流短路) | 296 |
| 1904 | 0.14 | 1天 (颱風) | 8天 | – | – | – | 293 |
| 1905 | 0.26 | 9天 (烈風及雷暴) | 2天 | – | 1天 | – | 292 |
| 1906 | 不詳 | 3天 (暴風及颱風) | 10天 | – | – | – | 287 |
| 1907 | 0.15 | 1天 (颱風) | – | – | – | 32天 (遷至訊號山) | 281 |
| 1908 | 0.18 | 4天 (烈風及颱風) | – | – | – | – | 292 |
| 1909 | 0.17 | 2天 (烈風) | – | – | 2天 | – | 296 |
| 1910 | 0.15 | 2天 (颱風) | 12天 | – | – | – | 285 |
| 1911 | 0.15 | 5天 (颱風) | 2天 | – | – | – | 291 |
| 1912 | 0.18 | 2天 (烈風) | – | – | – | – | 300 |

Doberck, W., 'Report of the Director of the Observatory', for the years 1891, 1898–1902, 1905–1906, *Hong Kong Sessional Papers*, Hong Kong, Noronha & Co., 1892, 1899–1903, 1906–1907.
Figg, F. G., 'Report of the Director of the Observatory', for the years 1903–1904, 1907, *Hong Kong Sessional Papers*, Hong Kong, Noronha & Co., 1904–1905, 1908.
Figg, F. G., *Meteorological Observations Made at the Hong Kong Observatory in the Year 1908*, Hong Kong, Noronha & Co., 1909, pp. 1–2.
Figg, F. G., 'Report of the Director of the Observatory', for the years 1909–1911, *Hong Kong Administrative Reports* Appendix E, Hong Kong, Noronha & Co., 1910–1912.
Jeffries, C. W., 'Report of the Director of the Royal Observatory, Hong Kong', for the years 1932–1939, *Hong Kong Administrative Reports*, Appendix F, Hong Kong, Noronha & Co., 1933–1940.

To improve the time service, the Observatory adopted enhanced measures over time. In 1901, the time ball was replaced by a copper one lined with steel strings to reduce mechanical breakdowns. In 1904, to reduce errors in time measurement, the Observatory adopted Greenwich Mean Time as Hong Kong's standard time and maintained close liaison with Greenwich. Hong Kong is situated in the eighth time zone east of the meridian line. In 1908, to strengthen the connection between the time ball tower and the Observatory, the time ball which had been situated at the Marine Police Station in Tsim Sha Tsui since 1 January 1885 was moved to Signal Hill where the time ball could more readily be seen by passing ships. Starting from 1920, to increase the frequency of time reporting, the Observatory also used three white display lights to report time at night.

## Wireless Time Signal Service

Apart from the susceptibility to mechanical breakdowns when manipulating the dropping of the time ball, the scope of service provided by the time ball was also limited. For people or ships outside the visual range of Tsim Sha Tsui, it was impossible to take advantage of the time service. So the Observatory began to expand the scope of its time service in 1913. Starting from 14 November that year, time signals from the Observatory were broadcast at the Kowloon-Canton Railway terminus and Eastern Extension Telegraph Co. at 9.45 AM each day. In the same year, the government adopted the use of radio telegraphy for time reporting, a recommendation from the International Time Service Conference.[117] In 1914, the Observatory allocated sums to acquire various facilities for the wireless time signal service, making preparations for the active promotion of the wireless broadcast of time signals.[118] However, such a service was not introduced until 1 September 1918,[119] after numerous technical improvements. From 1918 to 1920, time signals were broadcast



| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1913 | 0.20 | 1 天 (大風) | – | – | – | – | 354 |
| 1914 | 0.19 | 1 天 (強風) | – | – | – | – | 362 |
| 1915 | 0.19 | 1 天 (強風) | – | – | – | – | 365 |
| 1916 | 0.14 | – | 6 天 | – | – | – | 359 |
| 1917 | 0.13 | – | 14 天 | – | – | – | 347 |
| 1918 | 0.14 | 1 天 (大風) | 1 天 | – | – | – | 353 |
| 1919 | 0.15 | 3 天 (大風) | 17 天 | – | – | – | 334 |
| 1920 | 0.18 | 8 次 (大風；失誤) | – | – | – | – | 651 |
| 1921 | 0.18 | 3 次 (大風) | – | – | – | – | 657 |
| 1922 | 0.13 | 4 次 (大風) | – | – | – | – | 653 |
| 1923 | 0.17 | 9 次 (烈風) | – | – | – | – | 658 |
| 1924 | 0.19 | 1 次 (大風) | – | – | – | – | 649 |
| 1925 | 0.15 | 2 次 (大風；雷暴) | – | – | – | – | 664 |
| 1926 | 0.12 | 4 次 (大風) | – | – | – | – | 655 |
| 1927 | 0.12 | 4 次 (大風) | – | – | – | 1 天 (電流短路) | 659 |
| 1928 | 0.12 | – | – | – | – | 196 天 (時間塔搬遷) | 365 |
| 1929 | 0.11 | 1 次 (烈風) | – | – | – | 2 次 (電流短路) | 658 |
| 1930 | 0.12 | – | – | – | – | 2 次 (電流短路) | 661 |
| 1931 | 0.11 | 3 次 (烈風) | – | – | – | 1 次 (電流短路) | 660 |
| 1932 | 不詳 | 2 次 (烈風) | – | – | – | 1 次 (電流短路) | 659 |

資料來源：
Claxton, T. F., 'Report of the Director of the Royal Observatory, Hong Kong', for the years 1912–1914, *Hong Kong Administrative Reports*, Appendix E, Hong Kong, Noronha & Co., 1913–1915.
Claxton, T. F., 'Report of the Director of the Royal Observatory, Hong Kong', for the years 1915–1931, *Hong Kong Administrative Reports*, Appendix F, Hong Kong, Noronha & Co., 1916–1932.
Doberck, W., *Observations and Researches Made at the Hong Kong Observatory in the Years 1886–1896,* Hong Kong, Noronha & Co., 1887–1897.
Doberck, W., 'Report of the Director of the Observatory', for the years 1891, 1898–1902, 1905–1906, *Hong Kong Sessional Papers*, Hong Kong, Noronha & Co., 1892, 1899–1903, 1906–1907.
Figg, F. G., 'Report of the Director of the Observatory', for the years 1903–1904, 1907, *Hong Kong Sessional Papers*, Hong Kong, Noronha & Co., 1904–1905, 1908.
Figg, F. G., *Meteorological Observations Made at the Hong Kong Observatory in the Year 1908*, Hong Kong, Noronha & Co., 1909, pp. 1–2.
Figg, F. G., 'Report of the Director of the Observatory', for the years 1909–1911, *Hong Kong Administrative Reports*, Appendix E, Hong Kong, Noronha & Co., 1910–1912.
Jeffries, C. W., 'Report of the Director of the Royal Observatory, Hong Kong', for the years 1932–1939, *Hong Kong Administrative Reports*, Appendix F, Hong Kong, Noronha & Co., 1933–1940.

為改良報時服務，天文台曾實施以下措施：1901年更換一銅製並配以鋼絃的時間球以減少機件故障；1904年採用格林威治時間，使香港列入距本初子午線以東的第 8 時區，與格林威治維持緊密聯繫，減少計時的誤差；1908年於訊號山興建一座更易為船隻遠眺的報時塔取代自1885年1月1日起使用的報時地點，即尖沙咀警署，加強報時塔與天文台的聯繫。1920年起天文台更於晚上使用三盞白燈作報時訊號，增加報時的頻率。

over the radio each day, between 11.56 AM and 12 noon and between 8.56 PM and 9 PM, at the 2nd, 28th, 50th, 52nd and 54th seconds.[120] From 1921, the time signal broadcasting times were changed to 10 AM and 9 PM each day.

Although the wireless time signal service had the advantages of covering a larger area, requiring less manpower to increase time service frequency, and resulting in fewer errors in broadcasting time signals when compared with the use of the time ball, this new mode of time service did not officially replace the time ball method until 1 July 1933.[121] There were two reasons for this. Firstly, in the initial stage, the transmission and reception system was unstable

*Fig. 3.32 The pendulum clock used by the Observatory from 1950 to 1966. Courtesy Hong Kong SAR Information Services Department*

*圖 3.32 天文台於 1950 至 1966 年使用的擺鐘。香港特別行政區政府新聞處檔案*



## 無線電報時服務

利用時間球報時，除在控制降球的機械操作上容易產生一定的技術故障外，所提供的服務範圍亦相當有限，在尖沙咀視程範圍以外的船隻或市民，根本無法透過時間球知道時間，因此在1913年天文台開始擴大報時範圍，是年11月14日起，九廣鐵路總站、大東電報局 (Eastern Extension Telegraph Co.) 均會於上午9時45分發佈自天文台接收到的報時訊號；同年政府接納國際報時研討會的建議，採用無線電報時。[117] 1914年天文台撥款添置多項有關無線電報時的設備，準備大力推行無線電報時，[118] 但使用電台報時的服務要到1918年9月1日經多番技術改良後，才能實施。[119] 1918至1920年無線電報時的廣播時間為每天的上午11時56分至正午12時及每天的晚上8時56分至9時之間，第2、28、50、52及54秒發出；[120] 1921年以後則改為上午10時及晚上9時播送。

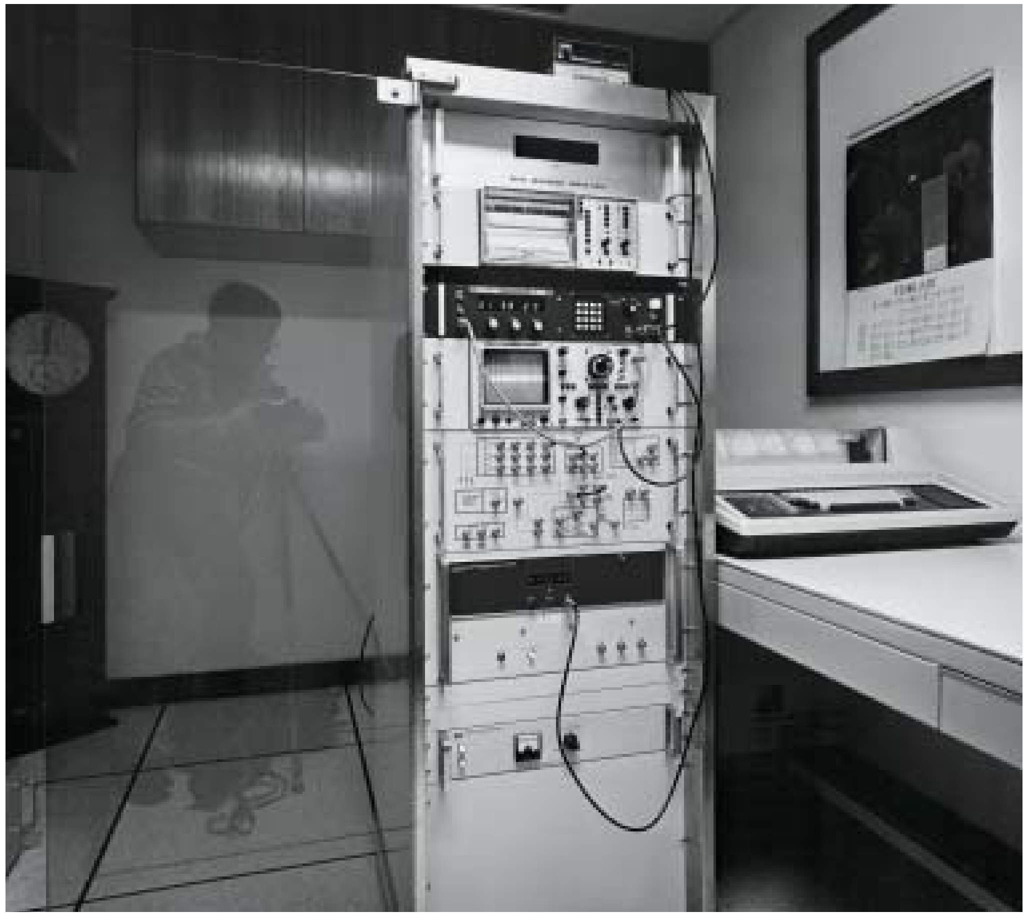


*Fig. 3.33 The Observatory's first caesium beam atomic clock acquired in 1980. Courtesy Hong Kong SAR Information Services Department*

*圖 3.33 天文台於 1980 年添置的首個銫原子鐘。香港特別行政區政府新聞處檔案*

due to interference of radio waves. In 1920, the Observatory moved the time service station built in 1918 at Cape d'Aguilar to Stonecutters Island. But on 31 March 1927, the station was relocated back to Cape d'Aguilar[122] and the radio time signal service was suspended.[123] Secondly, ships passing through or berthing in Hong Kong were used to the existing method of time service. The Observatory had to obtain consent from the affected users before it could discontinue the use of the time ball. After reaching a consensus with the Hong Kong General Chamber of Commerce and the British naval authorities on 1 July 1933, the Observatory terminated the time service based on the use of the time ball.[124]

## Differences Between Chinese and Western Time Services

Although the accuracy and frequency of the time service of the 1880s may be judged to be rather backward by today's standards, it was in fact a valuable new service to society at that time. Such a service was markedly different from the traditional Chinese methods of measuring and reporting time.

The earliest Chinese time measurement instrument was a ceramic seeping tray, such as the one unearthed from the Yangshao Village of the New Stone Age. This was believed to be the clepsydra (water clock) used in Huangdi's time, as described in ancient texts. *Tianwenzhi* (Records of the Celestial Phenomena) of *Suishu* (History of the Sui Dynasty) wrote that 'In the old days, Huangdi observed the water seeping phenomenon and invented the clepsydra to differentiate nights from days'.[125] According to *Louke jing* (Book of Clepsydra) published in the Liang Dynasty (AD 502–557), it recorded that the clepsydra was invented in the Huangdi's days, but was popularised in the Xia and Shang Dynasties (twenty-first century BC – eleventh century BC). These were accounts of the earliest timekeeping devices used by the Chinese. With the growing use of copper, copper clepsydras gradually replaced ceramic ones in the Xia and Shang Dynasties. The concept of using dripping water or funnelling sand to mark time was to keep track of the length of time. No reference was made to the relationship between the sun and the earth and observing their intervening distances and directions.



雖然使用無線電報時，覆蓋的地域範圍較時間球廣，增加報時頻率所需人手較少，而發放報時訊號的信息所產生的錯誤亦較報時球低，但是項報時方法要到1933年7月1日才正式完全取代時間球，[121] 可考的主要原因有二：在推行初期，技術上的困難相當多，如無線電電波受到干擾、無線電系統訊息的接收及放送不穩定、天文台的報時站多次被遷徙 —— 1920年將早在1918年於鶴咀設立的報時站遷往昂船洲，1927年3月31日又將報時站再次遷回鶴咀，[122] 天文台被迫中斷無線電報時服務；[123] 而另一方面，經港或留港船隻已習慣既有的報時方法，天文台必須徵得受影響的使用者同意，方能取消舊有報時方法；1933年7月1日在徵得香港總商會及英國海軍同意後，天文台正式宣佈停止使用時間球報時。[124]

## 中西方報時方法的差異

用今天的眼光去衡量1880年代測量時間方法的準確性及報時頻率的多寡，可能會覺得報時服務相當落後，但對當時的社會來說，卻已是一項嶄新的服務。而這種服務與古代中國的測時及報時方法並不盡同。

中國人最早量度時間的工具是一件陶質的漏盤，據考古發現屬新石器時期仰韶的出土文物，估計為古書中所說黃帝時的刻漏計時工具。根據《隋書•天文志》所載：「昔黃帝創觀漏水，制器取則，以分晝夜。」[125] 根據梁代 (公元502–557年)《漏刻經》記載：「漏刻之作，蓋肇於軒轅之日，宣乎夏商之代。」這是有關中國人最早使用的計時工具的記載。隨著銅器的廣泛應用，銅漏在夏商之際 (公元前21世紀 – 公元前11世紀) 逐漸取代陶製漏刻計時。按滴水或沙漏做記號的計時概念，目的在掌握時間的長短，並沒有利用地球與太陽的相互關係，觀察二者的距離及方向。

有關中國人最早觀測日影制定方向、時間的文獻記載可見甲骨文中關於「立中」的卜辭，而使用土圭測影計時，則最早見於《周禮》夏官司馬第四卷，「土方氏，掌土圭之灋法以致日景」，[126] 可說是中國人利用太陽方位推測地球時間較詳盡的記述。及後圭表再發展成日晷，即用日影方向指示時間，據近代考古發現最早的三具日晷為秦末漢初 (公元前221– 公元24年) 所使用的赤道式日晷。

由於觀測日影不便，利用蠟燭或於香上畫上刻度，是自宋代以後民間相當流行的計時方法，北宋 (公元960–1127年)的更香據說多至13種，按照不同的時間長度分五更香、十二時辰香及百刻香等。更香不著重香氣，只側重計時的準確性，故以易燃及燃燒速度均勻的香料為好。無論是用銅壺刻漏抑日晷或更香的計時方法，均顯示中國人很早就有測量時間的觀念，而且一套頗為完善的計時方法亦已建立。


*Fig. 3.34 The emperor appointing time-service officials. Cf. Liu Tuo, Meng Bai,* Qingdian banhua huikan, *Volume 15, p. 39.*

*圖 3.34 〈命官授時圖〉。參閱劉托、孟白，《清殿版畫匯刊》，卷十五，頁 39。*


*Fig. 3.35 An ancient clepsydra in lotus form. Cf. Chen Jiujin, Yang Yi,* Zhongguo gudai de tianwen yu lifa *(Ancient Chinese Astronomy and Calendar), Taiwan, Shangwu yinshuguan, 1993, p. 41.*

*圖 3.35 〈古製蓮漏圖〉。參閱陳久金、楊怡，《中國古代的天文與曆法》，台灣，商務印書館，1993 年，頁 41。*

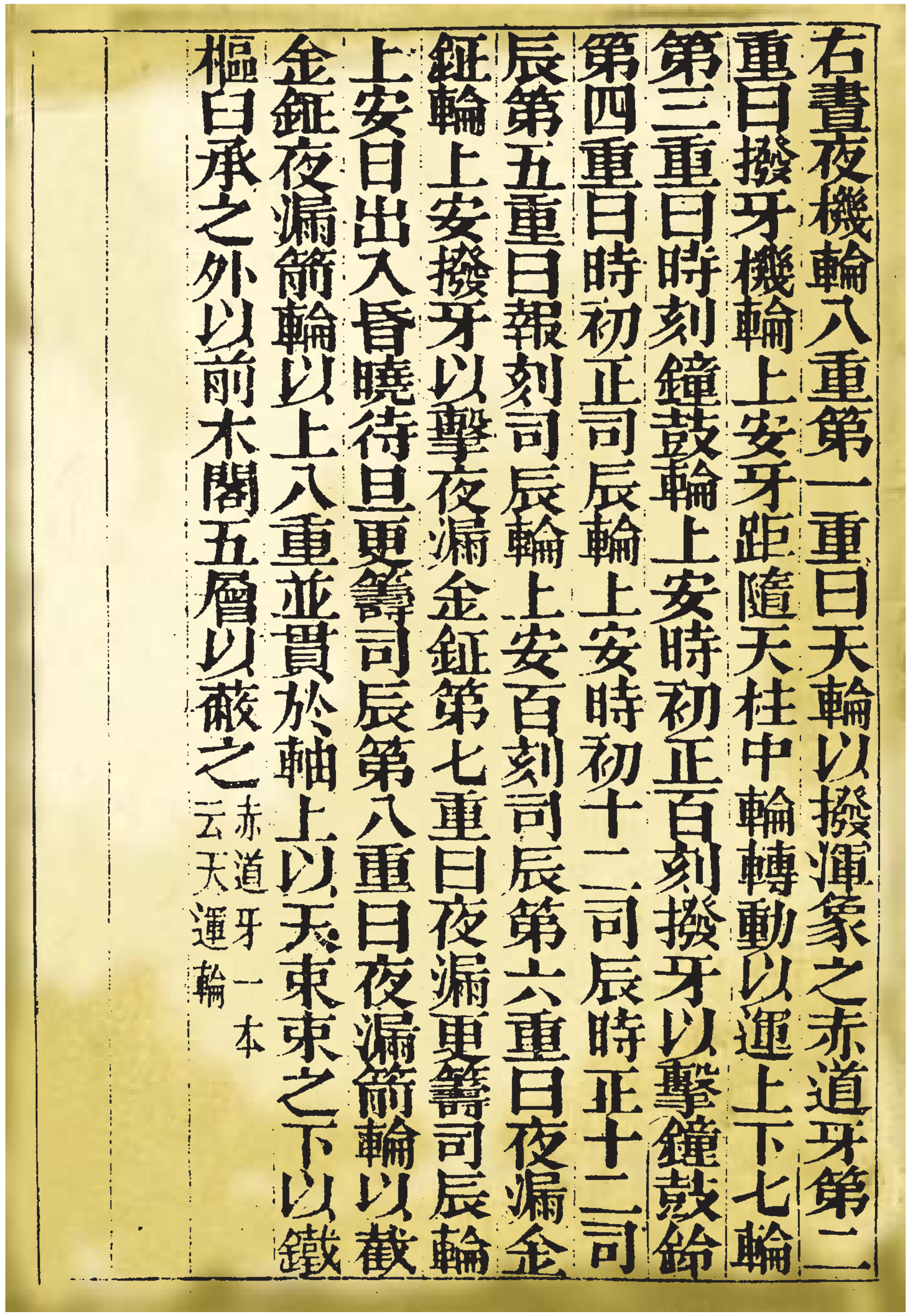

右晝夜機輪八重第一重曰天輪以撥渾象之赤道牙第二重曰撥牙機輪上安牙距隨天柱中輪轉動以運上下七輪第三重曰時刻鐘鼓輪上安時初正百刻撥牙以擊鐘鼓鈴第四重曰時初正司辰輪上安時初十二司辰時正十二司辰第五重曰報刻司辰輪上安百刻司辰第六重曰夜漏金鉦輪上安撥牙以擊夜漏金鉦第七重曰夜漏更籌司辰輪上安日出入昏曉待旦更籌司辰第八重曰夜漏箭輪以截金鉦夜漏箭輪以上八重並貫於軸上以天束束之下以鐵樞臼承之外以前木閣五層以蔽之（赤道牙一本云天運輪）

*Fig. 3.36 A mechanical time wheel. Cf. Su Song, Xin Yixiang fayao (Keys to New Planetarium), Taibei, Shangwu yinshuguan, 1969 reprint, Volume 2, p. 94.*

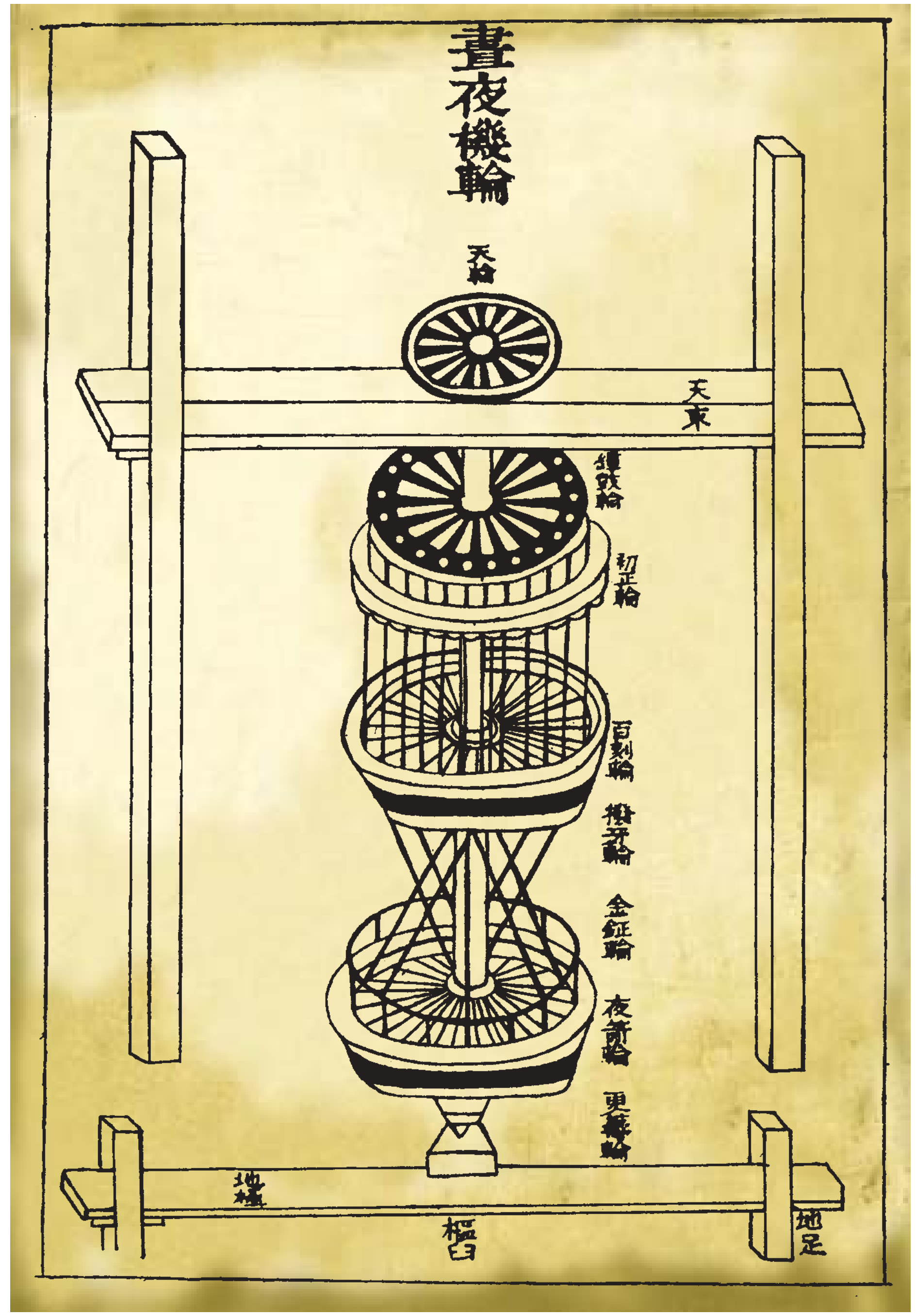



*圖 3.36 〈晝夜機輪〉。參閱蘇頌，《新儀象法要》，台北，商務印書館，1969 年重印，卷下，頁 94。*

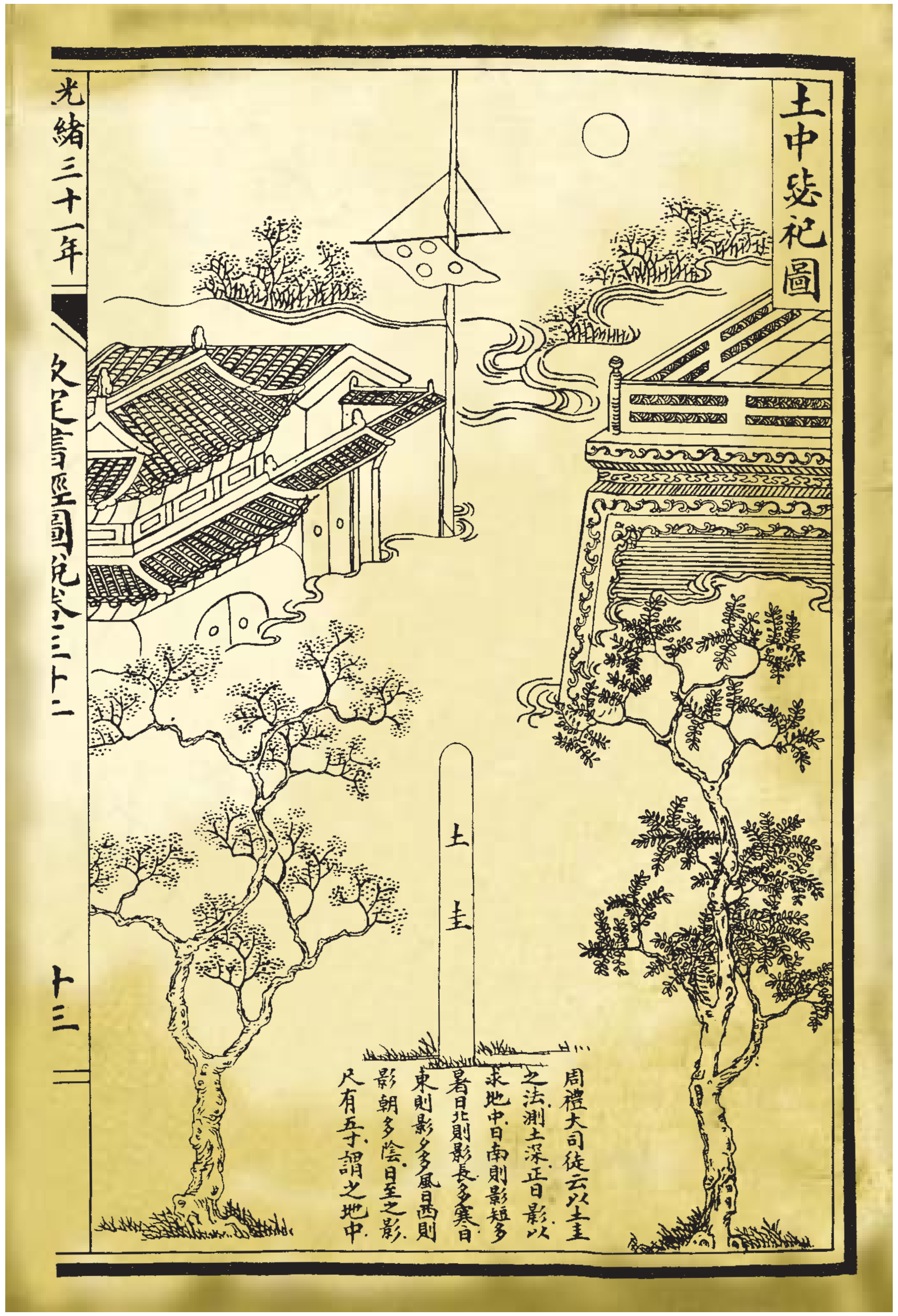



*Fig. 3.37 An ancient Chinese sundial used for measuring the length of the year and the 24 solar terms. Cf. Liu Tuo, Meng Bai,* Qingdian banhua huikan, *Volume 16, p. 567.*

*圖 3.37 〈土圭測影計時圖〉。參閱劉托、孟白，《清殿版畫匯刊》，卷十六，北京，學苑出版社，頁 567。*



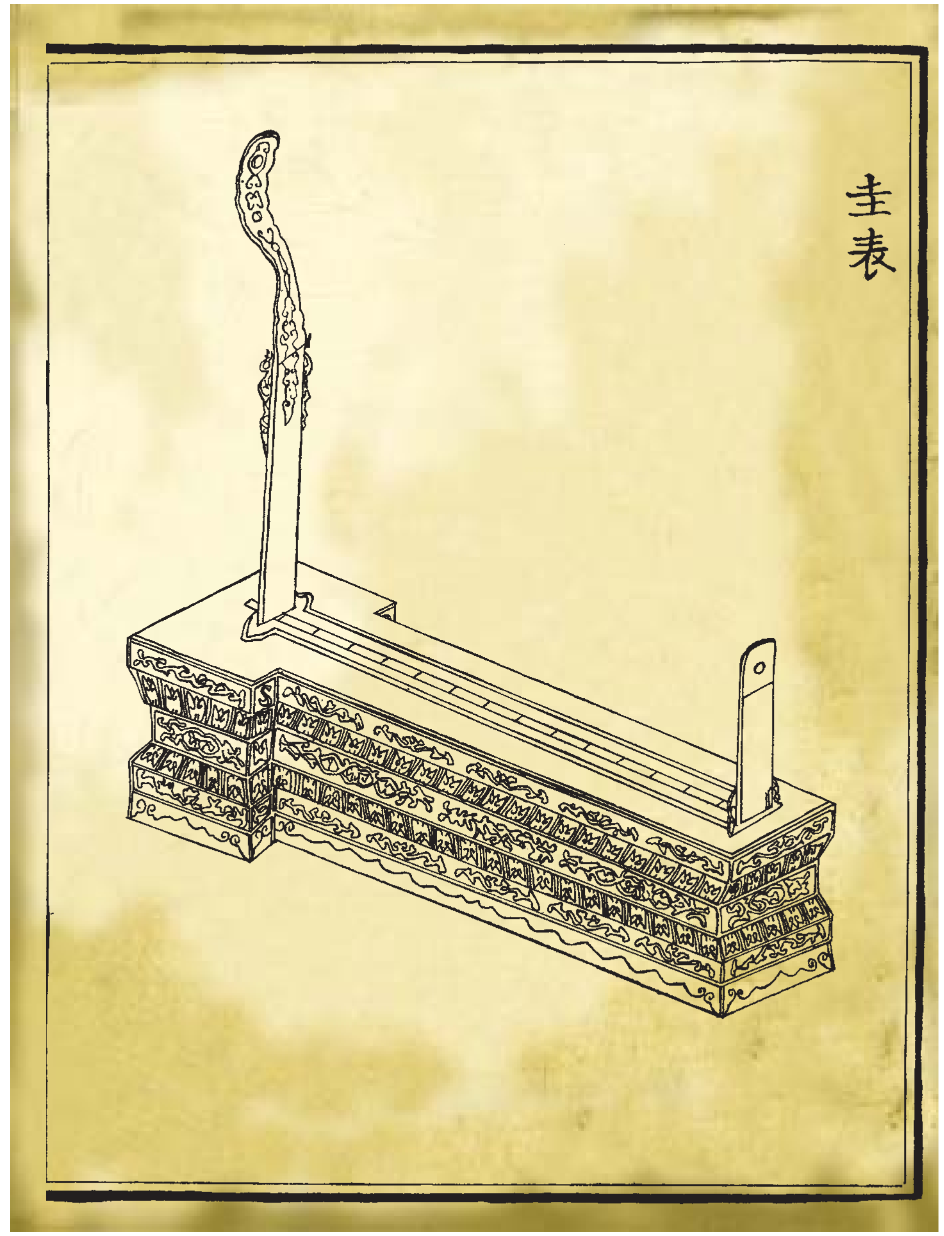



*Fig. 3.38 A sketch of an ancient Chinese sundial. Cf. Liu Tuo, Meng Bai,* Qingdian banhua huikan, *Volume 8, p. 260.*

*圖 3.38 〈圭表圖樣〉。參閱劉托、孟白，《清殿版畫匯刊》，卷八，北京，學苑出版社，頁 260。*

In connection with the earliest use of the sun's shadow to determine direction and time, the earliest document can be found in '*Lizhong*' (standing in the middle) of the oracular inscription collection (inscriptions on tortoise shells and animal bones). The use of the device *tugui* to measure the shadow of the sun in order to determine time was first seen in *Xiaguan sima*, Volume 4, of *Zhouli* (The Rites and Ceremomies of the Zhou Dynasty). This text mentions an official section called *tufangshi*. This section mastered the use of *tugui* to determine the shadow of the sun.[126] This was a more comprehensive description of how the Chinese made use of the sun's position to calculate the earth's time. Later *guibiao* (a type of sundial) evolved into *rigui*, using the direction of the sun's shadows to determine time. According to archaeological findings in modern times, the earliest three sets of sundials were the equatorial sundials used during the late Qin and early Han Dynasties (221 BC–AD 24 ).

As it was inconvenient to observe the sun's shadow, commoners used graduated candles or incense sticks from the Song Dynasty onwards. By the Bei Song Dynasty (AD 960–1127), there were at least 13 kinds of *geng* incense-sticks which catered for different lengths of time: five-*geng* incense-sticks (one *geng* stands for a two-hour period), 12-*geng* incense-sticks, and incense sticks that lasted for 25 hours. The incense stick was not chosen for its aroma, but for its accuracy in measuring time. Good incense material burns easily and at an even combustion rate. Regardless of the use of copper clepsydras, sundials or incense sticks, they all show that at a very early date, the Chinese already had the notion of time determination, and had established a fairly accurate system to carry out such a task.

The traditional Chinese time service method was completely different from that used in the late nineteenth century by the Hong Kong government. According to *Xiaguan sima*, Volume 4, of *Zhouli*, clepsydras were used during military operations and funeral ceremonies, and a receptacle was employed to hold the dripping water. An attendant was required as the clepsydra had to be heated in winter to ensure the smooth flow of water.[127] Clepsydras were used to determine time and the time message was then spread around by drum-beating. After Han Wei (206 BC–AD 265), the period from 3 AM to 1 PM was divided into five *geng*. The first *geng* (3 AM–5 AM) was reported by beating the drum once, twice for the second *geng* and so on. This was the earliest record of the use of geng-drums to report time during the night.[128] In the Liang Dynasty (AD 502–557), after the time was determined by a clepsydra, the attendant would pass out bamboo strips to the messenger who would then throw them onto stone steps to make noise, so as to attract people's attention


*Fig. 3.39 The ancient Chinese sundial kept at the Imperial Palace, Beijing. Courtesy Hong Kong Science Museum*

*圖 3.39 現仍保存於北京故宮的日晷。香港科學館館藏*

to the time.[129] In the Tang Dynasty, bells and drums were used. In the book *Tanghuiyao*, Volume 71, it recorded that time service by bells and drums were required to be performed in accordance with the scheduled readings of the clepsydra and not otherwise.[130] In the Song Dynasty (AD 960–1279), while *Taizu* (the founder) was troubled by the noise of *geng*-drums at night and replaced them with iron inverted bells, sound remained the medium adopted for time service. The use of sound to tell time continued to be used in the Yuan Dynasty (AD 1271–1368) by the beating of the drums and the bell.[131] In the Ming Dynasty (AD 1368–1644), a *geng*-drum room was established to perform a time service. Each night, five soldiers took turns and went up the *Xuanwumen* building to report time by beating the drums. It started from the third *dian* of the first *geng* to the third *dian* of the fifth *geng*. A rattan stick was used to beat the drum to report the *geng*, with the stroke numbers matching the numbering of the *geng*. A sandal wood hammer was used to report the *dian*.[132] In the Qing Dynasty (AD 1644–1911), the drum was also used for security purpose, with the person beating the drum also performing the role of a night watchman.[133] The accuracy of using clepsydras and incense sticks to determine time could be adversely affected by the quality of instruments used. The timekeeper had to first examine the markings on the clepsydra or incense stick with the naked eye and then make the report, raising the possibility of delay. The use of different instruments for measuring and reporting time would also compromise the accuracy of the time signal transmitted.

As for sundials, they were not used widely among the people, as they were very complicated and their performances were susceptible to weather conditions. They were also beyond the means of most people. Thus, they were only used by the government for meteorological observations. When comparing the time ball system used in 1885 by the Observatory with the traditional Chinese timekeeping instruments and time service, the time ball was far more accurate and reached more people. The accurate time service rendered by the time ball not only assisted ocean-going vessels to determine their longitudinal positions, but it also standardised the city's time. Individuals, commerce and industry all referred to the time based on the Observatory's clock to co-ordinate their daily activities. Hong Kong gradually transformed itself from an agricultural society into an industrial and commercial one that strived for economic efficiency.





中國古代的報時方法卻與十九世紀末香港政府所施行的報時方法完全迥異。據《周禮》卷七夏官司馬第四所載：「凡軍事，懸壺以序聚檯。凡喪，懸壺以代器者，皆以水火守之，分以日夜，及冬，則以火爨鼎水而沸之，而沃之。」[127] 用刻漏審時，並擊鼓報時，傳令四方。漢魏以後 (公元前 206– 公元 265 年)，自寅時至午時的五個時辰，分為五更，每更鼓聲逐漸遞增，一更一鼓、二更二鼓、三更三鼓、四更四鼓、五更五鼓，是晚上用更鼓報時的最早記載。[128] 梁朝 (公元 502–557年) 時曾用竹籤報更，但傳遞消息仍靠聲音去辨別：「每雞[更]人伺漏，傳更籤於殿中，乃敕送者必投籤於階石之上，令鎗[鏘]然有聲，云『吾雖眠，亦令驚覺也』。」[129] 及至唐代報更主要用鐘鼓：《唐會要》卷七十一：「諸街鐘鼓比來依漏刻發聲，從朝堂發遠處，每至夜纔到，伏望今日以後減常或一刻發聲，庶絕違犯，敕旨依奏。」[130] 宋代 (公元 960–1279 年) 曾因宋太祖以鼓警寢改以鐵磬作更鼓，改變報時工具，但聲音仍為報時媒介。元朝 (公元 1271–1368 年) 置鐘鼓更漏，令早晏有節。[131] 明朝 (公元 1368–1644 年) 設有更鼓房，「軍隊每夜五名輪流上玄武門樓打更，每夜自一更三點起至五更三點止，按數目用籐條擊鼓，用檀木梆頭擊點」[132] 及至清朝 (公元 1644–1911 年) 亦有使用更鼓防守的記載：「儆夜嚴更鼓慎巡防。」[133] 利用壺漏、更香觀測時間，可因量度器材的質素影響量度的準確性，報時者憑肉眼觀察銅壺刻度或更香刻度，作出相應的報導，中間經過轉折，有耽誤時間的可能；量度時間的工具與報時工具的分開使用，對訊息傳遞的準確性會有一定的影響。

至於日晷測影計時，在民間並未被普遍應用，因其本身易受天氣阻礙運行機制，且儀器亦相當複雜，一般人未必有能力購置，故只為官方作天文觀測之用。如將中國古代測量時間的儀器及所應用的報時方法與 1885 年天文台所實行的報時比較，報時球報時較中國傳統方法準確及影響力亦較廣泛，時間球所報導的準確時間，不但可協助遠洋輪船釐定本身所處的經度，亦使全城的時間統一，無論是個人抑工商業機構，均可參考天文台的時鐘統一日常生活的節奏，使香港逐漸從農業社會步入講求經濟效率的工商業社會。

# Aviation Centre of the Asia-Pacific Region

In 1920, while on holiday leave, the Director of the Observatory proposed to the British aviation authorities that upper air measurements be carried out in Hong Kong to facilitate aviation business. He also visited various aviation research centres, including the Benson Observatory, the South Farnborough Observatory and the London Observatory, to familiarise himself with the details of implementing upper air meteorological observations. After his return, he applied for government funds to acquire some upper air measurement instruments for meteorological observations.[134] Unfortunately, his application was turned down by the government. The upper echelons of the government thought that the air route between Japan and Australia had yet to be opened up and Hong Kong could not become a major aviation transit centre. The Observatory should therefore continue to treat conventional surface meteorological services as its major duties. The Director's application for additional manpower for upper air meteorological observation work was likewise turned down.[135]

## Upper Air Pilot Balloon Sounding

Despite the government's meagre support in the development of upper air meteorological observations, the Director still managed to acquire some instruments for upper air meteorological sounding. These instruments arrived in Hong Kong on 21 September 1921. They included two sets of theodolites, upper air pilot balloons, slide rules, hydrogen, etc. With this modest set-up, the Observatory began its upper air meteorological observation work in 1921. Upper air sounding using hydrogen pilot balloons was performed in two places. They were the Observatory headquarters and Signal Hill, both in Kowloon. The main purpose of the sounding was to measure the upper air wind speed and direction. The altitude of the ascending balloon was recorded by a theodolite. However, the accuracy of the altitude reading obtained by only one theodolite was questionable.[136] Also, limited by technical factors, balloons launched in the early days could only reach an altitude of around 2,000 feet. Although the maximum height was later increased to 5,000 feet, the observation results remained unsatisfactory.[137] In the 1920 to 1930 period, upper air soundings could not be carried out in adverse weather, such as the typhoon or rainy season. According to the reports of the Observatory, there were between



# 亞太地區的航空中心

1920年天文台台長已開始醞釀高空氣象探測的構思，台長於休假期間曾向英國航空部門建議在香港推行高空氣象探測，以協助本港的航空業務。天文台台長並親自往訪各航空研究所，包括本遜氣象所 (Benson Observatory)、南泛盧堡氣象所 (South Farnborough Observatory) 及倫敦氣象所 (London Observatory)，了解實施高空氣象探測的細則。回港後，天文台台長向政府申請購置一批高空觀測儀器，以方便進行高空氣象觀測。[134] 可惜建議並未獲政府當局批准，主要原因是政府高層認為日本至澳洲間的航道尚未開發，香港實難以成為航線間的重要中轉站，故天文台仍應以一般地面氣象服務為工作重點，而天文台台長要求增添人手進行高空氣象觀測的建議亦因此被拒絕。[135]

## 氣球探測

雖然政府高層並沒有大力支持高空氣象觀測的發展，但天文台台長仍按照原定計劃，購置了部份高空氣象探測儀器，該批於1921年9月21日運抵本港的儀器，包括兩套經緯儀 (theodolites)、高空探測氣球、計算尺和氫氣等。高空氣象探測遂於1921年開展了。利用氫氣球進行高空探測的地點有兩個，一為尖沙咀天文台總部，另一為九龍訊號山。主要是量度高空的風速與風向，而氫氣球升空的高度則借助經緯儀記錄。單靠一部經緯儀去量度氣球升空的正確高度，準確程度是值得懷疑的，[136] 加上技術水平所限，氣球最初只能升空2,000多呎，後來氣球可升到5,000呎高空，但探測的結果卻始終未如理想。[137] 1920至1930年代，在天氣情況惡劣的時候，如颱風季節、雨季時，高空氣球探測工作均無法進行。根據天文台的工作年報記載，1920年代利用氣球升空作高空探測每年最少有11次，最多達82次，平均每年約46次。氣球升空監測，在1929年逐漸改善，最高升空高度可達6,400多呎。高空探測在1931年有了較長足的進展，透過高空探測的資料，當局製成溫熵圖 (tephigrams)，幫助預測天氣，而同年美國華盛頓氣象局每月均有發佈有關香港上空750、1,500及3,000公尺高空的風向資料。

11 and 82 soundings every year in the 1920s, with an average of 46 times per year. Upper air soundings were improved in 1929 with the pilot balloons reaching a maximum height of over 6,400 feet.

Significant progress was achieved in upper air meteorological observations in 1931. Making use of the data gathered through upper air soundings, the Observatory was able to compile tephigrams, which were very useful in weather forecasting. In the same year, the Washington Meteorological Agency released monthly data on Hong Kong's wind directions at heights of 750 metres, 1,500 metres and 3,000 metres.

## Upper Air Aircraft Sounding

Although the upper air meteorological observations commencing in 1921 did not receive much attention from the government, the Observatory, with the support of RAF pilots and other foreign aviators, was able to carry out upper air meteorological measurements using aircraft. By 1928, the number of upper air observations made by aircraft exceeded the figure obtained by pilot balloons. Moreover, the maximum height reached by aircraft was 19,000 feet, which was almost three times higher than the 6,400 feet achieved by pilot balloons.

**Table 3.5** Survey of Upper Air Meteorological Observations (1921–1940)

| Date | Upper Air Pilot Balloon Meteorological Observations | | Aircraft Observations | |
|---|---|---|---|---|
| | Number of Flights | Flight Nature | Number of Flights | Flight Nature |
| 10 Jun–21 Sep 1921 | 19 | First uses of upper air pilot balloons. The longest flight lasted 70 minutes. | – | – |
| 1922 | 40 | – | – | – |
| 1923 | 49 | – | – | – |
| 1924 | 49 | – | First surveys by aircraft flights. The number of flights carried out was not known. | |
| 1925 | 40 | The longest time balloon remained airborne was 131 minutes | – | – |
| 1926 | 35 | – | 21 | In general 500 feet was used as an interval. The maximum flight height was 15,000 feet. |
| 1927 | 11 | – | 18 | The maximum flight height was 14,400 feet. |
| 1928 | 64 | – | 71 | A height of 19,000 feet was reached within 109 minutes. |





*Fig. 3.40 A sounding balloon sent out with wireless meteorological instruments. Photograph taken on 5 June 1981 at the King's Park Meteorological Station. Courtesy Hong Kong SAR Information Services Department*

圖 3.40 汽球將一無線電探空儀送上高。1981年6月5日攝於九龍京士柏氣象站。香港特別行政區政府新聞處檔案

| | | | | |
|---|---|---|---|---|
| 1929 | 82 | The highest height reached was 6,469 feet. | 4 | – |
| 1930 | 325 | – | 34 | – |
| 1931 | 356 | – | 33 | – |
| 1932 | 343 | – | NA | – |
| 1933 | 415 | – | – | – |
| 1934 | 400 | – | – | – |
| 1935 | 419 | – | – | – |
| 1936 | 479 | – | – | – |
| 1937 | – | – | – | – |
| 1938 | 667 | – | – | – |
| 8 Sep 1938– 31 Mar 1939 | – | – | 93 | – |
| 1 Apr 1939– Mar 1940 | – | – | 269 | – |

Sources:
Claxton, T. F., 'Report of the Director of the Royal Observatory, Hong Kong', for the years 1921–1931, *Hong Kong Administrative Reports*, Appendix F, Hong Kong, Noronha & Co., 1922–1932.
Jeffries, C. W., 'Report of the Director of the Royal Observatory, Hong Kong', for the years 1932–1939, *Hong Kong Administrative Reports*, Appendix F, Hong Kong, Noronha & Co., 1933–1940.

Upper air soundings carried out by aircraft was suspended in 1933 due to manpower shortage and lack of sufficient support from the government. It was not until 1936 that the upper air meteorological service of the Observatory began to show its importance, when daily weather summary charts on the Far Eastern region and the hourly meteorological reports were sent directly to Kai Tak airport and Imperial Airways. The Observatory also prepared flight path meteorological charts for the pilots of Imperial Airways.[138]

In 1938, the Far Eastern Flying Training School began to provide the Observatory with upper air temperature and relative humidity data. These data were manifested in charts and distributed every hour through the Q-code to all incoming aircraft.[139] In 1939, funding was finally provided for making daily upper air temperature and humidity soundings. During that year, aircraft made a total of 269 upper air measurements and the total cost for carrying out such upper air observations was HK$13,269, equivalent to 12% of the total expenditure of the Observatory of HK$110,373.[140]

Eighteen years had gone by before the upper air meteorological observations, which started unofficially in 1921, finally received government funding in 1939. In the 1920s, the viability of such a service was seriously questioned. Fortunately, with the rapid development of the aviation industry, the importance of the 18 years of preparatory work became much more tangible. The upper air meteorological information provided by the




*Fig. 3.41 Another type of sounding balloon. Courtesy Hong Kong SAR Information Services Department*

*圖 3.41 利用高空汽球將無線電探空儀送上高空的另一種方法。香港特別行政區政府新聞處檔案*

## 飛機探測

始於 1921 年的高空氣象服務雖然一直未受到政府當局重視，但卻不斷發展。1926年天文台除利用氣球進行高空氣象觀測外，更徵得皇家飛行隊隊員及外國飛行員協助，利用飛機進行高空探測。1928 年飛機高空探測工作的次數比氣球高空探測更多，而飛機升空的高度最高可達19,000呎，是氣球6,400呎升空的紀錄的 3 倍。

Observatory was indispensable to busy air traffic. Besides being a hub for sea traffic, Hong Kong had also evolved into an aviation centre of the Asia-Pacific region.

# Earthquake Monitoring

## Establishment of the Seismological Section

In Hong Kong, earthquake monitoring started in September 1921. As early as 1917, the Director of the Observatory had plans to install seismological instruments. On 20 August 1917, Director T. F. Claxton wrote to Professor H. H. Turner, Chairman of the Seismological Committee of the British Association for the Advancement of Science, and enquired about information on seismological instruments. He also applied to the government for a sum of £150 for instrument acquisitions.[141] His application was eventually rejected by the government. On 13 to 14 February 1918, a series of tremors hit the city of Shantou in Guangdong province. In Hong Kong, the tremor damaged some houses and its intensity was estimated to be VI on the Rossi-Forel scale. Without seismological instruments, the Observatory had to seek information about the earthquake from the neighbouring regions such as Manila, Taihoku (today's Taipei) and the Xujiahui Observatory of Shanghai.[142] This earthquake provided fresh impetus for realising the proposal by the Director of the Observatory made a year ago to acquire seismological instruments for earthquake monitoring.

Before the Second World War, the Observatory's earthquake monitoring service had close links with the Seismological Committee of the British Association for the Advancement of Science. The Director relied on the advice of Professor H. H. Turner with regard to the purchase of instruments, their proper operation and the storage of data. In 1920, while taking his annual leave, the Director visited Professor Turner in England and conferred with him on the procurement details of the Milne-Shaw seismograph.[143] In the following year, the Director also discussed with Professor Turner on the operation of the seismograph and sent the draft earthquake monitoring report to the Seismological Committee of the British Association for the Advancement of Science. From the earthquake data gathered, the Observatory also published the *Earthquake Monthly Newsletter*. In 1923, the Director again sought Professor





**表 3.5** 香港高空氣象觀測概況 (1921–1940 年)

| 日期 | 高空氣球觀測 | | 飛機探測 | |
|---|---|---|---|---|
| | 升空次數 | 升空概況 | 次數 | 最高高度 |
| 1921 年 6 月 10 日 – 9 月 21 日 | 19 | 首次使用高空氣球探測，最長升空時間為 70 分鐘 | – | – |
| 1922 | 40 | – | – | – |
| 1923 | 49 | – | – | – |
| 1924 | 49 | – | 首次使用飛機探測次數不詳 | – |
| 1925 | 40 | 最長升空時間為 131 分鐘 | – | – |
| 1926 | 35 | – | 21 | 通常以 500 呎為一分段，最高飛行高度達 15,000 呎 |
| 1927 | 11 | – | 18 | 最高飛行高度達 14,400 呎 |
| 1928 | 64 | – | 71 | 109 分鐘內最高飛行高度達 19,000 呎 |
| 1929 | 82 | 最高升空高度為 6,469 呎 | 4 | – |
| 1930 | 325 | – | 34 | – |
| 1931 | 356 | – | 33 | – |
| 1932 | 343 | – | 次數不詳 | – |
| 1933 | 415 | – | – | – |
| 1934 | 400 | – | – | – |
| 1935 | 419 | – | – | – |
| 1936 | 479 | – | – | – |
| 1937 | – | – | – | – |
| 1938 | 667 | – | – | – |
| 1938 年 9 月 8 日 – 1939 年 3 月 31 日 | – | – | 93 | – |
| 1939 年 4 月 1 – 1940 年 3 月 | – | – | 269 | – |

資料來源：

Claxton, T. F., 'Report of the Director of the Royal Observatory, Hong Kong', for the years 1921–1931, *Hong Kong Administrative Reports*, Appendix F, Hong Kong, Noronha & Co., 1922–1932.

Jeffries, C. W., 'Report of the Director of the Royal Observatory, Hong Kong', for the years 1932–1939, *Hong Kong Administrative Reports*, Appendix F, Hong Kong, Noronha & Co., 1933–1940.

利用飛機進行高空探測的工作，在天文台人手短缺及政府當局並未大力支持的情況下，1933年被迫暫時終止。1936年，天文台每天製作遠東地區天氣概要圖及每小時的氣象報告，直接送往啟德機場及帝國航空公司，並為該航空公司機師準備飛行路線氣象報告圖，高空氣象服務才開始發揮其效用。[138]

Turner's advice on the acquisition of a second set of seismograph and the building of an underground cellar for placing the seismographs. These, among other things, demonstrated the strong ties between the Observatory and the Seismological Committee of the British Association for the Advancement of Science.

Since the commencement of earthquake monitoring in 1921, Hong Kong has registered earthquakes every year, as detailed in Table 3.6.

**Table 3.6** Earth Tremor Records (1921–1939)

| Year | Number of Recorded Earth Tremors | Number of Locally Felt Earth Tremors |
|---|---|---|
| 26 Sep–31 Dec 1921 | 37 | Five minor tremors was recorded |
| 1922 | 144 | – |
| 1923 | 141 | – |
| 1924 | 149 | On 10 January one light tremor was registered at 10.45 PM |
| 1925 | 159 | – |
| 1926 | 210 | 18 minor tremors were recorded on 5–6 August; another 6 on 7–8 August; and 4 on 16 August |
| 1927 | 202 | On 23 May, a major earthquake was recorded, which was even stronger than the one recorded in Japan on 31 August–1 September 1923 |
| 1928 | 183 | On 29 January, one earthquake with its epicentre 2,500 km away was experienced at 10:58:38 AM |
| 1929 | 252 | – |
| 1930 | 320 | – |
| 1931 | 386 | On 21 September, an earthquake was registered with its epicentre 60 miles (97 km) east of Hong Kong |
| 1932 | 430 | – |
| 1933 | 356 | – |
| 1934 | 353 | – |
| 1935 | 475 | – |
| 1936 | 342 | – |
| 1937 | 398 | – |
| 1938 | 372 | – |
| 1939 | 285 | – |

Sources:
Claxton, T. F., 'Report of the Director of the Royal Observatory, Hong Kong', for the years 1921–1931, *Hong Kong Administrative Reports*, Appendix F, Hong Kong, Noronha & Co., 1922–1932.
Jeffries, C. W., 'Report of the Director of the Royal Observatory, Hong Kong', for the years 1932–1939, *Hong Kong Administrative Reports*, Appendix F, Hong Kong, Noronha & Co., 1933–1940.

As Hong Kong is not situated within a seismic belt, destructive earthquakes that pose a direct threat to Hong Kong are very rare. Thus, the monitoring of earthquakes made very little contribution to the meteorological development in Hong Kong.





1938年遠東飛行訓練學校人員開始向天文台提供高空氣溫及相對濕度的資料，由天文台製成圖表，而每小時的氣象報告透過Q電碼發佈給入境的飛機。[139] 1939年當局才正式撥款資助每日一次的高空氣溫及相對濕度探測，同年飛機高空探測次數多至269次，是年高空氣象觀測費用高達13,269港元，佔天文台是年總支出 110,373 港元的 12%。[140]

高空氣象探測從 1921 年展開非正式的任務，至 1939 年正式獲香港政府撥款資助，歷時18年。在1920年代，高空探測的存在價值一直被質疑，幸而這18年的籌備工作在航空業務日趨發達後，日漸凸顯其重要性，而天文台對高空氣象觀測的資訊是繁忙的空中交通必不可少的服務，使香港不但在海上，同時亦在空中成為亞洲太平洋地區的交通樞紐。

# 地震監測

## 部門的成立

香港的地震探測工作最早始於 1921 年 9 月，原來早在 1917 年香港天文台台長已有設置地震探測儀的計劃。在1917年8月20日，當時的天文台台長卡勒士頓 (T. F. Claxton) 去信英國牛津地震學會會長端納 (H. H. Turner) ，查詢有關地震儀的資料，並準備向政府申請 150 英鎊作購置儀器之用，[141] 但未獲當局批准。1918 年 2 月 13 至 14 日廣東省汕頭市發生大地震，香港也感受到羅西 • 佛瑞爾 (Rossi-Forel) 第六度的震動，部分房屋遭到破壞，由於沒有量度地震的儀器，天文台只好向鄰近城市馬尼拉、台北 (Taihoku) 及上海的徐家匯天文台，查詢有關地震的資料。[142] 是次地震，可說促成了天文台台長實踐他在 1917 年的願望。

第二次大戰前，天文台一直與英國牛津地震學會緊密聯繫，進行地震的探測工作。從地震儀器的購置、使用以至資料的保存，天文台台長均依賴牛津的端納教授。 1920 年，台長趁年休往訪端納教授，徵詢訂購米爾恩 • 肖式地震儀 (Milne-Shaw seismograph) 的詳情。[143] 1921 年，台長向端納教授查詢有關儀器的使用方法，並將香港的地震測量報告原稿寄往英國地震學會，香港也按照錄得的資料印行《地震月報》。 1923 年台長再就增添第二部地震儀及於天文台總部設置地下室安放地震儀等事宜，向端納教授請教，可見當時香港天文台與牛津地震學會有相當緊密的合作關係。

*Fig. 3.42 The seismographs are protected at constant temperature and humidity within a double-walled cellar built in 1923. Courtesy Hong Kong SAR Information Services Department*

*圖 3.42 天文台於 1923 年以密封地下室安放地震探測的儀器，免受外界氣溫及濕度影響。香港特別行政區政府新聞處檔案*

*Fig. 3.43 Seismographs housed inside the double-walled cellar. Courtesy Hong Kong SAR Information Services Department*

*圖 3.43 地下室的地震探測儀。香港特別行政區政府新聞處檔案*



*Fig. 3.44 Seismographs housed inside the Observatory's seismological laboratory. Courtesy Hong Kong SAR Information Services Department*

*圖 3.44 天文台地震部的地震紀錄儀。香港特別行政區政府新聞處檔案*

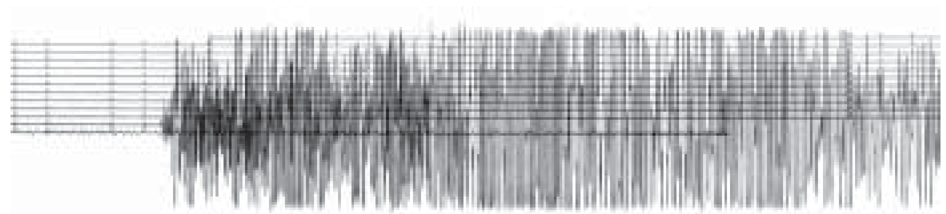


*Fig. 3.45 A seismogram recording an earthquake in Taiwan of magnitude 6.5 on the Richter Scale on 16 September 1994. Courtesy Hong Kong Observatory*

*圖 3.45 1994 年 9 月 16 日的地震圖記錄了在台灣發生的一次震級達黎克特制 6.5 級的地震。香港天文台檔案*

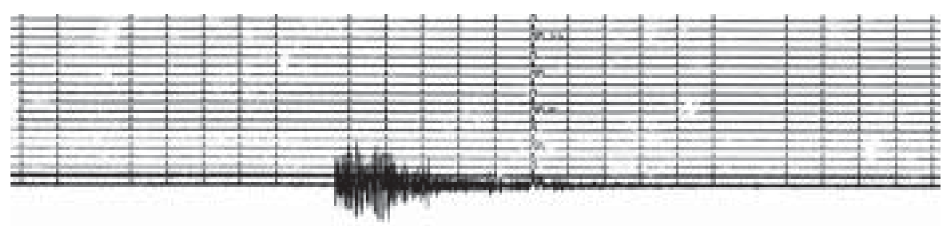


*Fig. 3.46 A seismogram showing a minor local earthquake near the east coast of Lantau Island on 11 May 1995. Courtesy Hong Kong Observatory*

*圖 3.46 1995 年 5 月 11 日的地震圖記錄了在香港大嶼山東岸附近發生的一次輕微地震。香港天文台檔案*

## Enhancing Exchange With the International Community

The setting up of a seismological service enabled Hong Kong to establish closer relationships with other meteorological organisations in other parts of the world. Since the publication of the *Earthquake Monthly Newsletter* by the Observatory in 1921, other regions have used these earthquake records as important reference material. Organisations that had exchanged seismological data with Hong Kong included Geodetic Institute of Copenhagen in Denmark; Carnegie Institution of Washington, Oxford International Earthquake Society, Saint Louis University of Missouri and Santa Clara University of California in the US; the Weather Bureau of Manila in the Philippines; Tokyo Imperial University in Japan; the Dominion Observatory of Wellington in New Zealand; the Taihe Geological Survey Station of Jiangxi and Academia Sinica of Nanjing in China; and the Regional Meteorological Centre in Bombay, India.[144] The exchange of data with earthquake monitoring centres all over the world has helped Hong Kong gain a better understanding of the seismological observation work of other places, as well as making Hong Kong an important centre for the dissemination of seismological data.

# Trials of War

On 25 December 1941, Hong Kong fell into enemy hands and the whole city was paralysed. The Observatory was forced to suspend its normal meteorological observation service. With the dedication of a few imprisoned employees, the Observatory was able to maintain, on and off, part of its work during the Japanese occupation between December 1941 and August 1945. Although the wartime records were unable to fulfill all the fundamental requirements of comprehensive meteorological observations, these meteorological data, obtained with very restricted manpower and resources, were in fact relatively systematic reports of that contemporary period. They are indispensable for meteorological research on the wartime period.[145]

These wartime meteorological data included information on rainfall, temperature, atmospheric pressure, wind directions, relative humidity and general observations on weather conditions. While summaries of weather conditions were recorded from January 1942 to December 1944, other meteorological information was recorded in the period from June 1942 to



自地震監測在1921年開始實施以來，本港每年均有錄得地震紀錄，其詳細情況如表 3.6 。

**表 3.6** 香港天文台 1921 至 1939 年地震紀錄

| 年份 | 錄得地震總數 | 本港錄得有感地震次數 |
|---|---|---|
| 1921 年 9 月 26 日 – 12 月 31 日 | 37 | 錄得輕微地震 5 次 |
| 1922 | 144 | – |
| 1923 | 141 | – |
| 1924 | 149 | 1 月 10 日晚上 10 時 45 分錄得 1 次輕微地震 |
| 1925 | 159 | – |
| 1926 | 210 | 8 月 5 至 6 日錄得 18 次輕微地震；8 月 7 至 8 日 6 次; 8 月 16 日 4 次 |
| 1927 | 202 | 5 月 23 日錄得強烈地震震幅範圍較日本 1923 年 8 月 31 至 9 月 1 日大 |
| 1928 | 183 | 1 月 29 日上午 10 時 58 分 38 秒錄得 1 次地震, 震央離本港 2,500 公里 |
| 1929 | 252 | – |
| 1930 | 320 | – |
| 1931 | 386 | 9 月 21 日錄得 1 次地震, 震央離本港東面 60 哩 (97 公里) |
| 1932 | 430 | – |
| 1933 | 356 | – |
| 1934 | 353 | – |
| 1935 | 475 | – |
| 1936 | 342 | – |
| 1937 | 398 | – |
| 1938 | 372 | – |
| 1939 | 285 | – |

資料來源：
Claxton, T. F., 'Report of the Director of the Royal Observatory, Hong Kong', for the years 1921–1931, *Hong Kong Administrative Reports*, Appendix F, Hong Kong, Noronha & Co., 1922–1932.
Jeffries, C. W., 'Report of the Director of the Royal Observatory, Hong Kong', for the years 1932–1939, *Hong Kong Administrative Reports*, Appendix F, Hong Kong, Noronha & Co., 1933–1940.

由於香港並非處於地震帶，直接威脅本地的嚴重地震災難並不常見，故地震監測對香港本地的氣象發展，並沒有直接幫助。

August 1945. The recording format followed the standards of the days before the Japanese occupation. The interned Observatory staff sought to adopt a uniform and comprehensive recording method. The records for 1942 were comparatively hasty and primitive: they were mainly scribbled notes on the back of cigarette packets, or on the picture cards that came with the biscuit and candy tins; the handwriting was a bit scratchy. The data since 1943 became more coherent and detailed. Sometimes, reports were typewritten and neatly displayed. The hand-written records were legible and some even bore the Director's signature to indicate his approval, and some statistical data were illustrated by way of charts. This shows the meticulousness of the work of the interned staff.

Taking the rainfall records as an example, the data provided statistics on the daily, monthly and yearly rainfall from June 1942 to August 1945. These data were not only compared with the figures of the corresponding period in the previous year, but also with the monthly mean rainfall in Hong Kong since 1884. Occasionally, the monthly rainfall data were even presented in the form of statistical charts.

For temperature measurements, the period covered was from July 1942 to August 1945. The times of observation were 7 AM in the morning, 4 PM in the afternoon and 10 PM in the evening. Within the same hour, four temperature readings were taken: highest, lowest, indoor and outdoor. As the observation places and measurement methods were not clearly stated, the accuracy of such data requires further verification.

As for atmospheric pressure and wind direction measurements, the coverage period was the same: from July to December 1942, and from June 1943 to August 1945. The British Imperial System inch was used as the unit of measurement of atmospheric pressure. Observations were made three times each day at 8 AM, noon and 4 PM. Of the three, data obtained in the morning and at noon were more consistent. As far as wind directions and the general weather description were concerned, the data were purely based on the judgement of the observers. Rarely were the analyses based upon results obtained by instruments. There were only scanty data on relative humidity, which were principally recorded between April 1944 and July 1945. As it is not possible to understand how the measurements were carried out, it is quite impossible to work with this information.

Judging from the reporting methods and data comprehensiveness of these records, which were collected manually with the use of rudimentary apparatus,



## 加強對外交流

地震監測的設置為本港與世界各地的氣象監測機構建立了良好的關係。自1921年天文台發行《地震月報》後，其他地區都以香港所錄得的地震紀錄作為重要的參考資料。經常與香港交換地震資料的機構包括丹麥哥本哈根的治奧達德學院(Geodetic Institute of Copenhagen)、美國華盛頓的噶尼治學院 (Carnegie Institution of Washington)、英國牛津國際地震學會、美國密蘇里聖路易大學(Saint Louis University)、馬尼拉的中央氣象局 (Weather Bureau, Manila)、美國加州的聖丹尼噶那大學 (Santa Clara University)、日本東京帝國大學、新西蘭威寧頓的多迷尼氣象台 (Dominion Observatory)、中國江西省太和地質調查站、印度孟買氣象部，以及中國南京中央研究院氣象研究所等。[144] 天文台與世界各地的地震研究中心交換資料，增加香港對其他地區地震監測狀況的認識，更使香港成為地震紀錄資料的重要發佈中心。

## 戰爭的考驗

1941年12月25日香港淪陷，整個城市進入癱瘓狀況，天文台正常的天氣觀測工作也被迫擱置。憑著幾位被日軍俘虜的職員的信念，1941年12月至1945年8月日佔期間，天文台竟能斷斷續續的維持部分的天氣觀測工作。戰時的紀錄雖未能完全符合一般觀測的基本要求，但這些在有限的人力及物力支援下所蒐集到的氣象資料，卻是同期較有系統的報告，是研究這段時期香港氣候不可或缺的資料。[145]

該批戰時的氣象資料，內容包括了雨量、氣溫、氣壓、風向、相對濕度及一般的氣候概況的觀測，其中有關天氣概況的資料，記錄日期自 1942 年 1 月至1944年12月，其他氣象資料則以 1942年6月至1945年8月為主。記錄格式仍以日佔前的為標準，登記方法亦力求統一及全面。 1942年的紀錄較為草率及原始，大部分都是一些由人手在煙包的背面或附於罐裝餅乾及糖果內的畫卡上所做的筆記，字體稍嫌潦草。 1943年後資料開始較連貫及詳細，報告偶有以打字機打印的，相當整齊，即使是人手記錄的資料，亦可辨認；部分紀錄更由天文台台長加簽認可，部分資料甚至有使用繪圖表達統計數據的，可見記錄者態度嚴謹。

以雨量紀錄為例，資料羅列了 1942 年 6 月至 1945 年 8 月期間每天、每月及全年雨量統計，除了與上年同期比較以外，更與全港自 1884 年以來的每月平均降雨量比較。每月降雨量偶會製成統計圖表，可謂分析細緻。氣溫觀測為1942年7月至1945年8月的數據，記錄時間為每天的上午7時、下午4時及晚


Fig. 3.47 The rainfall records written on the back of a cigarette packet was approved by the Director of the Observatory. Courtesy Hong Kong Observatory

圖 3.47 記錄在煙包紙背面的雨量紀錄，隱約可見天文台長審核的簽署。香港天文台檔案




Fig. 3.48 Rainfall records written on the back of a cigarette packet. Courtesy Hong Kong Observatory

圖 3.48 記錄在煙包紙背面的雨量紀錄。香港天文台檔案


*Fig. 3.49 Meteorological data recorded on the back of a picture card. Courtesy Hong Kong Observatory*

*圖 3.49 記錄在畫咭背後的氣象紀錄。香港天文台檔案*





上 10 時，同一小時內有四個讀數：最高、最低、室內及室外的氣溫，由於沒有清楚說明量度的地點及方法，故資料的準確性仍有待深入驗證。氣壓的觀測日期與風向紀錄相同，包括了 1942 年 7 月至 12 月， 1943 年 6 月至 1945 年 8 月，氣壓量度以英吋為單位，每天三次：分別為上午 8 時、正午 12 時及下午 4 時，其中上午及正午的資料較連貫。風向及一般的氣候概況的描述，則純粹以觀測員的個人推測為本，甚少以儀器量度後的結果作為分析的依據。相對濕度資料最少，主要是 1944 年 4 月至 1945 年 7 月的紀錄，由於無法明瞭量度的方法，故該批資料最難應用。

從報導的方法，資料的完整性的角度來看，這批利用人手及簡單儀器測量的氣象紀錄，充分表現了量度者對氣象觀測的經驗及識見，但亦反映了資源不足所導致的局限，例如同日同類型的氣象資料紀錄不完整，或部分日子資料闕如，可能是人手不足所致。據資料顯示，被禁錮於赤柱集中營的天文台員工共有三位，而氣象資料的紀錄，可能主要是由這三位職員負責，要同時兼顧各方面資料，想亦會有一定困難。資料被記錄在煙包、罐裝餅乾及糖果內的畫卡的背面，也反映了資源極度缺乏，試想連一張可用的白紙張也沒有，更遑論其他工具了。這批戰

*Fig. 3.50 Weather observations taken in May 1944. Courtesy Hong Kong Observatory*

*圖 3.50 1944 年 5 月的天氣紀錄。香港天文台檔案*

the experience and professionalism of the weather observers were fully demonstrated. But it also reflected the limitations due to inadequate resources. For example, records on certain types of meteorological observations conducted on the same days were incomplete; and data for certain days were missing, possibly a result of manpower shortage. Records show that three Observatory staff members were interned at the Stanley concentration camp. They were possibly responsible for most of the recording of the meteorological observations. Having to attend to so many aspects of the data would have been a daunting task in a difficult time. The fact that data were recorded on the back of cigarette packets and animal picture cards inside biscuits and candy cans indicates the extreme shortage of resources. The staff did not have the luxury of even a blank sheet of paper, not to mention meteorological instruments. Although this batch of wartime data stopped short of the requisite scientific standards, they fully demonstrated the will and perseverance of the Observatory's personnel. Through their efforts the Observatory became the only government department that carried out normal operations during the occupation. The preserved cigarette packets and picture cards have become historical material for understanding the living conditions of prisoners in the concentration camps during the Second World War; something that the Observatory staff had probably not anticipated (see Table 3.7 for a survey of wartime meteorological records).

**Table 3.7** Survey of Wartime Meteorological Records

| | Rainfall | Temperature | Air Pressure | Wind Direction | Humidity | Weather Conditions |
|---|---|---|---|---|---|---|
| 1942 | | | | | | |
| Jan | | | | | | ✓ |
| Feb | | | | | | ✓ |
| Mar | | | | | | ✓ |
| Apr | | | | | | ✓ |
| May | | | | | | ✓ |
| Jun | ✓ | | | | | ✓ |
| Jul | ✓ | ✓ | ✓(12th–31st) | ✓(12th–31st) | | ✓ |
| Aug | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Sep | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Oct | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Nov | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Dec | ✓ | ✓ | ✓(1st–20th) | ✓(1st–20th) | | ✓ |
| 1943 | | | | | | |
| Jan | ✓ | ✓ | | | | ✓ |
| Feb | ✓ | ✓ | | | | ✓ |
| Mar | ✓ | ✓ | | | | ✓ |
| Apr | ✓ | ✓ | | | | ✓ |





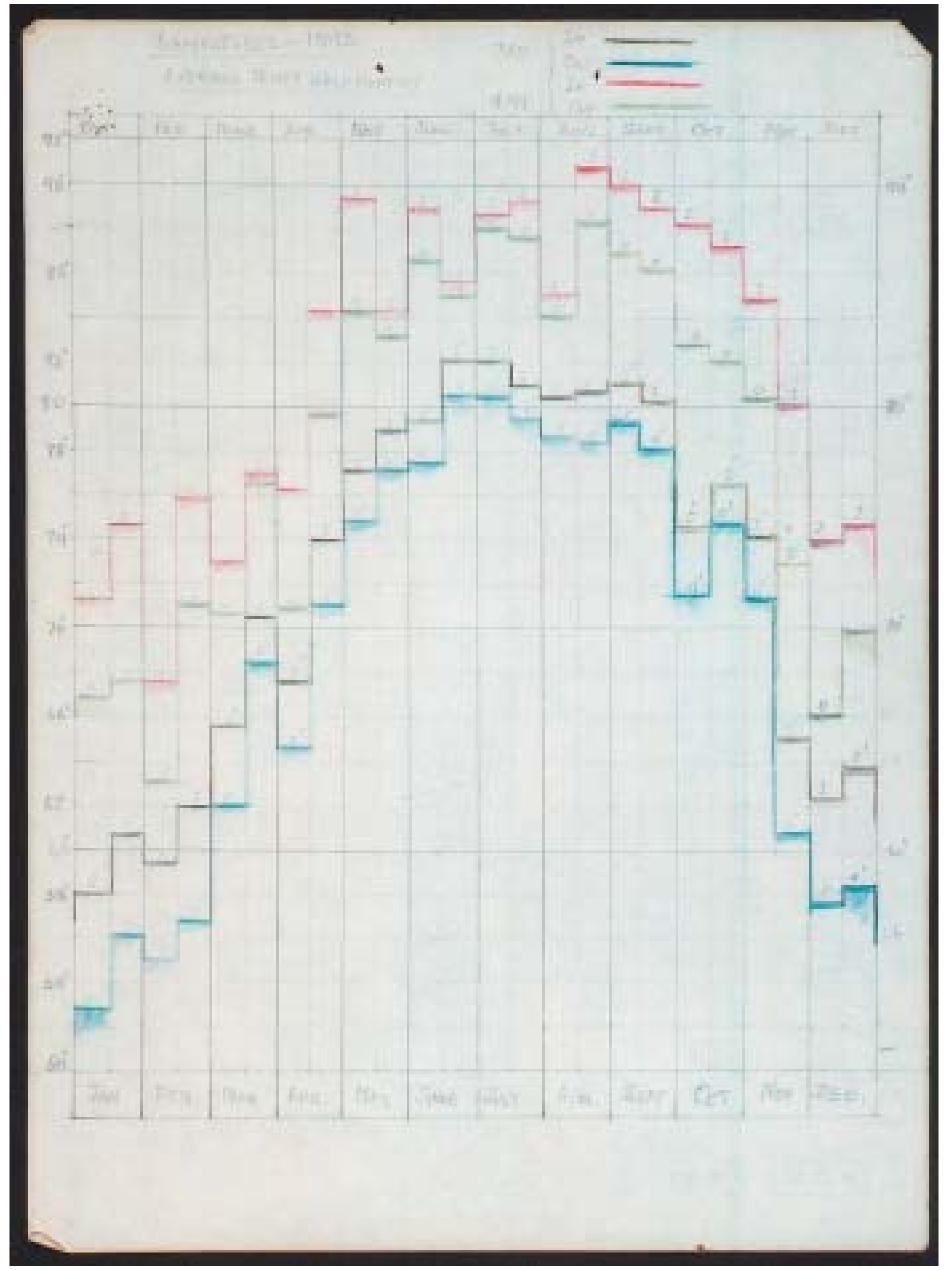


*Fig. 3.51 Temperature records of 1943. Courtesy Hong Kong Observatory*

*圖 3.51 1943 年的氣溫紀錄。香港天文台檔案*

時的資料雖未能做到完全符合科學標準，卻完完全全地表達了部門員工的意志及毅力，使天文台成為戰時唯一執行日常工作的政府部門。被保存的煙包、畫卡亦變成觀察戰時集中營俘虜生活狀況的史料，這可能是記錄者始料不及的 (有關戰時氣象資料紀錄概覽可參閱表 3.7)。

| | | | | | | |
|---|---|---|---|---|---|---|
| May | ✓ | ✓ | | | | ✓ |
| Jun | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Jul | ✓ | ✓ | ✓(12th–31st) | ✓(12th–31st) | | ✓ |
| Aug | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Sep | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Oct | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Nov | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Dec | ✓ | ✓ | ✓(1st–20th) | ✓(1st–20th) | | ✓ |
| 1944 | | | | | | |
| Jan | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Feb | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Mar | ✓ | ✓ | ✓ | ✓ | | ✓ |
| Apr | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| May | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Jun | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Jul | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Aug | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Sep | ✓ | ✓ | | | ✓ | ✓ |
| Oct | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Nov | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dec | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 1945 | | | | | | |
| Jan | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Feb | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Mar | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Apr | ✓ | ✓ | ✓ | ✓ | ✓ | |
| May | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Jun | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Jul | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Aug | ✓ | ✓ | ✓ | ✓ | ✓ | |

Source:
Internal records of the Hong Kong Observatory.

# Conclusion

From its inception in 1883, the Observatory has broadened the vision of the people of Hong Kong by introducing the Western system of astronomical and meteorological observation methods based on Western scientific principles. Meteorological observation has been transformed from a disorganised practice into one that adopts a standardised and systematic approach; from the reliance on individuals' experiences to the verification by scientific measurements; and from the belief in the unpredictability of weather to mastering the laws of climatic changes. These changes have not only altered the view of the Chinese people towards nature, but have also changed the whole economic environment of Hong Kong.



**表 3.7** 戰時氣象資料紀錄概覽

| | 雨量 | 溫度 | 氣壓 | 風向 | 濕度 | 天氣概況 |
|---|---|---|---|---|---|---|
| 1942 年 | | | | | | |
| 1 月 | | | | | | ✓ |
| 2 月 | | | | | | ✓ |
| 3 月 | | | | | | ✓ |
| 4 月 | | | | | | ✓ |
| 5 月 | | | | | | ✓ |
| 6 月 | ✓ | | | | | ✓ |
| 7 月 | ✓ | ✓ | ✓ (12 日 –31 日) | ✓ (12 日 –31 日) | | ✓ |
| 8 月 | ✓ | ✓ | ✓ | ✓ | | ✓ |
| 9 月 | ✓ | ✓ | ✓ | ✓ | | ✓ |
| 10 月 | ✓ | ✓ | ✓ | ✓ | | ✓ |
| 11 月 | ✓ | ✓ | ✓ | ✓ | | ✓ |
| 12 月 | ✓ | ✓ | ✓ (1 日 –20 日) | ✓ (1 日 –20 日) | | ✓ |
| 1943 年 | | | | | | |
| 1 月 | ✓ | ✓ | | | | |
| 2 月 | ✓ | ✓ | | | | |
| 3 月 | ✓ | ✓ | | | | |
| 4 月 | ✓ | ✓ | | | | |
| 5 月 | ✓ | ✓ | | | | |
| 6 月 | ✓ | ✓ | ✓ | ✓ | | ✓ |
| 7 月 | ✓ | ✓ | ✓(12 日 –31 日) | ✓(12 日 –31 日) | | ✓ |
| 8 月 | ✓ | ✓ | ✓ | ✓ | | ✓ |
| 9 月 | ✓ | ✓ | ✓ | ✓ | | ✓ |
| 10 月 | ✓ | ✓ | ✓ | ✓ | | ✓ |
| 11 月 | ✓ | ✓ | ✓ | ✓ | | ✓ |
| 12 月 | ✓ | ✓ | ✓(1 日 –20 日) | ✓(1 日 –20 日) | | ✓ |
| 1944 年 | | | | | | |
| 1 月 | ✓ | ✓ | ✓ | ✓ | | ✓ |
| 2 月 | ✓ | ✓ | ✓ | ✓ | | ✓ |
| 3 月 | ✓ | ✓ | ✓ | ✓ | | ✓ |
| 4 月 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 5 月 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 6 月 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 7 月 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 8 月 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 9 月 | ✓ | ✓ | | | ✓ | ✓ |
| 10 月 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 11 月 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 12 月 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 1945 年 | | | | | | |
| 1 月 | ✓ | ✓ | ✓ | ✓ | ✓ | |

The application of astronomical observation to time measurement and reporting, and the introduction of regional weather reporting were the prime factors behind Hong Kong's development into Asia's premier entrepôt by the end of the nineteenth century. The Observatory placed very stringent demands on meteorological reports. Apart from comprehensiveness, accuracy, frequency and coverage, the reports also had to meet the needs of society of the time. Take the time service as an example, the frequency of time reporting kept on increasing and the annual mean error was kept below 0.2 seconds. Avidly applying the latest technology, the Observatory introduced the wireless time signal service. However, in view of the needs of the ocean-going vessels, the Observatory did not abolish the use of the time ball immediately. This spirit of constantly seeking improvements while being understanding and continuing to meet the needs of the receiving ends of the service were the driving force behind the development of society.

Collating meteorological data from over 40 regions and maritime messages from over 20,000 ocean-going ships, the Observatory published the *China Coast Meteorological Register*. This was not only an important service to the mariners of the region, but was also a pivotal factor for Hong Kong's ascendancy as the leading data exchange centre in the Asia-Pacific region. Hong Kong's status as an entrepôt in that region was firmly established.

The two new services initiated by the Observatory in the 1920s, namely, that of upper air meteorological observation and earthquake monitoring, did not make an immediate impact on society. The service of earthquake monitoring came about as a direct result of the earthquake that struck Shantou, Guangdong between 13 and 14 February 1918. As the number of locally felt earth tremors was small, the importance of this service gradually diminished. As for the upper air meteorological observation service, it was never taken seriously by the government since its inception in 1921. It was even severely criticised as a waste of public money. Notwithstanding the criticisms and lack of support, the Observatory persevered with the upper air monitoring work. Such persistence paid off with the launching of Hong Kong's aviation industry in the mid–1930s. Most people would concur that it was visionary to embark on the early upper air meteorological observation. It was through such work that Hong Kong made a successful transition from being a leading sea transport hub into a pioneer in air transportation business. Likewise, the recording of seismological data and their dissemination have prompted the development of Hong Kong as a prominent information exchange centre.




| | | | | | | |
|---|---|---|---|---|---|---|
| 2月 | ✓ | ✓ | ✓ | ✓ | ✓ | |
| 3月 | ✓ | ✓ | ✓ | ✓ | ✓ | |
| 4月 | ✓ | ✓ | ✓ | ✓ | ✓ | |
| 5月 | ✓ | ✓ | ✓ | ✓ | ✓ | |
| 6月 | ✓ | ✓ | ✓ | ✓ | ✓ | |
| 7月 | ✓ | ✓ | ✓ | ✓ | ✓ | |
| 8月 | ✓ | ✓ | ✓ | ✓ | | |

資料來源：
香港天文台內部資料。

## 小結

1883年成立的天文台，以西方的科學理念為依據，引入了西洋天文及氣象觀測方法，可以說是開拓了香港市民的視野。氣象觀測方法從雜亂無章至統一測量的標準，從依靠個體經驗至透過科學儀器驗證，從相信氣候變幻無常的觀感到掌握氣候變化的規律，不但改變了中國人對大自然的看法，亦推動了整個香港社會的經濟發展。

天文觀測結果應用在計時、報時及區域內氣象狀況的報導，都是促使香港在十九世紀末期成為亞洲貿易重鎮的關鍵因素。天文台對氣象監測結果的報導有十分嚴格的要求，除內容要準確、詳盡外，報導的次數及服務的範圍亦盡量造到頻密而廣泛，並盡量照顧到當時社會的需要。以報時服務為例，時間球報時的次數不斷遞增，而每年的平均誤差一直維持在 0.2 秒以下。隨著科技進步，當局推行新的無線電報時方法，但仍顧及遠洋輪船的需要，並未馬上取締時間球報時法。這種精益求精、和衷共濟的精神，成為推動社會發展的動力。

天文台透過蒐集 40 多個地區的氣象資料，及多至二萬個遠洋輪船海上訊息，綜合整理而成的《中國沿岸氣象紀錄》，不但方便了航海人士，同時亦使香港成了亞太區資訊交流中心，奠定了香港作為貿易中轉站的地位。

1920 年代開始，天文台拓展新的領域 —— 高空氣象監測及地震監測，這兩項服務對 1920 年代的香港社會，並沒有馬上產生重要作用，其中地震探測可說是因應著 1918 年 2 月 13 至 14 日廣東汕頭發生地震而設立的。由於香港地區實際錄得的有感地震並不嚴重，故該部門的重要性亦漸漸減弱；高空氣象監測工作自 1921 年開展以來，更一直未受到政府當局重視，甚至被斥為浪費公帑。但天文台並沒有放棄，仍努力不懈地進行高空氣象監測，這份堅持是香港於1930年代中期航空事業起飛的重要依據。用高瞻遠矚來形容早期高空氣象監測工作，相信大部分人也會同意。香港藉此成功地從海運中轉站的領導地位過渡為空運貿易的先鋒，而地震資料的紀錄與發佈亦使香港成為氣象資訊交流中心。