# Head 168 — HONG KONG OBSERVATORY

**Controlling officer:** the Director of the Hong Kong Observatory will account for expenditure under this Head.

**Estimate 2019–20** ..... **$381.4m**

**Establishment ceiling 2019–20** (notional annual mid-point salary value) representing an estimated 327 non-directorate posts as at 31 March 2019 rising by 25 posts to 352 posts as at 31 March 2020..... **$220.1m**

In addition, there will be an estimated five directorate posts as at 31 March 2019 and as at 31 March 2020.

## Controlling Officer's Report

**Programmes**

| | |
|---|---|
| **Programme (1) Weather Services** | This programme contributes to Policy Area 7: Public Safety (Secretary for Commerce and Economic Development). |
| **Programme (2) Radiation Monitoring and Assessment** | This programme contributes to Policy Area 9: Internal Security (Secretary for Security). |
| **Programme (3) Time Standard and Geophysical Services** | This programme contributes to Policy Area 7: Public Safety (Secretary for Commerce and Economic Development). |

**Detail**

**Programme (1): Weather Services**

| | 2017–18 (Actual) | 2018–19 (Original) | 2018–19 (Revised) | **2019–20 (Estimate)** |
|---|---|---|---|---|
| Financial provision ($m) | 258.6 | 290.3 | 290.1 (–0.1%) | **325.4** (+12.2%) (or +12.1% on 2018–19 Original) |

***Aim***

**2** The aim is to provide weather forecasts and issue warnings to the public, special users, the shipping community and aviation groups in order to reduce loss of life and damage to property, and minimise disruption to economic and social activities during hazardous weather.

***Brief Description***

**3** The Central Forecasting Office and Airport Meteorological Office of the Hong Kong Observatory (HKO) are responsible for the preparation and issuance of weather information, forecasts and various warnings on hazardous weather to the public, the shipping community and aviation groups. HKO also promotes public awareness of, and community preparedness for, natural disasters. The work involves:

- operating a network of mostly automated weather stations;
- carrying out real-time exchange of data with meteorological centres in the world;
- receiving meteorological satellite imageries, and operating weather radar systems and other meteorological instruments;
- analysing meteorological data and computing the future weather by numerical modelling;
- disseminating weather information by a diversity of means;
- issuing warnings and advisory messages on hazardous weather such as tropical cyclones, storm surges, rainstorms, landslips, flooding, thunderstorms, windshear, fire danger and extreme hot and cold conditions; and
- conducting public talks, interviews and training courses as well as producing TV weather programmes and educational materials on hazardous weather phenomena.

**4** In 2018, HKO fulfilled its performance pledge of issuing at least one bulletin every hour of the day, disseminating 99 per cent of the bulletins within ten minutes after each hour, and attained a forecast accuracy (as verified by objective means) of 91 per cent. HKO was designated by the World Meteorological Organization (WMO) as a Regional Specialised Meteorological Centre for Nowcasting for the Asian region, a recognition of the significant role HKO plays in applying nowcasting techniques in predicting severe weather.

**5** To meet the needs of the public, HKO enhanced the provision of weather information in 2018–19 through:

- updating the precautionary announcements in tropical cyclone warning bulletins to strengthen public awareness of and preparedness for the impact of tropical cyclones including storm surge;
- launching a webpage on "Regional Information on Heavy Rain and Thunderstorm" to display regional rainfall amount and lightning locations, and feature the affected regions in the "Announcement on Localised Heavy Rain", "Special Announcement on Flooding in the northern New Territories" and "Thunderstorm Warning";
- enriching the HKO mobile weather application "MyObservatory" with regional information of Thunderstorm Warning;
- enriching regional weather information on the HKO website by providing additional temperature information at Clear Water Bay, weather photos taken at West Kowloon as well as higher-resolution weather photos at selected locations;
- enriching the weather satellite imagery on the HKO website and the "MyObservatory" application with imagery covering the western Asia region and hourly updates;
- enriching the "Met on Map" service, a one-stop service hub powered by a Geographic Information System platform, with more weather observations including wind speed and direction, air temperature and visibility from airports around the globe; and
- enhancing the tidal information service on the HKO website by adding real-time tide data collected at Tai O.

**6** HKO maintains a close surveillance of the weather at and around the Hong Kong International Airport (HKIA) and provides the aviation community with the weather information needed for its operations. In 2018–19, a wake vortex study for landing and departing aircraft at the HKIA commenced as a joint undertaking of the Airport Authority Hong Kong (AAHK) and HKO. In July, the Asian Aviation Meteorological Centre, jointly established by HKO, the Civil Aviation Administration of China and the China Meteorological Administration (CMA), commenced operation to support en route hazardous weather warning services in the Asian region.

**7** Other noteworthy activities for 2018–19 include:

- conducting studies on topics related to tropical cyclone activities and extreme weather events, including the storm surge brought by Super Typhoon Mangkhut, and producing a special series of educational videos about Mangkhut to raise public awareness of typhoon-related hazards;
- collaborating with airlines to promote the use and continuous improvement of "MyFlightWx", a mobile application on iOS platform, which provides electronically the latest inflight weather information to flight crew;
- providing meteorological support to the operation of the Hong Kong-Zhuhai-Macao Bridge upon its commencement in October 2018;
- promoting HKO Facebook and Instagram pages launched in March 2018 to enhance communication and engagement with the public through social media;
- launching a new "Ultraviolet (UV) Radiation Information" webpage to provide real-time UV information and related sun protection tips;
- commissioning a satellite data reception and processing system to receive data from the new generation of Chinese Feng Yun satellites;
- installing more microclimate stations for a pilot study on urban weather monitoring and development of data sharing platform and related weather products;
- enhancing marine meteorological observations over the South China Sea and western North Pacific by deploying drifting buoys and upgraded equipment on board Hong Kong Voluntary Observing Ships (VOS), and launching a new webpage for the sharing of weather photos taken by crew members on board Hong Kong VOS;
- extending the International Organization for Standardization (ISO) 9001:2015 certification for the provision of upper-air observation services to cover ozone and radioactivity profile measurements;
- signing a Memorandum of Understanding with WMO to strengthen co-operation in supporting global weather information services and, as initiatives of co-operation with WMO, launching a Global Multi-hazard Alert System for Asia together with CMA to enhance disaster risk reduction in the region and a revamped Severe Weather Information Centre website (SWIC 2.0) to aggregate authoritative warnings related to high-impact weather, water and climate events around the world;
- signing memoranda on meteorological co-operation with the respective authorities of Myanmar, Cambodia and Vietnam;
- securing WMO's designation as a Testbed for Doppler Light Detection and Ranging systems for aviation application;
- organising the photo and video exhibition "Cloud-sourcing: In Touch with Weather from Land, Sea and Air" at HKIA jointly with the AAHK, and the exhibition "Tracking Winds and Clouds: A Century of Archived Stories of the Observatory" jointly with the Government Records Service to feature historical archives on weather;

- organising jointly with the Shenzhen Meteorological Bureau and other parties an international contest on the use of artificial intelligence in rainfall nowcasting, which attracted the entries of over 1 700 teams; and
- organising a number of educational events and outreach activities engaging young people and students through the "Science in Public Service Campaign" and the "Community Weather Information Network", including the "Weather Observation and Weather Photos Competition", workshops on building community weather station as well as various scientific and public talks.

**8** The key performance measures in respect of weather services are:

***Targets***

| | Target | 2017 (Actual) | 2018 (Actual) | **2019 (Plan)** |
|---|---|---|---|---|
| forecasts perceived as accurate by the public (%)# | 78 | 77 | 78 | **78** |
| accurate public forecasts as verified by objective means (%) | 88 | 92 | 91 | **90** |
| accurate forecasts as assessed by ship captains (%) | 96 | 98 | 97 | **96** |
| accurate forecasts as assessed by airline operators (%) | 96 | 99 | 100 | **96** |
| hourly local weather reports disseminated within the first ten minutes of each hour (%) | 99 | 99 | 99 | **99** |

***Indicators***

| | 2017 (Actual) | 2018 (Actual) | **2019 (Estimate)** |
|---|---|---|---|
| calls answered by the Dial-a-Weather system (million)# | 8.4 | 7.5 | **8.0** |
| telephone enquiries answered manually# | 21 169 | 21 916 | **19 000** |
| visits to the HKO website (billion)^ | 167 | 146 | **160** |
| companies and organisations subscribing to special weather and warning services | 106 | 106 | **106** |
| total revenue from the above subscribers ($m) | 0.7 | 0.7 | **0.7** |
| media interviews and public lectures/talks on weather# | 1 653 | 1 663 | **1 600** |
| meteorological documents for flights departing Hong Kong | 213 000 | 217 000 | **220 000** |
| visits to the aviation weather information system (million) | 183.2 | 201.6 | **210.0** |

\# The actual figures may vary depending on whether there are more weather changes of concern to the public in that particular year.

^ Figures measured in page views refer to the number of access to the HKO website which includes the mobile website, the Weather Wizard and the mobile application.

***Matters Requiring Special Attention in 2019–20***

**9** During 2019–20, HKO will:

- continue to provide weather forecasts, regional weather services and extended weather outlook, and conduct research and enhance forecasting and warning services on high-impact weather;
- strengthen efforts in public communication of high-impact weather, outreach and public educational activities to enhance public awareness of and preparedness for natural disasters and impact of climate change;
- enhance the provision of forecast tracks of tropical cyclones over the western North Pacific;
- continue to promote the use and continuous improvement of "MyFlightWx" in collaboration with airlines to provide the latest inflight weather information to flight crew electronically;
- continue to take forward the implementation of meteorological facilities in support of the Three-Runway System project;
- continue to implement urban-scale weather monitoring (including the implementation of microclimate stations), provide support to the Innovation and Technology Bureau's pilot Multi-functional Smart Lampposts scheme, and develop forecasting products in support of initiatives under the Smart City Blueprint;
- continue to develop nowcasting products on high-impact weather for local and regional applications;
- conduct a meteorological study for Government Flying Service's new Forward Base at Kai Tak;

- continue to enhance marine meteorological observations and the provision of weather information to the marine community;
- continue to develop social media services for enhancing communication to the public of weather information, forecasts and warnings, by means including timelapse video competition on such platforms to promote appreciation of weather and sharing of weather videos;
- continue to enrich the content of the "MyObservatory" mobile application;
- continue to enhance the "Met on Map" service with more weather and geophysical information;
- continue to enhance the automatic weather station network for the provision of more weather information;
- develop a website to provide weather information services for the Guangdong-Hong Kong-Macao Greater Bay Area in collaboration with relevant meteorological authorities of the Mainland and Macao; and
- develop automatic forecast products for major cities and airports around the world.

**Programme (2): Radiation Monitoring and Assessment**

| | 2017–18 (Actual) | 2018–19 (Original) | 2018–19 (Revised) | **2019–20 (Estimate)** |
|---|---|---|---|---|
| Financial provision ($m) | 32.1 | 35.3 | 35.8 (+1.4%) | **39.5** (+10.3%) (or +11.9% on 2018–19 Original) |

***Aim***

**10** The aim is to provide information on environmental radiation levels in Hong Kong and advise government departments on the protective action that may be necessary during nuclear emergencies.

***Brief Description***

**11** HKO monitors ambient radiation levels in Hong Kong and conducts radiological measurements on air, soil, water and food samples. In the event of a nuclear emergency, HKO will notify and advise government departments on the possible consequences in Hong Kong and recommend protective action. HKO organises training and exercises on radiation monitoring for other government departments involved in the Hong Kong contingency plan for nuclear emergencies. The work involves:

- operating a network of radiation monitoring stations, an aerial radiation monitoring system, two radiological survey vehicles, a radiation laboratory and an emergency radiation data management system;
- keeping abreast of the latest development on the methodology for nuclear accident consequence assessment; and
- planning and participating in exercises and drills in response to nuclear emergencies.

**12** In 2018–19, all radiation monitoring and assessment work in this programme was carried out satisfactorily. All equipment was maintained in a state of readiness. The radiation laboratory and the ambient gamma radiation level measurement service successfully received the latest ISO 9001:2015 certification. Inter-comparisons between Hong Kong and Guangdong on radiological measurements continued. Exercises, drills and training on radiation monitoring and assessment were conducted. Implementation of new radiation monitoring and assessment facilities, in particular the replacement alpha spectrometry system at the radiation laboratory, high pressure ionization chambers of the Radiation Monitoring Network and the automatic gamma spectrometry system at Ping Chau were in steady progress. In-house produced video clips on radiation and nuclear emergency preparedness were shown on "Cool Met Stuff" channel on the HKO website, the "MyObservatory" mobile application and Youtube. Outreach activities such as public and school talks, exhibitions and visits to radiation monitoring facilities were also conducted to promote public education.

**13** The key performance measures in respect of radiation monitoring and assessment are:

***Target***

| | Target | 2017 (Actual) | 2018 (Actual) | **2019 (Plan)** |
|---|---|---|---|---|
| data availability of radiation monitoring network (%) | 99.0 | 99.8 | 99.8 | **99.5** |

***Indicators***

| | 2017 (Actual) | 2018 (Actual) | **2019 (Estimate)** |
|---|---|---|---|
| exercises and drills | 22 | 22 | **20** |
| visits to HKO's webpage on radiation | 2 280 794 | 1 681 870 | **2 000 000** |

***Matters Requiring Special Attention in 2019–20***

**14** During 2019–20, HKO will continue to:

- implement the agreed arrangements between Hong Kong and Guangdong on radiation monitoring and assessment;
- conduct drills and exercises on emergency response in conjunction with other government departments as well as the relevant Guangdong counterparts;
- organise training on radiation monitoring and assessment;
- take forward the enhancement of radiation monitoring and assessment facilities; and
- further promote public education on radiation by launching an e-book on radiation and revamping the "Radiation Monitoring, Assessment and Protection" webpage.

**Programme (3): Time Standard and Geophysical Services**

| | 2017–18 (Actual) | 2018–19 (Original) | 2018–19 (Revised) | **2019–20 (Estimate)** |
|---|---|---|---|---|
| Financial provision ($m) | 12.1 | 12.9 | 12.9 (—) | **16.5** (+27.9%) (or +27.9% on 2018–19 Original) |

***Aim***

**15** The aim is to maintain the Hong Kong time standard and to provide geophysical, oceanographic, astronomical and climatological information to the public.

***Brief Description***

**16** HKO maintains the Hong Kong time standard, provides time signals for the public and contributes to the International Bureau of Weights and Measures (BIPM) for the determination of the universal standard time. It provides geophysical, oceanographic, astronomical and climatological information to meet the requirements for planning, engineering design and environmental impact assessments. It monitors earthquakes and the sea level and releases related information to the public, including the operation of the tsunami warning system. It also keeps abreast of research and development on international issues such as global climate change and advises the public and government departments on the likely implications. The work involves:

- maintaining a caesium beam atomic clock as the Hong Kong time standard and providing time signals for radio broadcasts, automatic telephone answering service and synchronisation of clocks via the Internet;
- operating seismological, tide and sea level monitoring networks and conducting related analyses;
- carrying out real-time exchange of seismic data with overseas centres and disseminating earthquake information by various means;
- compiling climatological and other related data;
- conducting studies on climate change in Hong Kong and promoting public understanding; and
- providing updates on the effects of El Nino and other longer term atmospheric phenomena on Hong Kong.

**17** In 2018–19, the objectives and targets of this programme were generally met through the following:

- providing scientific support to studies by relevant government bureaux/departments on the mitigation, adaptation and resilience-building measures required in combating climate change and its impacts including extreme weather events;
- conducting school talks on climate change, providing educational videos, and publishing articles and latest research findings of global climate on HKO's webpage to promote public understanding and awareness of climate change and its impacts;
- collaborating with the Ho Koon Nature Education cum Astronomical Centre to produce a curriculum-based climate change education package for secondary schools;

- collaborating with the Agriculture, Fisheries and Conservation Department to produce a book for public education on combating climate change and conserving biodiversity;
- strengthening the resilience of the tide stations through additional sensors and enhanced facilities;
- participating in the Pacific-wide Tsunami Exercise "PacWave18" organised by the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization;
- enhancing the reliability of time measurement through participation in the calibration programme under the auspices of BIPM;
- enhancing the mobile webpage on "Astronomy & Calendar" to provide an interactive diagram of sun path and information of moon phases; and
- conducting a joint webcast of the total lunar eclipse on 28 July 2018 with the Hong Kong Space Museum, the Ho Koon Nature Education cum Astronomical Centre, the Po Leung Kuk Ngan Po Ling College and the Hong Kong Sheng Kung Hui Solar Tower, attracting about 70 000 page views.

**18** The key performance measures in respect of time standard and geophysical services are:

***Targets***

| | Target | 2017 (Actual) | 2018 (Actual) | **2019 (Plan)** |
|---|---|---|---|---|
| time standard accuracy (microseconds per day) | 0.01Δ | 0.10 | 0.01 | **0.01** |
| geophysical, meteorological and oceanographic data capture rate (%) | 99 | 100 | 100 | **99** |
| climatological information (% of written requests responded to within ten working days) | 99 | 100 | 100 | **100** |

Δ The target is enhanced from 0.1 to 0.01 as from 2019 due to technological advancement.

***Indicators***

| | 2017 (Actual) | 2018 (Actual) | **2019 (Estimate)** |
|---|---|---|---|
| visits to HKO's Internet time service (million) | 25 634 | 26 295 | **26 000** |
| requests for geophysical, climatological and oceanographic information and advice | 802 | 782 | **800** |

***Matters Requiring Special Attention in 2019–20***

**19** During 2019–20, HKO will continue to:

- undertake and support monitoring and assessment of earthquake, tsunami risk and sea level in the region;
- continue to strengthen the resilience of the tide stations to better cope with extreme sea level conditions;
- monitor and study climate change issues, provide relevant government bureaux/departments with latest information and assessment of climate change and its impacts to support their studies, and develop new methodology for the projection of likely impacts on Hong Kong;
- upgrade relevant hardware of the timing system to meet the growing demand for HKO's Internet time service;
- engage various stakeholders in promoting the effective use of climate information and in developing climate-related services in support of the emerging needs of different sectors and government bureaux/departments; and
- support outreach activities to promote the understanding of the mitigation, adaptation and resilience-building measures required in combating climate change impacts.

## ANALYSIS OF FINANCIAL PROVISION

| Programme | 2017–18 (Actual) ($m) | 2018–19 (Original) ($m) | 2018–19 (Revised) ($m) | **2019–20 (Estimate) ($m)** |
|---|---|---|---|---|
| (1) Weather Services | 258.6 | 290.3 | 290.1 | **325.4** |
| (2) Radiation Monitoring and Assessment | 32.1 | 35.3 | 35.8 | **39.5** |
| (3) Time Standard and Geophysical Services | 12.1 | 12.9 | 12.9 | **16.5** |
| | 302.8 | 338.5 | 338.8 (+0.1%) | **381.4 (+12.6%)** |
| | | | | **(or +12.7% on 2018–19 Original)** |

**Analysis of Financial and Staffing Provision**

**Programme (1)**

Provision for 2019–20 is $35.3 million (12.2%) higher than the revised estimate for 2018–19. This is mainly due to the increase of 20 posts in 2019–20, increased operating expenses and increased requirement for capital expenditure.

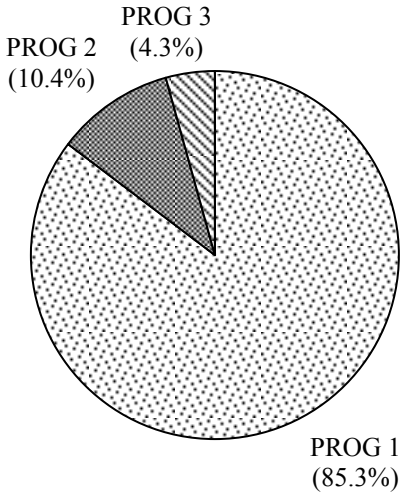
**Programme (2)**

Provision for 2019–20 is $3.7 million (10.3%) higher than the revised estimate for 2018–19. This is mainly due to increased operating expenses and increased requirement for capital expenditure.

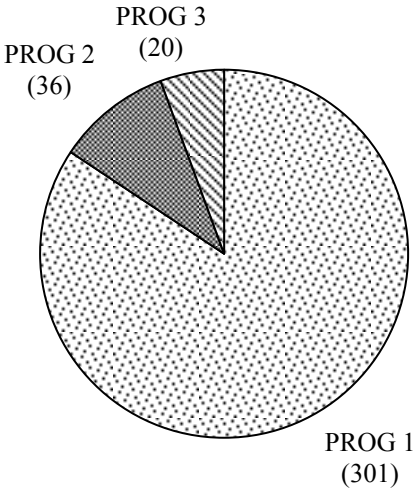
**Programme (3)**

Provision for 2019–20 is $3.6 million (27.9%) higher than the revised estimate for 2018–19. This is mainly due to the increase of five posts in 2019–20, increased operating expenses and increased requirement for capital expenditure.

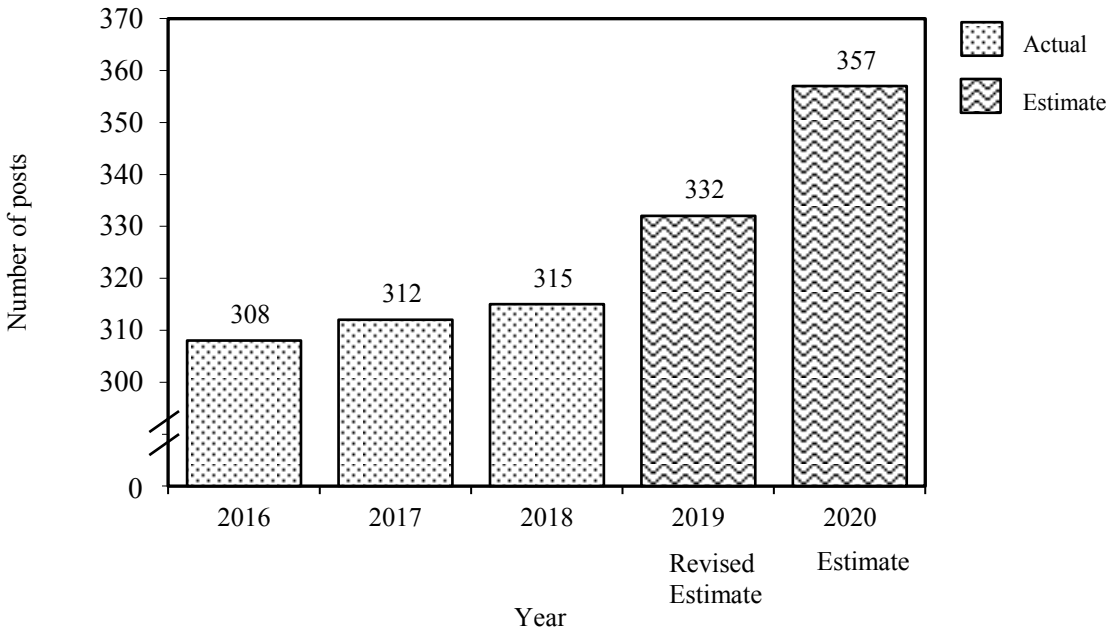
*Allocation of provision to programmes (2019-20)*




*Staff by programme (as at 31 March 2020)*




*Changes in the size of the establishment (as at 31 March)*



| Sub-head (Code) | | Actual expenditure 2017–18 | Approved estimate 2018–19 | Revised estimate 2018–19 | **Estimate 2019–20** |
|---|---|---|---|---|---|
| | | $'000 | $'000 | $'000 | **$'000** |
| | **Operating Account** | | | | |
| | Recurrent | | | | |
| 000 | Operational expenses | 291,526 | 318,188 | 318,491 | **353,098** |
| | Total, Recurrent | 291,526 | 318,188 | 318,491 | **353,098** |
| | Total, Operating Account | 291,526 | 318,188 | 318,491 | **353,098** |
| | **Capital Account** | | | | |
| | Plant, Equipment and Works | | | | |
| 661 | Minor plant, vehicles and equipment (block vote) | 11,258 | 20,351 | 20,351 | **28,266** |
| | Total, Plant, Equipment and Works | 11,258 | 20,351 | 20,351 | **28,266** |
| | Total, Capital Account | 11,258 | 20,351 | 20,351 | **28,266** |
| | Total Expenditure | 302,784 | 338,539 | 338,842 | **381,364** |

**Details of Expenditure by Subhead**

The estimate of the amount required in 2019–20 for the salaries and expenses of the Hong Kong Observatory is $381,364,000. This represents an increase of $42,522,000 over the revised estimate for 2018–19 and $78,580,000 over the actual expenditure in 2017–18.

*Operating Account*

Recurrent

**2** Provision of $353,098,000 under *Subhead 000 Operational expenses* is for the salaries, allowances and other operating expenses of the Hong Kong Observatory. This represents an increase of $34,607,000 (10.9%) over the revised estimate for 2018–19. This is mainly due to increased provision for filling of vacancies and new posts in 2019–20, and increased requirement for departmental expenses in connection with weather forecasting and warning services.

**3** The establishment as at 31 March 2019 will be 332 posts. It is expected that there will be an increase of 25 posts in 2019–20. Subject to certain conditions, the controlling officer may under delegated power create or delete non-directorate posts during 2019–20, but the notional annual mid-point salary value of all such posts must not exceed $220,090,000.

**4** An analysis of the financial provision under *Subhead 000 Operational expenses* is as follows:

| | 2017–18 (Actual) ($'000) | 2018–19 (Original) ($'000) | 2018–19 (Revised) ($'000) | **2019–20 (Estimate) ($'000)** |
|---|---|---|---|---|
| Personal Emoluments | | | | |
| - Salaries | 194,679 | 208,405 | 208,673 | **227,696** |
| - Allowances | 1,560 | 2,048 | 2,136 | **2,228** |
| - Job-related allowances | 696 | 655 | 674 | **716** |
| Personnel Related Expenses | | | | |
| - Mandatory Provident Fund contribution | 622 | 788 | 703 | **960** |
| - Civil Service Provident Fund contribution | 6,020 | 7,414 | 7,427 | **9,706** |
| Departmental Expenses | | | | |
| - General departmental expenses | 87,843 | 98,768 | 98,773 | **111,682** |
| Other Charges | | | | |
| - World Meteorological Organization | 106 | 110 | 105 | **110** |
| | 291,526 | 318,188 | 318,491 | **353,098** |

*Capital Account*

Plant, Equipment and Works

**5** Provision of $28,266,000 under *Subhead 661 Minor plant, vehicles and equipment (block vote)* represents an increase of $7,915,000 (38.9%) over the revised estimate for 2018–19. This is mainly due to the increased requirement for new and replacement equipment.