

# **RAINFALL AND LANDSLIDES IN 1984**

**GEO REPORT No. 1**

**J. Premchitt**

**GEOTECHNICAL ENGINEERING OFFICE  
CIVIL ENGINEERING DEPARTMENT  
HONG KONG**

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Prepared by:

Geotechnical Engineering Office,  
Civil Engineering Department,  
Civil Engineering Building,  
101 Princess Margaret Road,  
Homantin, Kowloon,  
Hong Kong.

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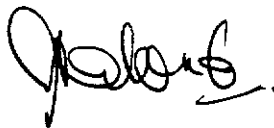
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## PREFACE

In keeping with our policy of releasing information of general technical interest, we make available some of our internal reports in a series of publications termed the GEO Report series. The reports in this series, of which this is one, are selected from a wide range of reports produced by the staff of the Office and our consultants.

Copies of GEO Reports have previously been made available free of charge in limited numbers. The demand for the reports in this series has increased greatly, necessitating new arrangements for supply. In future a charge will be made to cover the cost of printing.

The Geotechnical Engineering Office also publishes guidance documents and presents the results of research work of general interest in GEO Publications. These publications and the GEO Reports are disseminated through the Government's Information Services Department. Information on how to purchase them is given on the last page of this report.

A handwritten signature in black ink, appearing to read 'A. W. Malone'.

A. W. Malone  
Principal Government Geotechnical Engineer  
April 1995

# FOREWORD

This report presents a general review of rainfall and landslides in 1984, and provides some factual details of the major landslides.

K.S. Wong organised collection and initial sorting of the data for this report. Geotechnical Engineers of GCO District Divisions provided details of the landslides. Supplementary data were provided by Agriculture and Fisheries Department, Fire Services Department, Highways Office, Housing Department and Water Supplies Department. All contributions are gratefully acknowledged.

A handwritten signature in black ink, reading "J.W. Cowland". The signature is written in a cursive, flowing style with a large, prominent 'C' at the end.

J.W. Cowland

Chief Geotechnical Engineer/Special Projects

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## 1. INTRODUCTION

This report reviews rainfall and landslide occurrence in Hong Kong throughout 1984. Rainfall information has been obtained from the Royal Observatory (RO) and from the Geotechnical Control Office's (GCO) automatic raingauge system. Most of the landslide data have been taken from records of incidents reported to the GCO during the year. Supplementary data have been obtained from other government departments.

In this report, a landslide is defined as the collapse of a soil or rock mass, and includes the failure of fill slopes, cut slopes, retaining structures, natural slopes and rock or boulder falls.

The GCO received a total of 120 incident reports. Of these, 106 were classified as genuine landslides. The remaining incidents were minor ground and building movements. This report will emphasize the cases of landslides as reported to the GCO, since these were inspected by the GCO's engineers and detailed information is available. In addition, two failures of a special nature at Tuen Mun Area 19 and at Junk Bay Controlled Tip are also presented here, even though they were not listed in the incident record.

The arrangement of this report is similar to the three previous rainstorm reports of May and August 1982 and June 1983, (GCO, 1982a, 1982b; Choot, 1984) except that this report reviews rainfall and landslide occurrence throughout the whole one-year period rather than emphasizing only one specific rainstorm. This is a factual report, and apart from acknowledging that most of the landslides were initiated by heavy rainfall, it does not attempt to explain the mechanisms of failure nor to elaborate on whether these landslides could have been predicted. Information and discussion on the important aspect of correlation between rainfall and landslides can be found elsewhere, for example Lumb (1975) and Brand et al (1984). It is intended, however, that the data contained in this report may be used and interpreted by readers to further the understanding of rain-induced failures.

## 2. RAINFALL

### 2.1 The Raingauge System

In the rugged terrain of Hong Kong, rainfall distribution over different geographical areas, as well as over different time periods, can vary dramatically during a rainstorm. The Royal Observatory has installed 165 raingauges at strategic locations around the territory in order to provide sufficient coverage for a meaningful analysis of rainfall distribution. These raingauges range from a detailed automatic and instantaneous rate-of-rainfall recorder to raingauges which are read manually once a month. The 'principal' gauge is located at the Royal Observatory's headquarters in Tsim Sha Tsui, and a continuous rainfall record has been made at this location since January 1884. Weather summaries and rainfall statistics are normally based on the measurements made at this 'principal' location.

Since 1978, the GCO, in co-operation with the RO, has installed a number of automatic raingauges which transmit the current rainfall data via telephone lines to the GCO's 'Emergency Control' headquarters. Subsequent



improvements have been made and at present there are 46 GCO gauges and eleven RO gauges in this system, which provide up-to-date rainfall data every five minutes to the operation rooms of the GCO and RO. These data are also stored on computer tape for future reference. The locations of these automatic raingauges (Figure 1) were selected to supplement the existing raingauge network and to provide specific information in areas where slopes were under observation.

In this report, when a comparison is being made for 'daily' rainfalls, the 24-hour maximum rainfall in the rainstorm will be used instead of daily rainfall, since the latter is based on an arbitrary fixed-period of mid-night to midnight which does not necessarily represent the true rainstorm intensity. In addition, when a rainfall amount is quoted without reference to the location of measurement, this will be the amount measured at the RO headquarters.

## 2.2 Royal Observatory Records

The year's weather for 1984 was summarised by the Royal Observatory in the Monthly Weather Summary of December 1984. Their comments for the whole year are as follows :

" As a whole, 1984 was a year with the least amount of sunshine since records began in 1884. There were only 1,701.9 hours of bright sunshine, compared with an annual average of 2,011.6 hours. However, July 1984 was the sunniest month ever on record. The year's total rainfall recorded at the Royal Observatory amounted to 2,017.0 mm which was 9 percent below normal. The annual mean temperature of 22.5°C was also close to the normal value of 22.8°C. The Gale or Storm Signal was hoisted only once, during the approach of Severe Tropical Storm Wynne in June. No severe damage was caused by tropical cyclones in Hong Kong during the year."

The following are excerpts from the same report for the months of May, June and October when the most intense rainstorms of the year occurred :

" May was wetter than normal. The total rainfall for the month amounted to 468.2 mm, which was 57 percent above average. More than one third of the rain fell on 30 May when widespread thunderstorms and heavy showers occurred, causing serious flooding and numerous landslips over various parts of Hong Kong.

The temperature and rainfall in June were normal ..... Widespread thunderstorms and torrential rain on 16 June caused serious flooding and landslips in many places. The worst-hit area was Sai Tau Tsuen in Kowloon City where flood water was reported to be nearly 2-metres deep ..... Tropical cyclone warning signals were displayed for the first time in the year during the approach of Severe Tropical Storm Wynne which brought only slight damage to Hong Kong.

Fine weather prevailed during October. However, the month's total rainfall of 167.1 mm was 38 percent above normal. Most of the rain was recorded on 10 and 11 October when heavy showers occurred. An hourly rainfall amount of 67.2 mm was recorded at the Royal Observatory from 11 pm to midnight on 10 October. This rainfall amount was the second highest on record for October."

A summary of heavy rainstorms in 1984 is given in Table 1. This table shows all days in which 24-hour rainfall at the RO exceeded 50 mm. The three highest 24-hour rainfalls are 175 mm on 16th June, 157 mm on 11th October and 151 mm on 30th May. This table also shows the fifteen-day antecedent rainfalls which occurred prior to the 24-hour periods. Other detailed information in Table 1 will be discussed subsequently in separate sections.

The rainfall data as recorded at the RO, Tsim Sha Tsui, are presented in the following figures. Cumulative rainfall since 1st January is shown in Figure 2. Daily and monthly rainfalls are shown in Figures 3 and 4 respectively. Figures 5 to 7 show the hourly rainfall for the three highest rainfall days of 1984.

### 2.3 Geotechnical Control Office Records

Rainfall data are available from the GCO's 46 automatic raingauges, four of which were installed during 1984. A location map of these gauges is given in Figure 1.

Table 1 shows data from GCO's raingauges for the heavy rainstorms in 1984. The maximum rainfall recorded anywhere in the territory on these occasions are given for three arbitrary durations of one hour, five hours and 24 hours.

The maximum 24-hour and one-hour rainfalls within the territory during the year were 248 mm and 79 mm respectively and both occurred on 16th June.

Appendix B shows hourly rainfall obtained from GCO's raingauges for the three heavy rainstorms, i.e. 30th May, 16th June and 10-11 October.

### 2.4 Rainfall Distribution

Rainfall distribution within different time periods and geographical areas has been assessed from the records of GCO's gauges in Appendix B for the three major rainstorms. On these occasions, heavy rain occurred in the urban areas with only light rain in the New Territories. A large amount of rain fell within a few hours.

Rainfall maps, for 24-hour duration, are shown in Figures 8 to 10 for the three heavy rainstorms. On 30th May, rainfall of over 160 mm fell over the northern part of Hong Kong Island and most of Kowloon. On 16th June, the heavy rain was concentrated in East Kowloon only, and this was also the case for the rainstorm of 11th October. The distribution of rainfall had an important effect on the occurrence of landslides in these areas, and this will be discussed further in Section 3.4.

## 2.5 Warnings Issued by the Royal Observatory

Relevant warnings issued by the RO, and the Landslip Warning jointly issued by the GCO and the RO, are summarised in Table 2.

In 1984, there were 32 Thunderstorm Warnings, eighteen Flood Warnings, three Landslip Warnings and five Tropical Storm Warnings. The highest signal number raised in the year for the Tropical Storm Warning was No. 8 on 25th June. In 1984, tropical storms brought only light rain and there were no significant damages as a result of these storms. Most of these warnings were issued in the period from May to September.

Landslip Warnings were issued after consultation between the GCO and the RO on the basis of a predetermined rainfall criterion. The frequency of this warning in 1984 is the least among other warnings issued by the RO. The three Landslip Warnings were issued on the three days in which the highest 24 hour rainfall was recorded at the Royal Observatory (Table 1). A comparison of these three days with other notable rainfall-landslide days for which the landslip warning was not issued is shown in Table 1. On these three days, fifteen of the reported incidents for which times of the landslides were known accurately (Section 3.1) occurred after the warnings were issued, and one occurred before the warning was issued (on 11th October). Table 1 shows all other notable rainfall-landslide events. Those events not shown had rainfall of less than 50 mm in 24 hours and less than three landslides in any one day.

## 2.6 Comparison with Past Rainstorms

Maximum rainfall amounts of various durations recorded at the RO and GCO raingauges for heavy rainstorms in 1984 are shown in comparison with the recent major rainstorms of May and August 1982 and June 1983 in Table 1. The highest 24-hour rainfall at the RO in 1984 is still less than half of those in the three recent major rainstorms. The highest one-hour rainfall recorded anywhere in 1984 is 79 mm, in comparison with more than 95 mm for the three major rainstorms.

The return periods of heavy rainstorms in 1984 were estimated and they are shown in Table 3, for rainfall durations of one hour to fifteen days. The highest return periods, indicating intense and infrequent rainstorms, are only about four years for one-hour and five hour durations, and are less than two years for rainfall durations greater than twelve hours. It may be concluded, therefore, that rainfall in the year 1984 could generally be expected to occur in any normal year.

In Figure 2, cumulative rainfall since 1st January is shown in comparison with the average (1951-1980), the wettest year (1982) and the driest year (1963) since records began in 1884. The cumulative rainfall was close to the average amount for the whole year. Figure 4 shows monthly rainfall in 1984 in comparison with the recorded maximum (since 1884) and mean (1951-1980) monthly rainfalls. The monthly rainfall exceeded the mean values only for the four months of April, May, June and October.

### 3. LANDSLIDES

#### 3.1 Landslide Occurrence in 1984

The number of incidents reported to various government departments during 1984 are shown in Table 4. The number of landslides affecting various types of area (squatter, road etc.) in Hong Kong, Kowloon and the New Territories are shown in Table 5. The number of major failures are also given in this table. There were eight major failures in 1984, where major is defined as a failure in which the volume of slide debris exceeded 50 m<sup>3</sup>.

A list containing details of all 120 incidents reported to the GCO is provided in Appendix A. A location map for all these incidents is enclosed in Drawing No. GCSP 8/1. Selected photographs of the incidents are illustrated in Plates 1 to 34.

Wherever possible, the dates and times of the landslides were ascertained by the engineers during site inspection. Some incidents were not reported until several days or weeks after the times of occurrence. Out of 120 incidents, the times of occurrence were known to within one day for 88 incidents. The daily number of these incidents are plotted in Figure 3. Of these 88 incidents, the times were ascertained further to within one hour for 44 incidents.

The highest daily number of incidents is fifteen on 30th May and the next highest is eight on 16th June. The next highest number is three and these occurred on four separate occasions. All these occasions are included in Table 1, where the number of incidents reported in newspapers and reported by the Fire Services Department are also shown for comparison. There were less than three incidents in any single day for the rest of the year.

It is likely that there are many more failures which occurred but which were not known to the GCO, including minor failures of no consequence, such as failures in remote areas, open spaces and construction sites. This fact should be borne in mind in reading the following landslide statistics.

#### 3.2 Areas Affected by Incidents

The number of incidents, as reported to government departments, which affected various categories of area are given in Table 5. Landslide consequences, classified according to the type of failure, are shown in Table 6.

##### 3.2.1 Squatter Areas

A total of 60 incidents occurred in squatter areas. Of these, 50 occurred in Kowloon, and most of these were in the Kowloon East region, including Sau On Village, Tai Shing Village, Cheung Lung Tin Village and Lam Tin Villages.

Two major failures affected squatter areas. They are incidents K6/13 (Plates 12 & 13; to be discussed in Section 4.7) and K6/18 (Plates 20 & 21; to be discussed in Section 4.9). Examples of other minor failures in

squatter areas are incidents HK5/7 (Plates 6 & 7; Section 4.4), MW6/1 (Plate 11), K7/1 (Plates 22 & 23), K7/2 (Plate 24) and K9/2 (Plates 33 & 34). Incident HK5/1 (Plate 2) resulted in injury to one person and will be discussed in Section 4.3

Incidents in squatter areas caused permanent evacuation of 109 huts and temporary evacuation of 59 huts. 60% of these evacuations were due to the failures of soil cut slopes (Table 6).

The main cause of the large number of failures in squatter areas is the indiscriminate cutting and filling on steep hillsides and the erection of flimsy huts in these areas. The other important factor is the uncontrolled leakage and discharge of water supply, drainage and storm water pipes over the areas.

### 3.2.2 Buildings

There were nineteen incidents affecting buildings. Four of these were major failures. They are incidents MW6/3 (Plates 18 & 19; Section 4.10), HK9/1 (Plates 26 & 27; Section 4.12) ME9/1 (Plates 29 & 30; Section 4.13), and incident K9/5, which occurred on Stonecutters Island and was dealt with separately by Government Maintenance Surveyor's (GMS) consultant. Other minor failures affecting buildings are incidents ME6/6 (Plates 14 & 15) and ME6/7 (Plates 16 & 17; Section 4.8).

Incidents in this category resulted in partial closure of five buildings. Four of these were caused by soil cut slope failures (Table 7).

### 3.2.3 Roads and Access

33 incidents affected roads and access, none of which were major failures. Examples of incidents of this kind are HK4/2 (Plate 1; Section 4.2), HK5/3 (Plate 3), HK5/6 (Plates 4 & 5), HK5/7 (Plates 6 & 7; Section 4.4), HK5/9 (Plates 8 & 9; Section 4.5), K5/13 (Plate 10; Section 4.6), ME6/3 (Plate 25) and MW9/1 (Plate 28, Section 4.11).

Due to these incidents, 22 sections of road or access were closed to traffic. Eight of these were caused by failures of soil cut slopes.

### 3.2.4 Construction Sites

There were two incidents on construction sites and in both cases these were sites under the control of the GCO's current Landslip Preventive Measures Programme. One of these occurred at Rhondda Road, Kowloon (incident K9/1) and the other occurred at A Kung Ngam Road, Shau Kei Wan (incident HK5/3; Plate 3). No significant damage was caused by these failures.

### 3.2.5 Catchwaters and Reservoirs

Incidents affecting catchwaters and reservoirs were dealt with separately by the Water Supplies Department. There were sixteen incidents of this type, twelve of which occurred in the New Territories. Eight

failures occurred on the Tai Lam Chung Catchwater. In addition it was noted that overflow of the Wong Nai Chung catchwater had caused incident HK5/9 (Plates 8 & 9, Section 4.5).

### 3.2.6 Country Parks and Open Areas

Six incidents in Country Parks were reported by the Agriculture and Fisheries Department. One of these was a flash flooding over 100 hectares of farmland in the New Territories on 30th May, but no significant damage was reported. In addition, the GCO inspected three incidents in open areas. Two of these were major failures, incidents K5/3 and K5/4, but they were of no consequence.

### 3.3 Types of Incidents

The incidents reported to the GCO during 1984 were classified into six types of failure and the number in each type are shown in Table 7. Damages from various types of failure are shown in Table 6.

#### 3.3.1 Fill Slopes

There were fourteen fill slope failures, which was twelve percent of all incidents reported to the GCO. One of them was a major failure, incident K6/18 (Plates 20 & 21; Section 4.9). Examples of other minor fill slope failures are incident HK4/2 (Plate 1; Section 4.2) and incident ME6/1 (Plate 11).

#### 3.3.2 Cut Slopes

There were 70 cut slope failures, which is 59% of all incidents. These were classified further according to types of materials, i.e. soil, soil/rock and rock cut slope failures.

There were 62 soil cut slope failures. Three of these were major, i.e. incidents MW6/3 (Plates 18 & 19; Section 4.10), ME9/1 (Plates 29 & 30; Section 4.13) and K9/5 on Stonecutters Island. 37 out of 59 remaining minor failures occurred in squatter areas. Minor soil cut slope failures are typified by incidents HK5/6 (Plates 4 & 5), ME6/6 (Plates 14 & 15), K7/1 (Plates 22 & 23), K7/2 (Plate 24), K9/2 (Plates 33 & 34) and MW9/1 (Plate 28; Section 4.11).

There were six soil/rock cut slope failures. One of these was a major failure, i.e. incident HK9/1 (Plates 26 & 27; Section 4.12). Other minor failures are incidents HK5/7 (Plates 6 & 7; Section 4.4), ME6/7 (Plates 16 & 17; Section 4.8) and ME6/3 (Plate 25).

There were only two rock cut slope failures, both of which were minor. They are incidents MW5/1 and HK5/3 (Plate 3).

#### 3.3.3 Retaining Walls

There were eleven retaining wall failures, none of which was major.

Examples of these failures are incident HK5/9 (Plates 8 & 9; Section 4.5) and MW 9/3 (Plates 31 & 32).

#### 3.3.4 Natural Slopes

There were four natural slope failures, one of which was major. This is incident K6/13 (Plates 12 & 13; Section 4.7).

#### 3.3.5 Rock/Boulder Falls

These were seven failures in this category, all of which were minor failures.

#### 3.3.6 Other Failures

Other failures are incidents which cannot be properly classified into the above categories. These included erosion gullies, settlement and subsidence, and hut collapse. There were fourteen failures of this type. Two of these incidents, K5/3 and K5/4, were major failures in open areas with no significant consequences. Minor failures of this type are incidents HK5/1 (Plate 2; Section 4.3) and K5/13 (Plate 10; Section 4.6).

### 3.4 Rainfall-Landslide Relationships

The primary cause of a large majority of all failures in 1984 was rainfall. Other failures were mostly isolated incidents caused by such things as leakage of services, water from fire fighting and indiscriminate activities relating to earthworks and drainage alterations in squatter areas.

The geographical distribution of rainfall has a considerable effect on the occurrence of landslides in various areas. Figures 8 to 10 show the location of landslides for which dates of occurrence are known, imposed on the 24-hour rainfall maps for the three heavy rainstorms of 30th May, 16th June and 11th October respectively. A close relationship between landslide and rainfall distribution can be seen in these figures. More detailed and comprehensive discussions on rainfall-landslide relationships can be found in Brand et al (1984), where data over the past 20 years have been analysed, in contrast to the one-year data presented in this report.

## 4. NOTABLE INCIDENTS

### 4.1 Introduction

Twelve out of the 120 GCO incidents are discussed in more detail in this section. These are presented in chronological order. The nature of the incident is referenced under the caption of each incident. The selection of these incidents was based mainly on the size of failure.

In addition to the above, the last two sections describe two other major failures which were investigated by the GCO but were not included in the list of GCO incidents because of their special nature.

#### 4.2 Incident HK4/2, 5 Coombe Road

(Date : 28th April, minor fill slope failure affecting road, Plate 1)

This landslide occurred on 28th April, after one-day rainfall of 44.4 mm on 27th April. The failure occurred on the down slope side of Coombe Road, on an old fill slope (catalogued as 11SW-D/F107), and resulted in a loss of most of the fill material (about 40 m<sup>3</sup>). The road was undermined and settled, and the services were interrupted. As a result, half of the road was closed, pending the repair work. The probable causes were slow movement of the fill over a period of several months, leakage of services and infiltration of rainfall. In addition it was noted that for many months prior to the failure, the road had been subjected to unusually heavy traffic as it was used for traffic diversion during the repair of the Peak Road failure which occurred in June 1983.

#### 4.3 Incident HK5/1, Tsin Shui Ma Tau Village, Shau Kei Wan

(Date : 3rd May, hut collapsed in squatter area, one person injured, Plate 2)

The incident occurred at about 3 pm on 3rd May, resulting in a loss of foundation support and concrete floor of a collapsed hut. One man was injured in the incident. Five other huts in the area were also affected and were temporarily evacuated. Repair works were carried out on the slope and subsequently the damaged hut was reinstated.

#### 4.4 Incident HK5/7, Aldrich Terrace, Ngoi Man Street

(Date : 30th May, minor soil/rock cut slope failure affecting road and squatter huts, Plates 6 & 7)

The failure occurred at about noon on 30th May during heavy rainfall (see Figure 5 and Table 1). This is the catalogued slope 11SE-B/C80, and the failure occurred at a height of about 30 m above the slope toe, involving 20 m<sup>3</sup> of completely decomposed granite soil (CDG) and rock materials. The slip debris fell down and spread over Ngoi Man Street. As a result the road was closed, four huts were permanently evacuated and ten huts were temporarily evacuated. The probable cause of the failure was the scouring action of storm water discharged by make-shift channels which had been constructed by the squatters following blockage of the original slope channels.

#### 4.5 Incident HK5/9, Repulse Bay Road near House No. 11

(Date : 30th May, minor failure of retaining structure affecting road, Plates 8 & 9)

This landslide occurred at about 9 am on 30th May during heavy rain (Figure 5 and Table 1). The failure involved the collapse of a 3 m high random rubble wall, with slip debris of about 30 m<sup>3</sup>. Two water pipes and a drain pipe were broken and utility cables were exposed. Due to the failure the road was entirely closed for twelve hours, after which one lane



was opened to traffic while the other lane was closed pending the repair work. The probable cause of failure was the persistent and large volume of overflowing water crossing the road due to blockage of the Wong Nai Chung catchwater above the road on the opposite side.

The repair work involved reinstatement by compacted rock-fill with sprayed concrete surface protection.

#### 4.6 Incident K5/13, Hong Chong Road Embankment, Hung Hom

(Date : 30th May, minor failure of fill embankment affecting road, Plate 10)

The incident also occurred during the notable storm on 30th May (Table 1). The existing surface protection was stone pitching without weepholes. A 10 m long horizontal crack near the toe was observed. An amount of soil washed out from the crack had accumulated at the toe. Severe bulging of the embankment was also noted. No significant damage to the road or disruption to traffic was caused by this incident. Even though the incident occurred on a day of heavy rainfall, it was also noted that a water main had burst in the vicinity at the time, and it is considered that this was probably the major cause of this failure.

The repair was carried out by excavating the failed embankment and backfilling with compacted fill, with provision of weepholes.

#### 4.7 Incident K6/13, Lion Rock Park

(Date : 17th June, major failure on natural slope affecting squatters, Plates 12 & 13)

This landslide occurred at about 11 am on 17th June, the day after the heavy rainfall on 16th June (Table 1). The site is a 20 m high natural slope in CDG which had experienced previous failures. The slip debris volume was about 70 m<sup>3</sup>. The failure affected a squatter footpath at the top of slope and the Lion Rock Park at the toe, and as a result part of the park area was cordoned off. The probable cause was rainfall infiltration and sewage discharge from squatter huts at the top of the slope.

#### 4.8 Incident ME6/7, Yim Tso Ha Tsuen, North District

(Date : 22nd June, minor failure on soil/rock cut slope affecting building, Plates 16 & 17)

This failure occurred at about 9 pm on 22nd June, six days after heavy rain on 16th June (Table 1) and with rainfall in the intervening period of 75 mm. The site is a 12 m high soil/rock cut slope behind a village house. The superficial soil of 1-2 m thick had slipped along a 60° dipping joint plane in highly to moderately weathered volcanic rock. The slip debris consisted of soil, rock and large boulders, with a volume of about 30 m<sup>3</sup>, and piled up to 1.5 m high against the rear wall of the house. However, no structural damage to the house was observed.

Repair work was carried out on the damaged area by trimming the slope and providing surface protection and drainage.

#### 4.9 Incident K6/18, Fuk Tak New Village, Kowloon

(Date : 25th June, major failure on quarry spoil fill slope affecting squatters, Plates 20 & 21)

The failure occurred on 25th June during a rainstorm (Table 1). The material involved was quarry spoil, which had been dumped on a natural slope adjacent to the quarry. This dump had failed previously and the new failure occurred just below the old slip scar. The failed mass was 0.5 m thick, 3-4 m wide and the debris volume of about 50 m<sup>3</sup> slipped down slope to a squatter village below. As a result, three huts were permanently evacuated. No repair work was undertaken.

#### 4.10 Incident MW6/3, CLP Substation, Kwai Chung

(Date : 26th June, major failure of soil cut slope affecting buildings, Plates 18 & 19)

This failure was one of the largest in 1984 and occurred at about 5 pm on 26th June, the day after the rainstorm on 25th June (Table 1). The 10 m high soil cut slope (catalogued was 7SW-C/CR103) failed for the entire length of 20 m, with a debris volume of about 300 m<sup>3</sup> piled up to 3 m high against the China Light & Power (CLP) power substation. The top of the slip surface extended into part of a platform at the crest of the slope, on which a factory has been built. Cracks were observed on the wall of the substation and temporary shoring was erected inside by CLP. There was continuous discharge from broken water pipes and sewers on to the failure area. Hoarding was erected around the 132 KV cable for protection against further failures, which could have caused power cuts throughout Kwai Chung. The probable causes of failure were infiltration of stormwater from broken sewers as well as effluents from the factory at the top of slope.

A Dangerous Notice was subsequently issued and permanent remedial work is being carried out on the failed slope.

#### 4.11 Incident MW9/1, 20 MS Castle Peak Road, Tuen Mun

(Date : 1st September, minor soil cut slope failure affecting road, Plate 28)

This landslide occurred at about 4 pm on 1st September during a rainstorm (Table 1). It was a failure on a 70°, 7 m high soil cut slope and the slide debris volume was about 30 m<sup>3</sup>. The debris blocked the footpath and one lane of the road. The fence of the private lot at the top of slope was also affected. The east-bound carriageway of Castle Peak Road was closed while repair work on the slope was being carried out, and a temporary road diversion was provided during this period. The probable cause of failure was storm water infiltration at the top of the slope.

4.12 Incident HK9/1, 206-208 Tsat Tsz Mui Road, North Point

(Date : 2nd September, major failure of soil/rock cut slope affecting building, Plates 26 & 27)

This was another large failure and occurred at about 7am on 2nd September on a soil/rock cut slope (catalogued as 11SE-A/C85) of 15 m height and 85° slope angle, with a school at the top and a factory building at the toe of the slope. The slip debris volume was about 180 m<sup>3</sup> and caused complete collapse of one panel of the rear wall of the factory building, through which the debris fell and piled up inside on the ground floor. The walls on the first and second floors were also damaged. Partial closure of these floors of the factory was enforced, pending temporary remedial works. The landslide took place during heavy rainfall (Table 1). The probable causes were infiltration and the wedging effects of tree roots on the thick soil mass overlying adversely jointed rock.

Two minor failures had occurred previously at this site, in June 1982 and October 1983. A Dangerous Notice had been issued after the second of these two failures. At present the repair scheme to prevent further failures is being expedited by a private consultant.

4.13 Incident ME9/1, Fui Yiu Ha, Sai Kung

(Date : 7th September, major failure of soil cut slope affecting building, Plates 29 & 30)

This failure occurred at about 6 am on 7th September, five days after the rainstorm of 1st-2nd September (Table 1). Part of a soil cut slope of about 13 m high collapsed, with a slip debris volume of about 70 m<sup>3</sup>. The slip left a boulder of about 4 m<sup>3</sup> perched on the slope crest. The debris piled up on top of the canopy of the rear yard of house no. 58. As a result, a Dangerous Notice and Temporary Closure Order were issued to owners of the two affected houses. The probable cause was saturation of the volcanic soil due to the bursting and leaking of a water-bearing pipe.

The failed slope was subsequently reinstated. The water-bearing pipe was diverted after completion of the slope remedial works.

4.14 Area 19 Tuen Mun

(Continuing major movement of soil cut slope, Plates 35 & 36)

Borrow Area 19 was designated for the construction of housing within the Tuen Mun New Town. It was originally planned to accommodate some 50,000 people. Initial earthworks for site formation commenced in 1977 and slope instability has been a continuing problem in the area since then. The area is covered by an extensive mantle of colluvium, overlying highly fractured, decomposed volcanic soil and rock. Occasional major and minor failures were observed every year from 1977 to 1983 while the site formation was in progress. By May 1984, the newly-formed major cut slope had been regraded and revegetated. Damaged chevron drains were also repaired. However, new distress was observed on May 13th, and by June major movement had occurred with settlement of over 2 m. The extent of the failure can be

seen in Plates 35 and 36. The persistent occurrence of slope instability has affected the original planned use of Area 19. One possible cause of the prolonged instability is that formation of the borrow area has disrupted the existing subsurface and surface drainage pattern.

Detailed information on the sequence of instability in the area can be found in Planning Report PR 1/84 (Styles et al, 1984).

#### 4.15 Junk Bay Controlled Tip

(Date : 18th March, major failure of controlled tip on top of soft marine clay, Plates 37 & 38)

A controlled tip has been under construction in the Junk Bay area since 1977. The tip occupies a site on the shoreline of Junk Bay near Pak Shin Kok. It has been developed in stages by the formation of lagoons with temporary enclosing bunds and then back-filled with refuse to a predetermined height. Further lagoons were then built, giving a general advance of the controlled tip away from the shoreline. Temporary jetties were also constructed adjacent to the bunds and this involved dredging and backfilling, which was completed by the end of 1983. The final boundary of the tip will be formed by a permanent sea wall. The tip has been built on top of a layer of soft marine clay. A number of minor and some substantial failures occurred during the course of construction.

A major failure involving 500,000 m<sup>3</sup> of material occurred on 18th March, 1984 when the tip had been built up to a height of +22 mPD. Maximum movements recorded were 8 m vertically and 20 m horizontally. Aerial views of the failure are given in Plates 37 and 38. Details of these movements are discussed in Advisory Report ADR 17/84 (Powell et al, 1984).

#### 5. CONCLUSIONS

Rainfall amounts for various durations during 1984 can generally be considered as normal in comparison with previous years. Over the whole year 120 landslide and related incidents were reported to the GCO District Divisions and the damages resulting from these incidents may be summarised as follows : one person injured, 168 huts evacuated, five buildings partially closed and 22 sections of road and access closed. Most of these damages were caused during or shortly after rainstorms. The three most intense and damaging storms occurred on 30th May, 16th June and 11th October. The Landslip Warning was issued on each of these three occasions.

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Table 1 - Rainfall - Landslide Events in 1984 with 24-hour Rainfall Greater than 50 mm

| Date   | Maximum Rainfall (mm) |      |      |            |        |                 |      |      | Landslide Consequences        |           |     |                           |   |
|--|-----------------------|------|------|------------|--------|-----------------|------|------|-------------------------------|-----------|-----|---------------------------|---|
|  | Royal Observatory     |      |      |            |        | GCO Raingauges  |      |      | Number of Landslides Reported |           |     | Number Killed/<br>Injured | Number Huts<br>Evacuated<br>Permanently |
|  | 24-hr                 | 1-hr | 5-hr | Antecedent |        | 24-hr           | 1-hr | 5-hr | GCO                           | Newspaper | FSD |                           |   |
|  |                       |      |      | 4-day      | 15-day |                 |      |      |                               |           |     |                           |   |
| 16/6   | 175                   | 49   | 155  | 14         | 110    | 248             | 79   | 226  | 8                             | 5         | 1   | -                         | 16                                      |
| 10-11/10   | 157                   | 67   | 152  | 0          | 23     | maximum at R.O. |      |      | 3                             | -         | -   | -                         | 2                                       |
| 30/5   | 151                   | 29   | 103  | 64         | 228    | 246             | 67   | 154  | 15                            | 14        | -   | -                         | 14                                      |
| 1-2/9  | 105                   | 14   | 34   | 6          | 65     | 154             | 31   | 38   | 3                             | 2         | 1   | -                         | 6                                       |
| 4-5/8  | 89                    | 36   | 53   | 3          | 8      | 122             | 65   | 98   | 1                             | -         | -   | -                         | -                                       |
| 11/8   | 83                    | 26   | 51   | 23         | 135    | 206             | 41   | 89   | 3                             | 1         | -   | -                         | 7                                       |
| 9/7  | 76                    | 25   | 42   | 22         | 129    | 91              | 25   | 43   | 3                             | -         | -   | -                         | -                                       |
| 17-18/5  | 72                    | 18   | 60   | 38         | 88     | 129             | 45   | 101  | 1                             | -         | -   | -                         | 3                                       |
| 17/4   | 66                    | 35   | 62   | 14         | 22     | 83              | 44   | 77   | -                             | -         | -   | -                         | -                                       |
| 4/6  | 57                    | 30   | 31   | 5          | 256    | 133             | 35   | 56   | -                             | -         | -   | -                         | -                                       |
| 25/6   | 56                    | 18   | 39   | 37         | 268    | 72              | 40   | 53   | 1                             | -         | -   | -                         | 3                                       |
| Recent major rainstorms ( for comparison only )  |                       |      |      |            |        |                 |      |      |                               |           |     |                           |   |
| 29/5/82  | 394                   | 44   | 153  | 1          | 11     | 430             | 111  | 237  | 551                           | 498       | 15  | 48                        | 1153                                    |
| 16/8/82  | 362                   | 68   | 159  | 0          | 346    | 370             | 95   | 290  | 138                           | 62        | 6   | 9                         | 200                                     |
| 17/6/83  | 347                   | 69   | 274  | 2          | 77     | 460             | 101  | 303  | 155                           | 114       | 5   | 2                         | 149                                     |
| Note: (1) The events are arranged in order of 24-hour rainfall at the Royal Observatory, Tsim Sha Tsui.<br>(2) For the rest of 1984, there were less than 3 landslips in any one day reported to GCO.<br>(3) Newspaper searched is South China Morning Post. |                       |      |      |            |        |                 |      |      |                               |           |     |                           |   |
| Abbreviation: GCO = Geotechnical Control Office; FSD = Fire Services Department; R.O. = Royal Observatory  |                       |      |      |            |        |                 |      |      |                               |           |     |                           |   |

Table 2 - Type and Date of Warnings Issued by the Royal Observatory in 1984

| Month  | Dates of Warnings               |                 |                      |  |
|--|---------------------------------|-----------------|----------------------|--|
|  | Thunderstorm                    | Flood           | * Landslip           | Tropical Storm                                   |
| January  | -                               | -               | -                    | -  |
| February   | -                               | -               | -                    | -  |
| March  | 19                              | -               | -                    | -  |
| April  | 17, 18, 21, 27, 28              | 17, 21, 27, 28  | -                    | -  |
| May  | 4, 14, 19, 28-30                | 4, 17-19, 29-30 | 30 (7a.m. to 3p.m.)  | -  |
| June   | 2-5, 16, 28                     | 4, 5, 16, 25,   | 16 (4a.m. to 11a.m.) | 24-25 ( No. 8, Wynne )                           |
| July   | 3, 31                           | -               | -                    | 7-8 ( No. 3, Betty )                             |
| August   | 1, 4, 9, 10, 13, 14, 15, 26, 27 | 4, 11, 21       | -                    | 16-21 ( No. 3, Gerald )<br>29-31 ( No. 1, June ) |
| September  | 12, 13, 16, 17, 18, 20, 22      | 1, 16, 18       | -                    | 4-5 ( No. 3, Ike )                               |
| October  | 4                               | 11              | 11 (2a.m. to 6a.m.)  | -  |
| November   | -                               | -               | -                    | -  |
| December   | -                               | -               | -                    | -  |
| Total Number   | 32                              | 18              | 3                    | 5  |
| Legend:<br>* Landslip warnings were issued after consultation between GCO & RO |                                 |                 |                      |  |



Table 3 - Maximum Rainfalls during 1984  
and Estimated Return Periods

| Period  | * Rainfall<br>(mm) | Ending Time |       | † Estimated<br>Return Period,<br>Year |
|---|--------------------|-------------|-------|---------------------------------------|
|   |                    | Date        | Hours |                                       |
| 1 hour  | 67.2               | 10/10       | 2400  | 4                                     |
| 5 hour  | 155.2              | 16/6        | 0600  | 4                                     |
| 12 hour   | 172.5              | 16/6        | 1300  | 2                                     |
| 24 hour   | 174.7              | 16/6        | 2200  | < 2                                   |
| 2 day   | 201.1              | 30/5        | -     | < 2                                   |
| 4 day   | 206.4              | 31/5        | -     | < 2                                   |
| 7 day   | 270.8              | 4/6         | -     | < 2                                   |
| 15 day  | 381.3              | 30/5        | -     | < 2                                   |
| Legend:<br>* Rainfall at Royal Observatory, Tsim Sha Tsui<br>† Gumbel equation, Peterson & Kwong (1981) |                    |             |       |                                       |

Table 4 - Number of Incidents Reported to Various Offices/Departments during 1984

| Office/Department  | Total Number | Types of Incident |                        |        |
|--|--------------|-------------------|------------------------|--------|
|  |              | Landslip          | Flooding               | Others |
| Geotechnical Control Office  | 120          | 106               | -                      | 14     |
| Water Supplies Department  | 16           | 14                | 1                      | 1      |
| Fire Services Department   | 8            | 2                 | 3                      | 3      |
| Agriculture & Fisheries Department   | 6            | 5                 | 1                      | -      |
| Highways Office  | *            | *                 | over 5000 <sup>†</sup> | *      |
| Housing Department (Housing Estates)   | -            | -                 | -                      | -      |
| Legend:<br>* Landslips reported to H.O were referred to, and included in the incidents of GCO<br>† Most of these floodings occurred in Kowloon and they were not related to rainstorms |              |                   |                        |        |

Table 5 - Landslides during 1981 Classified by Affected Area

| Location                                     | Hong Kong | Kowloon | New Territories | All Areas |
|--|-----------|---------|-----------------|-----------|
| Squatters                                    | 7         | 50 (2)  | 3               | 60 (2)    |
| Buildings                                    | 5 (1)     | 4 (1)   | 10 (2)          | 19 (4)    |
| Roads  | 12        | 11      | 10              | 33        |
| Construction Site                            | 1         | 1       | -               | 2         |
| Catchwaters                                  | 2         | 2       | 12              | 16        |
| Country Parks/<br>Open Areas                 | -         | 2 (2)   | 7               | 9 (2)     |
| Total  | 27        | 70      | 42              | 139       |
| Legend:<br>( )      Number of major failures |           |         |                 |           |

Table 6 - Consequence Related to Type of Failures in 1984

| Type of Failure    |             | No. of Huts Evacuated |           | Closure of Part of Building | Road/ Access Blocked |
|--------------------|-------------|-----------------------|-----------|-----------------------------|----------------------|
|                    |             | Permanent             | Temporary |                             |                      |
| Fill Slope         |             | 10                    | 5         | -                           | 2                    |
| Cut Slope          | Soil        | 79                    | 23        | 4                           | 8                    |
|                    | Soil / Rock | 4                     | 10        | 1                           | 2                    |
|                    | Rock        | -                     | -         | -                           | 2                    |
| Retaining Wall     |             | 8                     | 9         | -                           | 2                    |
| Natural Slope      |             | -                     | -         | -                           | 2                    |
| Rock/ Boulder Fall |             | 1                     | 1         | -                           | 4                    |
| Others             |             | 7                     | 11        | -                           | -                    |
| Total              |             | 109                   | 59        | 5                           | 22                   |

Table 7 - Type of Incidents Reported to GCO during 1984

| Type of Incident                           |             | Number | Percentage |
|--|-------------|--------|------------|
| Fill Slope                                 |             | 14 (1) | 12 %       |
| Cut Slope                                  | Soil        | 62 (3) | 52 %       |
|  | Soil / Rock | 6 (1)  | 5 %        |
|  | Rock        | 2      | 2 %        |
| Retaining Wall                             |             | 11     | 9 %        |
| Natural Slope                              |             | 4 (1)  | 3 %        |
| Rock/Boulder Fall                          |             | 7      | 6 %        |
| Others                                     |             | 14 (2) | 11 %       |
| Total                                      |             | 120    | 100 %      |
| Legend:<br>( )    Number of major failures |             |        |            |

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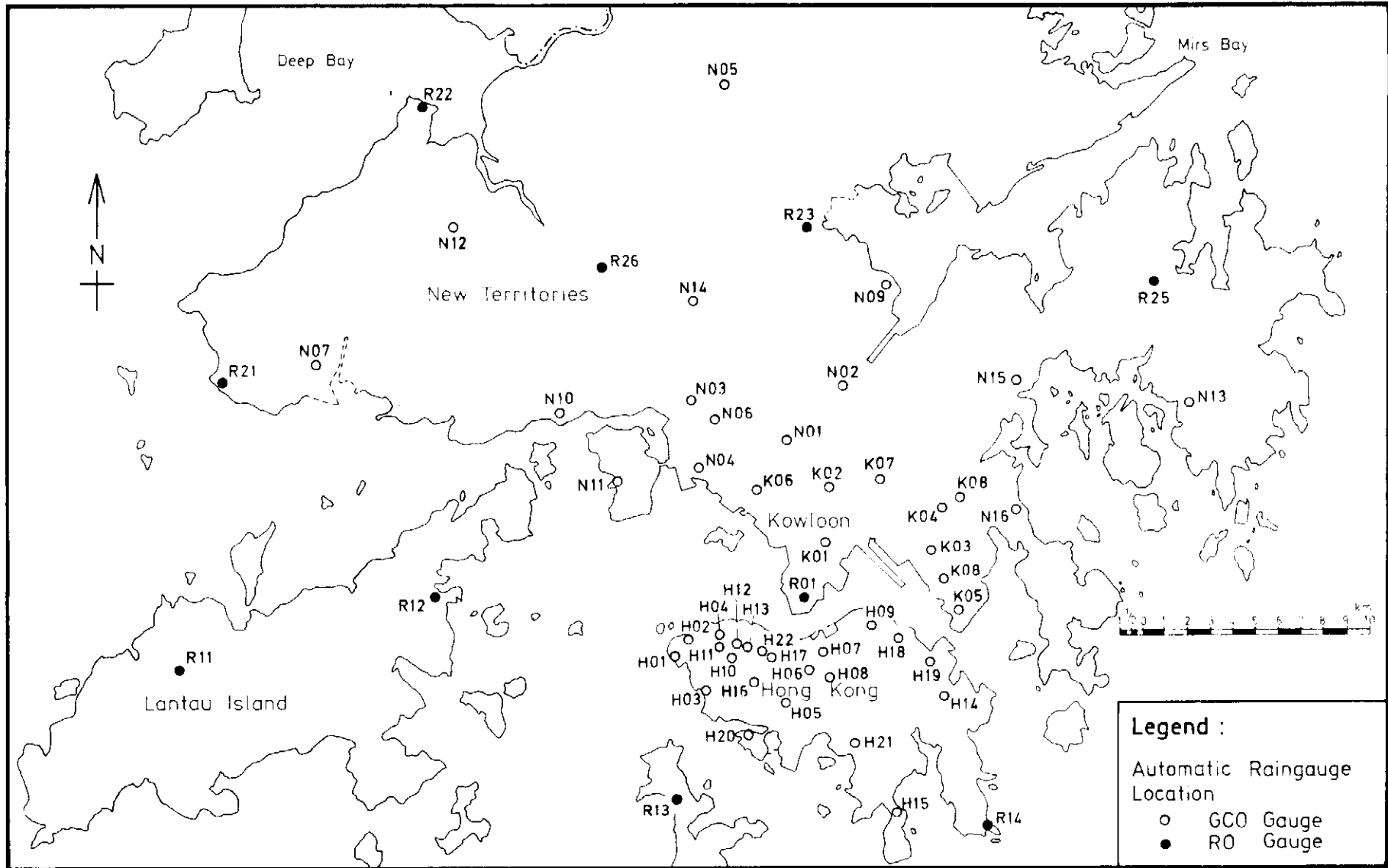


Figure 1 - Location of GCO and RO Automatic Raingauges

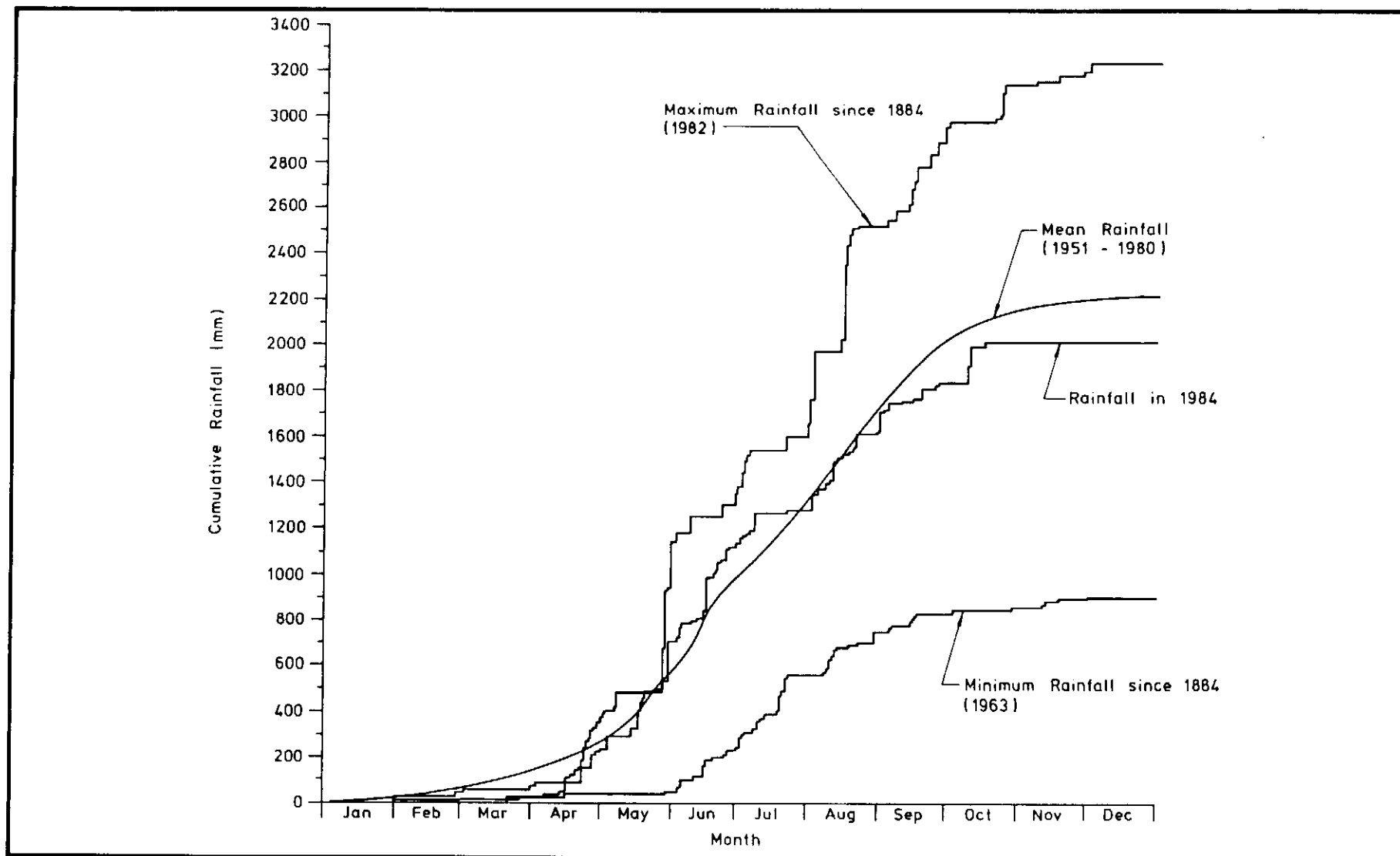


Figure 2 - Cumulative Rainfall since 1st January for 1984 and the Recorded Maximum, Mean and Minimum Cumulative Rainfalls



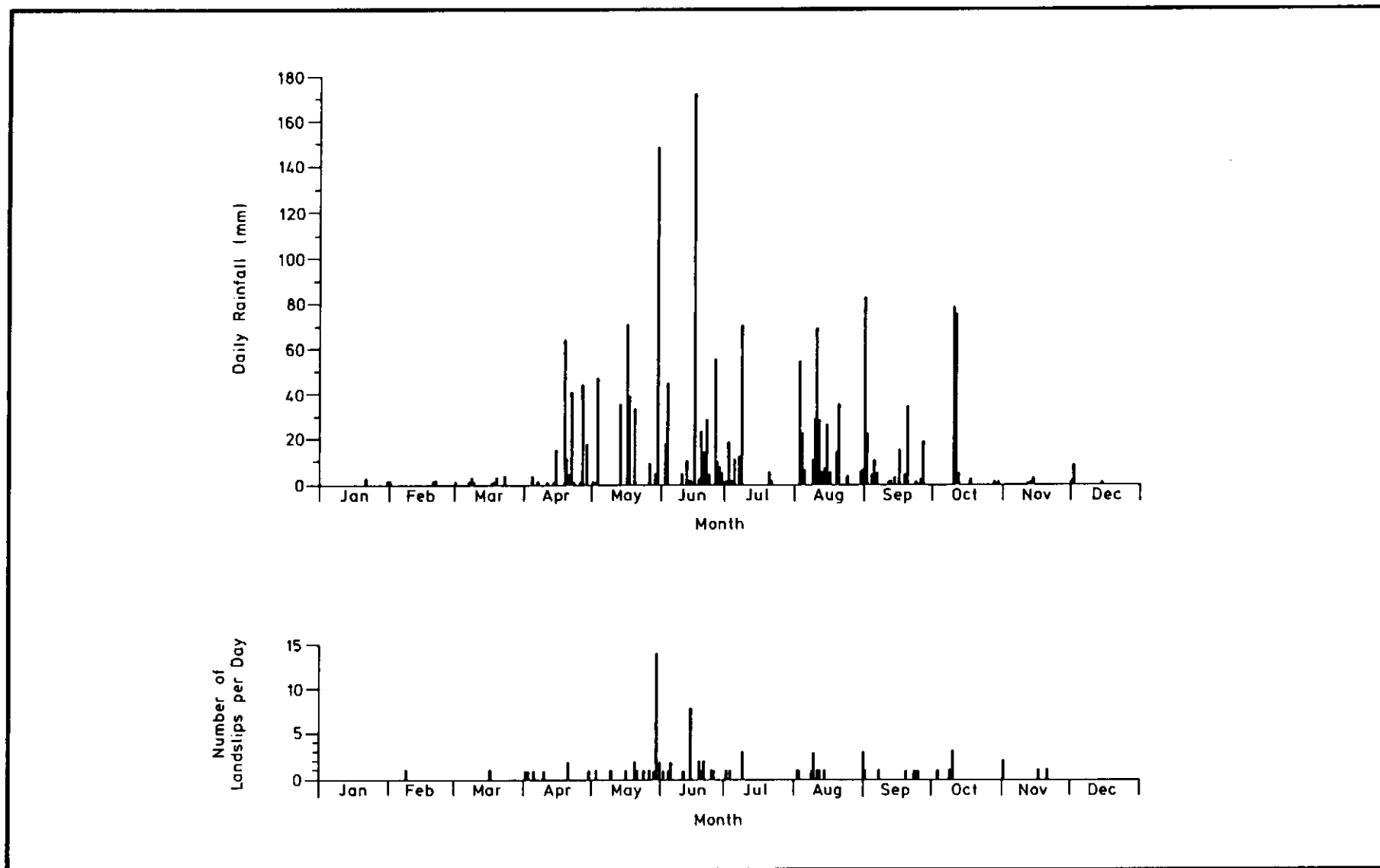


Figure 3 - Daily Rainfall and Distribution of Number of Landslides over the Year 1984

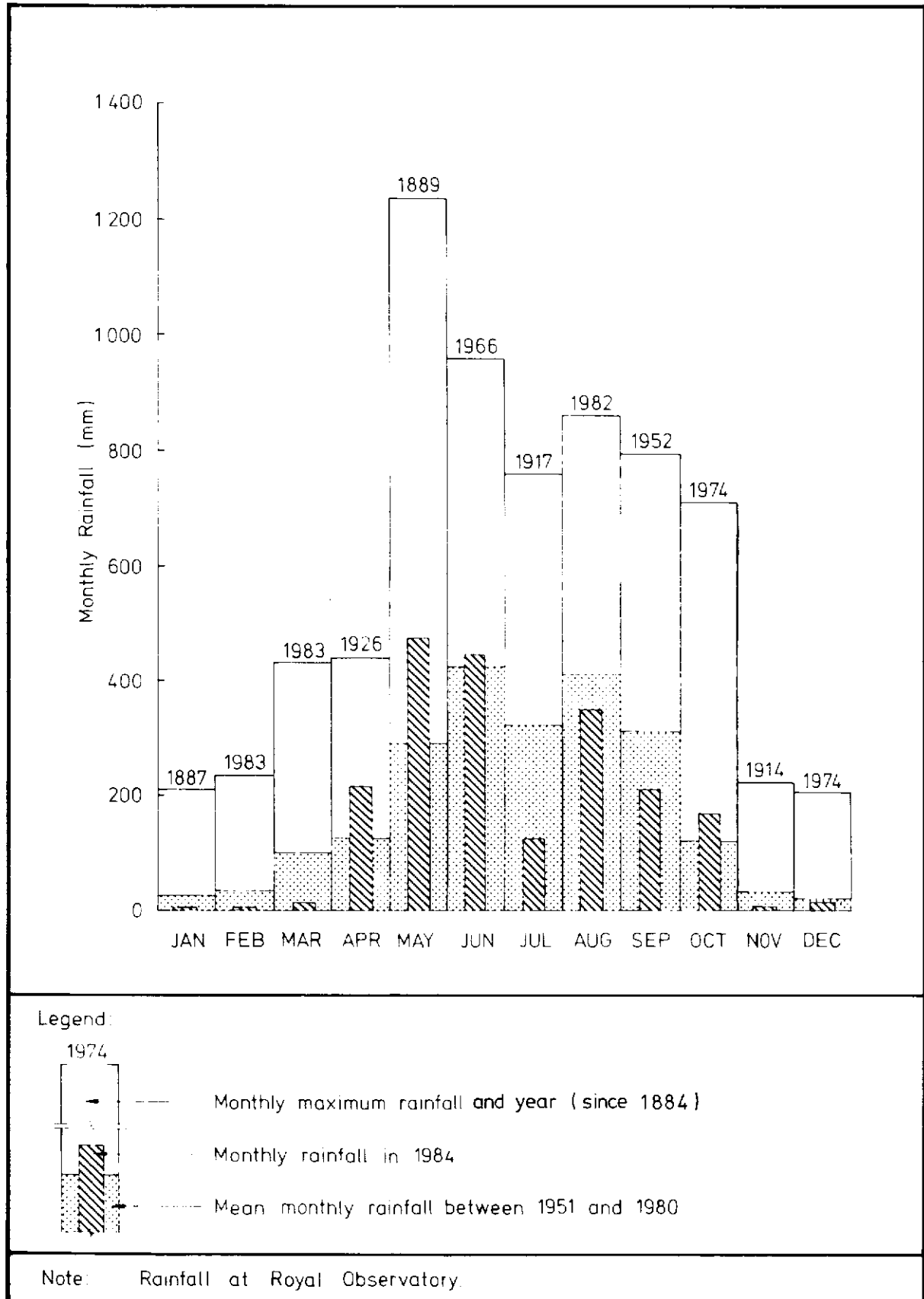


Figure 4 - Monthly Rainfalls in 1984 in Comparison with Recorded Maximum and Mean Monthly Rainfalls

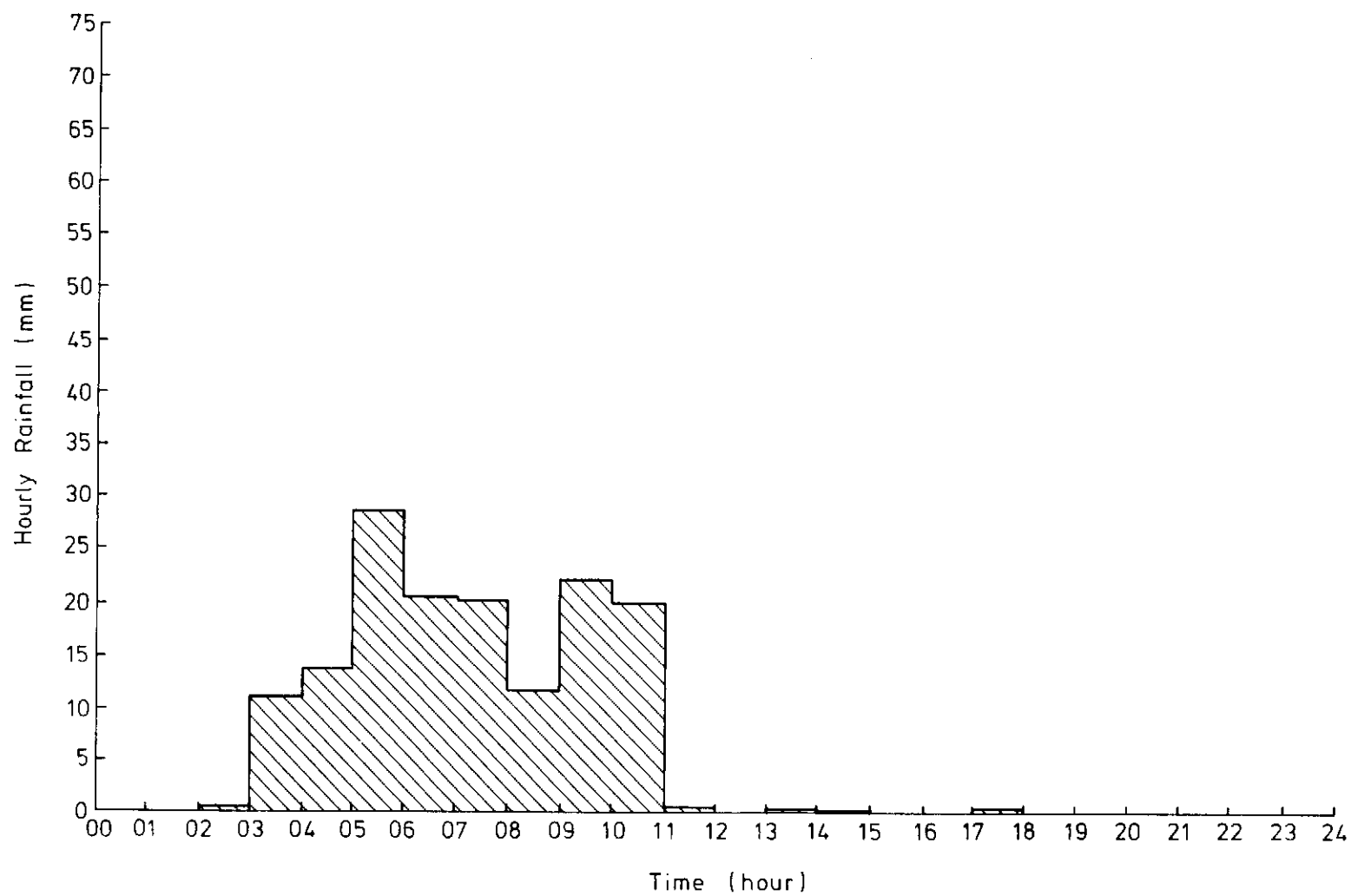


Figure 5 - Histogram of Hourly Rainfall at the Royal Observatory on 30.5.84

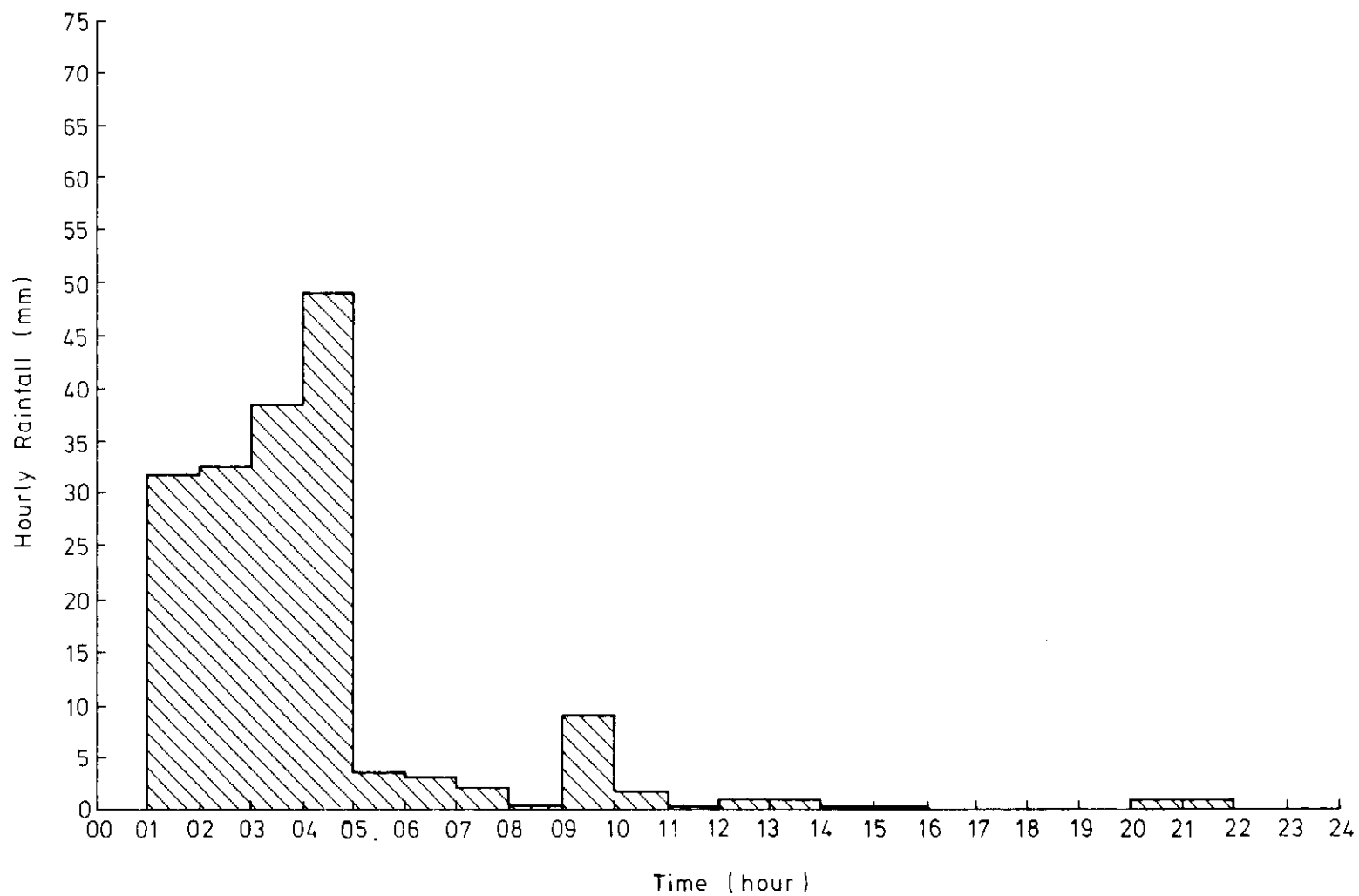


Figure 6 - Histogram of Hourly Rainfall at the Royal Observatory on 16.6.84

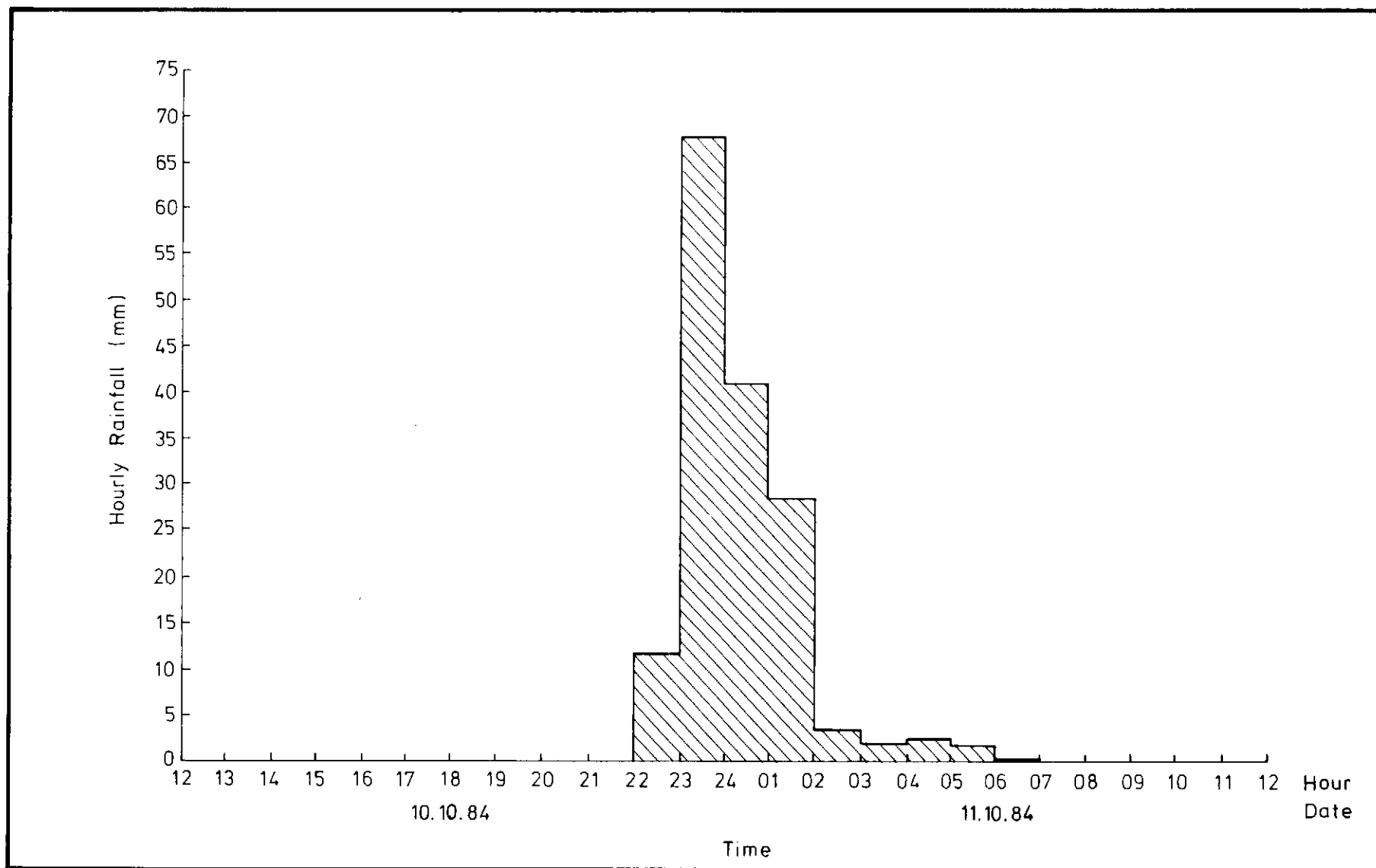


Figure 7 - Histogram of Hourly Rainfall at Royal Observatory from noon 10.10.84 to noon 11.10.84

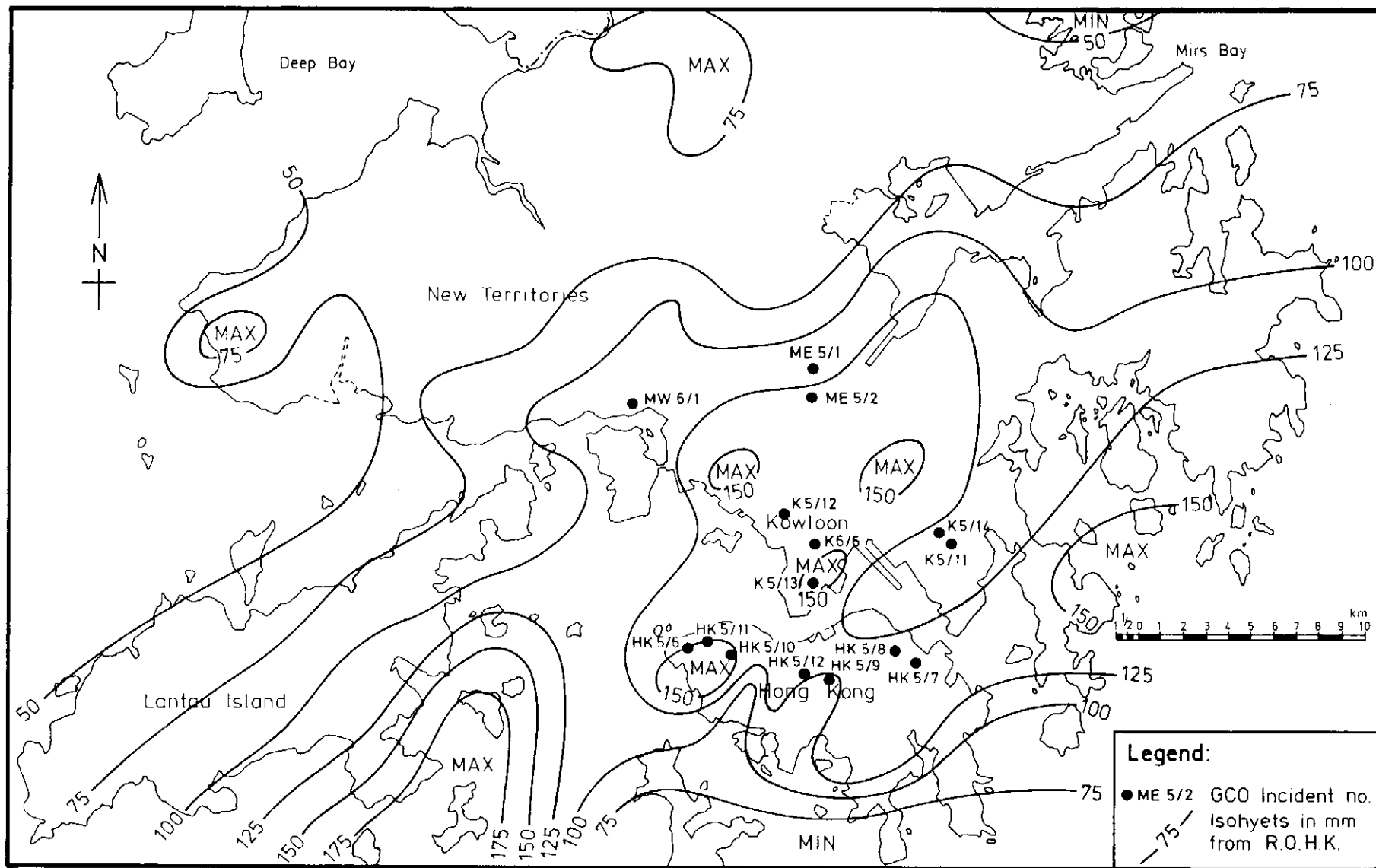


Figure 8 - 24-hour Rainfall Distribution Ending at 3 pm 30.5.1984 and Location of Landslides

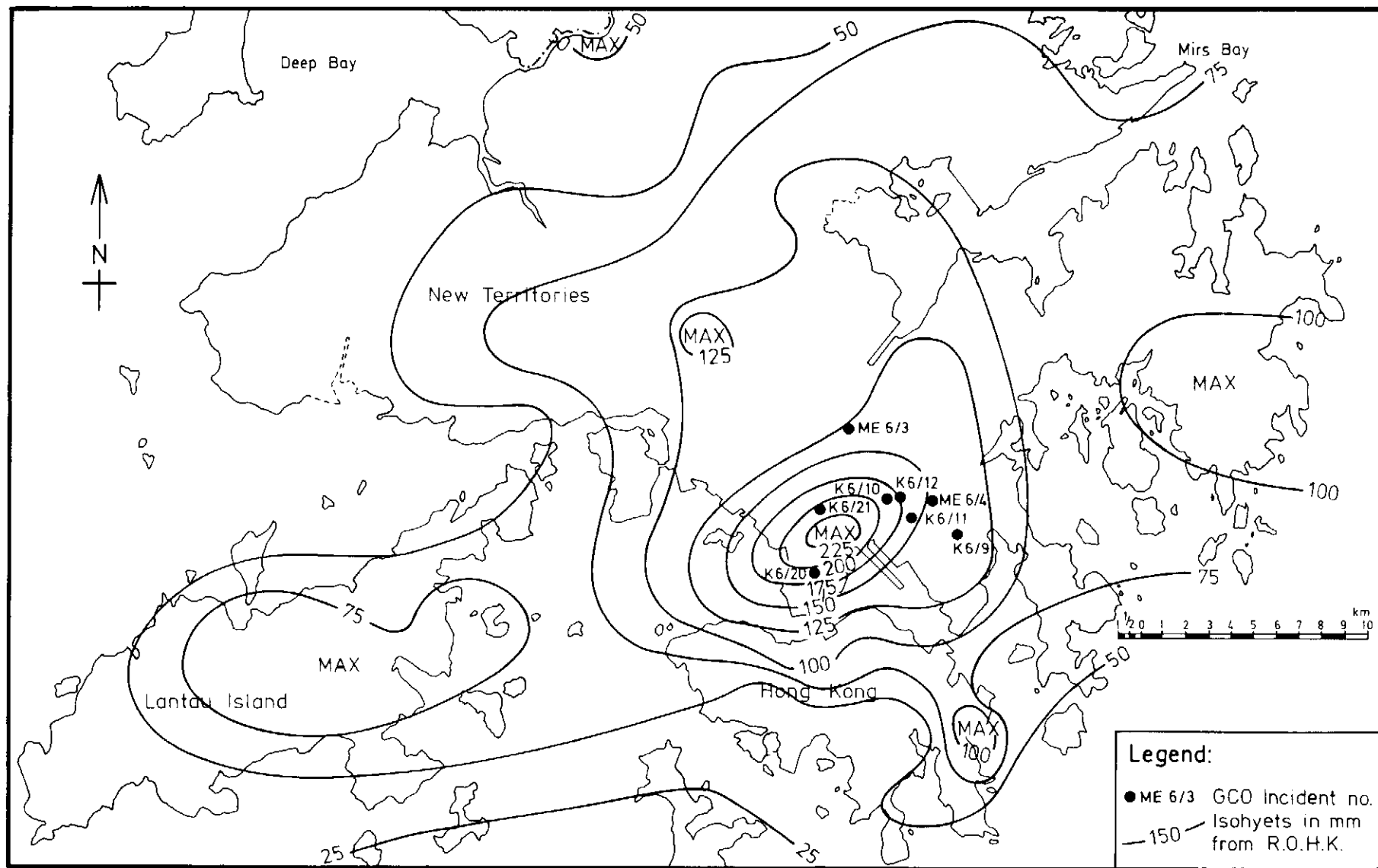


Figure 9 - 24-hour Rainfall Distribution Ending at 3 pm 16.6.1984 and Location of Landslides

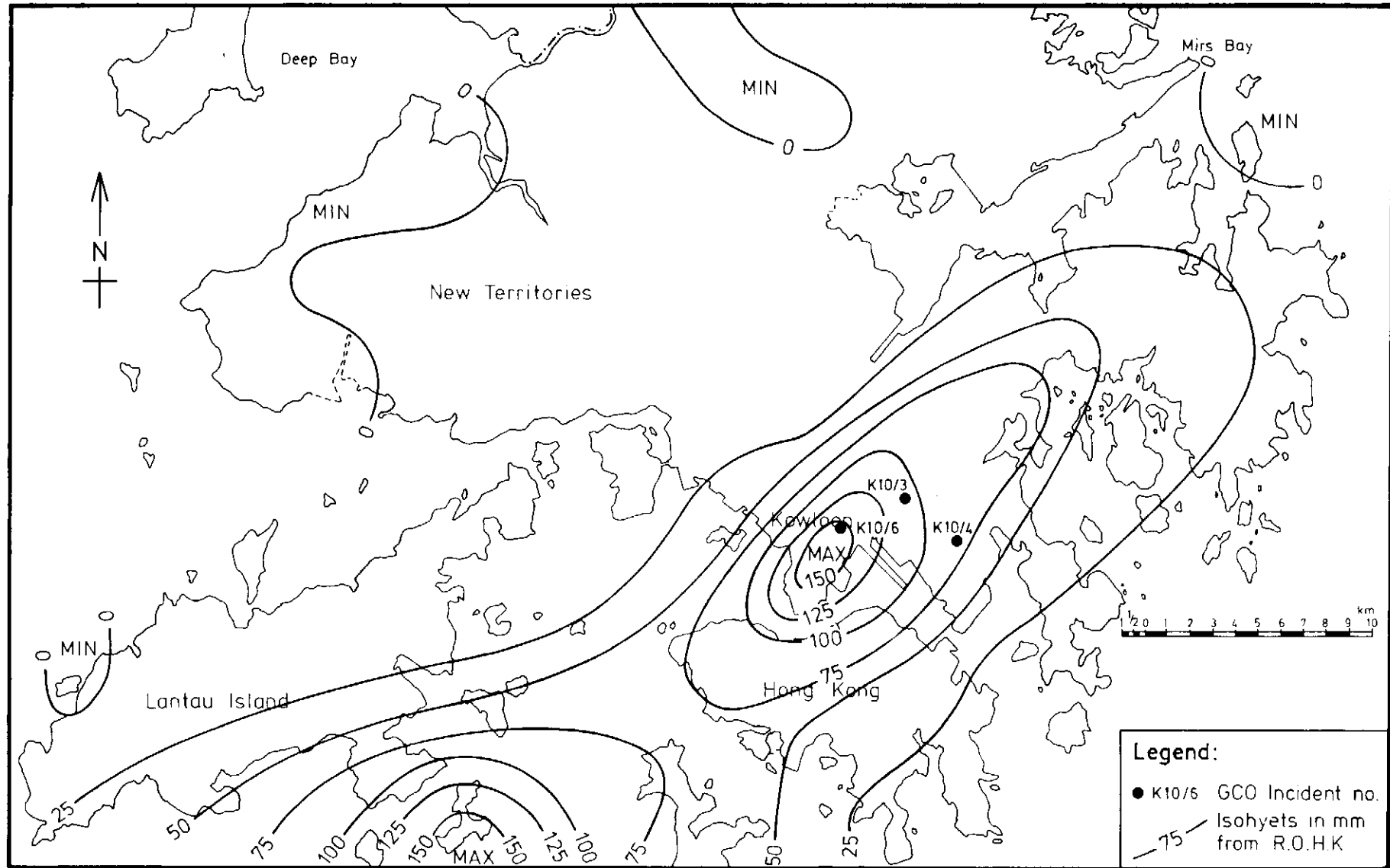


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Plate 1 : Negative No.IW 9/84/OA Date: 30.4.84



Plate 2 : Negative No. IE 2/84/5 Date : 3.5.84

Plate 2 - Tsin Shui Ma Tau Village, Shau Kei Wan  
(Incident No. HK 5/1) : 1 Person Injured



Plate 3 : Negative No.IE 21/84/17 Date: 21.5.84

Plate 3 - A Kung Ngam Road, Shau Kei Wan  
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Plate 4 : Negative No.IE 25/84/10 Date : 30.5.84



Plate 5 : Negative No.IE 25/84/11 Date : 30.5.84

Plates 4 & 5 - Lung Wah Street, Western (Incident No. HK 5/6)



Plate 6 : Negative No. IE 27/84/15A Date : 30.5.84



Plate 7 : Negative No. IE 27/84/20 Date : 30.5.84

Plates 6 & 7 - Aldrich Terrace, Ngoi Man Street, Shau Kei Wan  
(Incident No. HK 5/7)





Plate : 8

Negative No. IE 25/84/14

Date : 30.5.84



Plate 9 : Negative No. IE 25/84/19 Date : 30.5.84

Plates 8 & 9 - Repulse Bay Road near No. 11, Southern District  
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Plate 11 - Squatter Near Buddhist School, 9½ M.S. Castle Peak Road,  
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Plate : 12

Negative No. ME 107/84/16A

Date : 21.6.84



Plate 13 : Negative No. ME 107/84/13A Date : 21.6.84

Plates 12 & 13 - Lion Rock Park  
(incident No. K 6/13): Major Failure on Natural Slope





Plate 14 : Negative No. ME 109/84/2 Date : 22.6.84



Plate 15 : Negative No. ME 109/84/3 Date : 22.6.84

Plate 14 & 15 - 2A, Sheung Wo Hang Tsuen, Sha Tau Kok, North District  
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Plate : 16

Negative No. ME 124/84/16

Date : 27.6.84



Plate 17 : Negative No. ME 124/84/10 Date : 27.6.84

Plates 16 & 17 - 25, Yim Tso Ha Tsuen, North District  
(Incident No. ME 6/7)





Plate : 18

Negative No. MW 103/84/24

Date : 27.6.84



Plate 19 : Negative No. SP 202/84/3 Date : 27.6.84

Plates 18 & 19 - CLP Substation, Wo Tong Tsui Street, Kwai Chung  
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Plate : 20

Negative No. ME 122/84/10

Date : 28.6.84



Plate 21 : Negative No. ME 122/84/12 Date : 28.6.84

Plates 20 & 21 - Fuk Tak New Village, KE  
(Incident No. K 6/18) : Major Failure on Quarry Spoils





Plate : 22

Negative No. SP 202/84B/9

Date : 4.7.84



Plate 23 : Negative No.SP 202/84B/11 Date : 4.7.84

Plates 22 & 23 - Lam Tin First Village, KE (Incident No. K 7/1)



Plate 24 : Negative No. ME 131/84/9 Date : 5.7.84

Plate 24 - Chung Luen Chuen, above Tai Po Road  
(Incident No. K 7/2)



Plate 25 : Negative No. ME 129/84/18 Date : 10.7.84





Plate : 26

Negative No. IE 111/84/5

Date : 3.9.84



Plate 27 : Negative No. IE 111/84/6 Date : 3.9.84

Plates 26 & 27 - 206-208, Tsat Tsz Mui Road, North Point  
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Plate 28 : Negative No. MW 144/84/5 Date : 4.9.84

Plate 28 - 20 MS, Castle Peak Road, Tuen Mun  
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Plate : 29

Negative No. ME 177/84/9

Date : 7.9.84



Plate 30 : Negative No. ME 177/84/4 Date : 7.9.84

Plates 29 & 30 - 56A-58, Fui Yui Ha, Sai Kung  
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Plate 31 : Negative No. MW 148/84/15 Date : 7.9.84



Plate 32 : Negative No. MW 148/84/17 Date : 7.9.84

Plates 31 & 32 - Siu So Tsuen, Tuen Mun (Incident No. MW 9/3)



Plate : 33

Negative No. SP 202/84A/23

Date : 19.9.84



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Plates 33 & 34 - Sha Tin Pass Village, Tsz Wan Shan Road, K.C.  
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Plate 35 : Negative No. API 466/5      Date : 1.8.84



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A P P E N D I X A  
LIST OF INCIDENTS

APPENDIX A

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Table A1 - List of Incidents in Hong Kong Island Reported to GCO in 1984 (Sheet 1 of 2)

| Incident No. | Location   | Call Received |                   | Failure      |                              |       | Area Affected            | Consequence   | Remarks                              |
|--------------|--|---------------|-------------------|--------------|------------------------------|-------|--------------------------|---|--------------------------------------|
|              |  | On            | From              | Date (Time)  | Type                         | Scale |                          |   |                                      |
| HK 3/1       | Squatter near No.1 Mt. Parker Road                           | 19/3          | H/HK              |              | Hut collapsed                | Minor | Squatter                 | 1 hut permanently evacuated   |                                      |
| HK 4/1       | 132-144, IL 7716, Tin Hau Temple Road (11 SE-A/CR43)         | 2/4           | H/HK              | 2/4 (12 am)  | Rock fall                    | Minor | Footpath                 | Footpath partially closed   | DH 14176/HK                          |
| HK 4/2       | 5, Coombe Road (11 SW-D/F 107)                               | 28/4          | H/HK              | 28/4         | Fill slope                   | Minor | Road                     | One lane closed   | GCI 2/EI/11SW-D/F 107                |
| HK 5/1       | Tsin Shui Ma Tau Village, Shau Kei Wan                       | 3/5           | Police            | 3/5 (3 pm)   | Hut collapsed                | Minor | Squatter                 | 1 injured<br>1 hut permanently evacuated<br>5 huts temporarily evacuated        |                                      |
| HK 5/2       | 18 Gough Hill Road   | 5/5           | Ac.Div. Gov. Sec. |              | Settlement                   | Minor | Building lot             |   | GCI 3/1/332                          |
| HK 5/3       | A Kung Ngam Road, Shau Kei Wan (11 SE-B/C87)                 | 21/5          | H/HK              | 21/5 (5 pm)  | Rock cut slope               | Minor | Road & construction site | One lane closed   | LFK work contract                    |
| HK 5/4       | Area 3, Hoi Pong Village                                     | 24/5          | FSD               | 24/5         | Soil cut slope               | Minor | Squatter                 |   | Water from fire-fighting             |
| HK 5/5       | 54 Aldrich Village, Shau Kei Wan                             | 25/5          | H/HK              |              | Boulder                      | Minor | Squatter                 | 1 hut temporarily evacuated   |                                      |
| HK 5/6       | Lung Wah Street, Kennedy Town, Western (11 SW-A/C5)          | 30/5          | H/HK              | 30/5 (8 am)  | Soil cut slope               | Minor | Road                     | One lane closed   | DH 138/74/HK (within Housing Estate) |
| HK 5/7       | Aldrich Terrace, Ngai Man Street, Shau Kei Wan (11 SE-B/C80) | 30/5          | H/HK              | 30/5 (12 am) | Soil/rock cut slope          | Minor | Road and squatter        | 2 lanes closed<br>4 huts permanently evacuated<br>10 huts temporarily evacuated |                                      |
| HK 5/8       | Holy Cross Path Village, Sai Wan Ho                          | 30/5          | H/HK              | 30/5 (9 am)  | Soil cut slope               | Minor | Squatter                 | 1 hut temporarily evacuated   |                                      |
| HK 5/9       | Repulse Bay Road near No. 11, Southern District              | 30/5          | H/HK              | 30/5 (9 am)  | Retaining wall               | Minor | Road                     | One lane closed   | GCI 2/E2/24(2)                       |
| HK 5/10      | 26 Lugard Road, C/W District                                 | 30/5          | H/HK              | 30/5 (10 am) | Soil cut slope/natural slope | Minor | Road                     | Road blocked  | Catchwater overflow                  |



Table A1 (Cont.) - List of Incidents in Hong Kong Island Reported to GCO (Sheet 2 of 2)

| Incident No. | Location   | Call Received |               | Failure      |                           |       | Area Affected                 | Consequence  | Remarks                                     |
|--------------|--|---------------|---------------|--------------|---------------------------|-------|-------------------------------|--|---|
|              |  | Date          | From          | Date (Time)  | Type                      | Scale |                               |  |   |
| HK 5/11      | Petrol Station, IL 7923, Pok Fu Lam Road (11SW-A/C143)                           | 30/5          | H/HK          | 30/5 (10 am) | Soil/rock out slope       | Minor | Petrol station                | Entrance closed  |   |
| HK 5/12      | Mt. Nicholson Road (11SW-D/C332)   | 30/5          | H/HK          | 30/5 (9 am)  | Boulder                   | Minor | Road                          | One lane closed  |   |
| HK 5/13      | 60 Peak Road, RBL 310, Central.  | 28/5          | GCO           | 26/5 (6 pm)  | Boulder                   | Minor | Building lot                  |  | BDD(B) 6/1046/82                            |
| HK 7/1       | 78-80 MacDonnell Road, IL 8418 (11SW-B/R494)                                     | 9/7           | BOO           | 3/7          | Retaining wall            | Minor | Road                          |  | DH 165/73/HK                                |
| HK 8/1       | 19 Blue Pool Road, Wan Chai  | 4/8           | Public        | 4/8 (10 am)  | Fill slope                | Minor | Building lot                  |  | DH 59/80/HK                                 |
| HK 8/2       | Hang Hang Tung Village, Shau Kei Wan   | 10/8          | Police        | 10/8 (5 pm)  | Masonry retaining wall    | Minor | Squatter and electricity pole |  |   |
| HK 8/3       | Yee King Road, North Point (11SE-A/C212)   | 11/8          | H/HK          | 11/8 (3 am)  | Soil out slope            | Minor | Road                          | One lane closed  |   |
| HK 8/4       | King's Road, North Point (11SE-A/C158)   | 13/8          | H/HK          | 13/8 (9 am)  | Boulder                   | Minor | Footpath                      | Footpath closed  |   |
| HK 8/5       | Block H, Police R & F Quarters, Tanner Road, North Point (11SE-A/C229)           | 28/8          | Fugro Consult | 15/8         | Rock fall                 | Minor | Access road                   | Access road blocked  | Case dealt with by GMS Consultant           |
| HK 9/1       | 206-208, Tsat Tsz Mui Road, North Point between IL 7724 and IL 6876 (11SE-A/C85) | 2/9           | BOO           | 2/9 (7 am)   | Soil/rock out slope       | Major | Building/factory              | One wall panel collapsed, factory area partly closed, back lane closed | GCI 3/4/DH 122/82/HK<br>GCI 2/E1/11SE-A/C85 |
| HK 9/2       | 21, Magazine Gap Road, Central RBL 216 (11SW-D/CR299)                            | 2/9           | H/HK          | 2/9 (0 am)   | Natural slope and boulder | Minor | Road                          | One lane closed  |   |
| HK 9/3       | 7 & 9 Rosemead Road, Central (11SW-D/F149)                                       | 12/9          | Public        |              | Settlement                | -     | Road                          |  | Complaint only                              |

Table A2 - List of Incidents in Kowloon Reported to GCO in 1984 (Sheet 1 of 5)

| Incident No. | Location   | Call Received |      | Failure      |                 |       | Area Affected         | Consequence  | Remarks                  |
|--------------|--|---------------|------|--------------|-----------------|-------|-----------------------|--|--------------------------|
|              |  | Date          | From | Date (Time)  | Type            | Scale |                       |  |                          |
| K 1/1        | Ngau Chi Wan Village, KC.                        | 20/1          | H/K  |              | Hut collapsed   | Minor | Squatter              | 2 huts temporarily evacuated                                 | Water from fire-fighting |
| K 2/1        | Lam Tin Second Village, KE.                      | 14/2          | HD   | 7/2          | Soil cut slope  | Minor | Squatter              | 1 hut permanently evacuated                                  |                          |
| K 3/1        | Lam Tin Village, KE.                             | 15/3          | DO   | 15/3         | Hut collapsed   | Minor | Squatter              | 1 hut temporarily evacuated<br>2 huts permanently evacuated  |                          |
| K 4/1        | Hiu Kwong Street, Sau Mau Ping (11 MB-D/F10)     | 3/4           | H/K  |              | Fill slope      | Minor | Road                  |  | Water main burst         |
| K 4/2        | Sau On Village, KC.                              | 6/4           | H/K  | 5/4 (5 pm)   | Soil cut slope  | Minor | Squatter              | 1 hut permanently evacuated                                  |                          |
| K 4/3        | Sau Ming Ping Village, KC.                       | 11/4          | H/K  | 11/4         | Soil cut slope  | Minor | Squatter              | 1 hut temporarily evacuated<br>2 huts permanently evacuated  |                          |
| K 4/4        | Lam Tin Third Village, KE.                       | 24/4          | H/K  |              | Retaining wall  | Minor | Squatter              | 1 hut temporarily evacuated                                  |                          |
| K 5/1        | Ngau Chi Wan Village, KC.                        | 1/5           | H/K  | 28/4 (pm)    | Soil cut slope  | Minor | Squatter              | 1 hut permanently evacuated                                  |                          |
| K 5/2        | Cheung Lung Tin Village, KE.                     | 14/5          | H/K  | 9/5          | Soil cut slope  | Minor | Squatter              | 2 huts permanently evacuated                                 |                          |
| K 5/3        | Above Lung Cheung Road                           | 2/4           | GCO  |              | Erosion gullies | Major |                       |  |                          |
| K 5/4        | Access Road to Beacon Hill S/R and Radar Station | 26/4          | GCO  |              | Erosion gullies | Major |                       |  |                          |
| K 5/5        | Cheung Lung Tin Village, KE.                     | 17/5          | H/K  | 17/5         | Soil cut slope  | Minor | Squatter & Footpath   | 3 huts permanently evacuated                                 |                          |
| K 5/6        | Ngau Chi Wan East Village, KC.                   | 14/5          | DO   |              | Soil cut slope  | Minor | Squatter/<br>Footpath | 1 hut permanently evacuated                                  |                          |
| K 5/7        | Ngau Chi Wan East Village, KC.                   | 21/5          | H/K  | 20/5 (11 am) | Soil cut slope  | Minor | Squatter              | 2 huts temporarily evacuated<br>6 huts permanently evacuated |                          |

Table A2 (Cont.) - List of Incidents in Kowloon Reported to GCO in 1984 (Sheet 2 of 5)

| Incident No. | Location   | Call Received |      | Failure      |                 |       | Area Affected         | Consequence   | Remarks                  |
|--------------|--|---------------|------|--------------|-----------------|-------|-----------------------|---|--------------------------|
|              |  | Date          | From | Date (Time)  | Type            | Scale |                       |   |                          |
| K 5/8        | Cheung Lung Tin Village, KE.                                 | 21/5          | H/K  | 20/5 (7 am)  | Soil cut slope  | Minor | Squatter              | 1 hut temporarily evacuated                                 |                          |
| K 5/9        | Junction of New Clear Water Bay Road and Shun Lee Tsuen Road | 29/5          | H/K  |              | Soil cut slope  | Minor | Road                  |   |                          |
| K 5/10       | Fan Wa Street Village, KE.                                   | 29/5          | H/K  | 29/5 (2 pm)  | Rock fall       | Minor | Squatter              | 1 hut permanently evacuated                                 |                          |
| K 5/11       | Tai Shing Village, KC.                                       | 30/5          | H/K  | 30/5         | Retaining wall  | Minor | Squatter              | 1 hut temporarily evacuated<br>4 huts permanently evacuated |                          |
| K 5/12       | Yeung Mui Hang Village, KW.                                  | 30/5          | H/K  | 30/5 (2 pm)  | Soil cut slope  | Minor | Squatter              | 4 huts permanently evacuated                                |                          |
| K 5/13       | Hong Chong Road, Hung Hom                                    | 31/5          | H/K  | 30/5         | Fill embankment | Minor | Road                  |   |                          |
| K 5/14       | Sau Mau Ping Road (11 NE-D/G5)                               | 30/5          | H/K  | 30/5         | Soil cut slope  | Minor | Road                  |   |                          |
| K 5/15       | Tai Shing Village, KC.                                       | 31/5          | H/K  |              | Soil cut slope  | Minor | Squatter              | 2 huts permanently evacuated                                |                          |
| K 5/16       | Sau Ming Village, KC.  | 1/6           | H/K  | 31/5 (11 am) | Rut collapsed   | Minor | Squatter              | 1 hut permanently evacuated                                 |                          |
| K 6/1        | 486-488, Nathan Road (11 NW-D/N2)                            | 5/6           | DO   | 1/6          | Natural slope   | Minor |                       |   |                          |
| K 6/2        | On Lok Village, KC.  | 6/6           | H/K  | 5/6          | Fill slope      | Minor | Squatter              | 2 huts permanently evacuated                                |                          |
| K 6/3        | Lam Tin Village, KE.   | 7/6           | H/K  |              | Retaining wall  | Minor | Squatter and footpath | Footpath closed   |                          |
| K 6/4        | Lung Cheung Road near Phoenix House                          | 8/6           | GCO  |              | Soil cut slope  | Minor | Road                  |   |                          |
| K 6/5        | On Lok Village, KC.  | 8/6           | H/K  | 6/6          | Soil cut slope  | Minor | Squatter              | 2 huts temporarily evacuated                                |                          |
| K 6/6        | 273-275 Prince Edward Road                                   | 11/6          | BOO  | 30/5 (10 am) | Soil cut slope  | Minor | Garage                | Closure of carpark  |                          |
| K 6/7        | Lam Tin Village, KE.   | 13/6          | H/K  | 12/6 (5 pm)  | Soil cut slope  | Minor | Squatter              | 2 huts temporarily evacuated                                | Water from fire-fighting |



Table A2 (Cont.) - List of Incidents in Kowloon Reported to GCO in 1984 (Sheet 3 of 5)

| Incident No. | Location                              | Call Received |                 | Failure      |                            |       | Area Affected         | Consequence  | Remarks                           |
|--------------|---------------------------------------|---------------|-----------------|--------------|----------------------------|-------|-----------------------|--|-----------------------------------|
|              |                                       | Date          | From            | Date (Time)  | Type                       | Scale |                       |  |                                   |
| K 6/8        | Sai Tau Village, KW.                  | 14/6          | DO              |              | Hut collapsed              | -     | Squatter              |  | No geotechnical problems          |
| K 6/9        | Sau On Village, KC.                   | 19/6          | H/K             | 16/6         | Soil cut slope             | Minor | Squatter              | 1 hut permanently evacuated                                  |                                   |
| K 6/10       | Man Kuk New Village, KC.              | 19/6          | HD              | 16/6 (5 am)  | Soil cut slope             | Minor | Squatter              | 2 huts permanently evacuated                                 |                                   |
| K 6/11       | Ngau Chi Wan East Village, KC.        | 19/6          | HD              | 16/6 (5 am)  | Soil cut slope             | Minor | Squatter              | 8 huts permanently evacuated                                 |                                   |
| K 6/12       | Man Kuk New Village, KC.              | 19/6          | HD              | 16/6 (4 am)  | Soil cut slope             | Minor | Squatter              | 5 huts permanently evacuated                                 |                                   |
| K 6/13       | Lion Rock Park                        | 20/6          | H/K             | 17/6 (11 am) | Soil natural slope         | Major | Squatter and footpath |  |                                   |
| K 6/14       | Tai Ching Village, KC.                | 20/6          | H/K             | 20/6         | Retaining wall             | Minor | Squatter              | 4 huts permanently evacuated<br>1 hut temporarily evacuated  |                                   |
| K 6/15       | Lam Tin 2nd Village, KE               | 20/6          | H/K             | 20/6         | Settlement                 | Minor | Squatter              | 2 huts permanently evacuated<br>3 huts temporarily evacuated |                                   |
| K 6/16       | Butterfly Valley New Village, KW.     | 26/6          | H/K             | 23/6         | Soil cut slope             | Minor | Squatter              |  |                                   |
| K 6/17       | Nam Cheong Street near Chak On Estate | 13/6          | Public          |              | Fill slope                 | Minor | Footpath              |  |                                   |
| K 6/18       | Fuk Tak New Village, KE.              | 28/6          | H/K             | 25/6         | Quarry spoils fill slope   | Major | Squatter              | 3 huts permanently evacuated<br>2 huts temporarily evacuated |                                   |
| K 6/19       | Heung Yeung Village, KC.              | 19/6          | Public          |              | Soil cut slope             | -     | Squatter              |  | Complaint only                    |
| K 6/20       | 180 Argyle Street                     | 22/6          | Fugro Cons-ult. | 16/6         | Soil cut slope and boulder | Minor | Building and footpath | Minor damages to building                                    | Case dealt with by GMS consultant |
| K 6/21       | 12 Cornwall Street (11 NW-B/CR184)    | 28/6          | H/K             | 16/6         | Soil cut slope             | Minor | Carpark               | Carpark closed   |                                   |

Table A2 (Cont.) - List of Incidents in Kowloon Reported to GCO in 1984 (Sheet 4 of 5)

| Incident No. | Location                                     | Call Received |                | Failure     |                |       | Area Affected         | Consequence  | Remarks   |
|--------------|--|---------------|----------------|-------------|----------------|-------|-----------------------|--|---|
|              |  | Date          | From           | Date (Time) | Type           | Scale |                       |  |   |
| K 7/1        | Lam Tin First Village, KE                    | 4/7           | H/K            | 2/7         | Soil cut slope | Minor | Squatter and footpath | Footpath closed  | Refer to case K 10/6  |
| K 7/2        | Chung Luen Chuen above Tai Po Road           | 9/7           | H/K            | 9/7 (2 pm)  | Soil cut slope | Minor | Squatter              | 2 huts temporarily evacuated                                 |   |
| K 7/3        | 33, Inverness Road, HKIL 5279                | 31/7          | H/K            | 9/7         | Fill slope     | Minor | Access road           |  |   |
| K 8/1        | New Clear Water Bay Road Bridge              | 3/8           | H/K            |             | Soil cut slope | Minor | Road                  |  |   |
| K 8/2        | Sai Wo Yuen, Tai Ching Village, KC.          | 6/8           | HD             |             | Soil cut slope | Minor | Squatter              | 2 huts temporarily evacuated                                 |   |
| K 8/3        | Sau Mau Ping Road                            | 10/8          | H/K            |             | Soil cut slope | Minor | Road                  |  | Complaint only<br>LTK work contract No. 16/GCO/83             |
| K 8/4        | Cheung Lung Tin Village, KE.                 | 13/8          | H/K            | 11/8 (2 am) | Soil cut slope | Minor | Squatter              | 4 huts temporarily evacuated                                 |   |
| K 8/5        | Tai Ching Village, KC.                       | 12/8          | H/K            | 11/8        | Fill slope     | Minor | Squatter              | 3 huts permanently evacuated<br>3 huts temporarily evacuated |   |
| K 8/6        | Tong Yan Street (11 NW-B/C37)                | 28/8          | GCO            |             | Soil cut slope | Minor | Staircase             |  |   |
| K 9/1        | Rhonda Road (11 NW-B/FR10)                   | 19/9          | Police         |             | Fill slope     | -     | Road and house        |  |   |
| K 9/2        | Sha Tin Pass Village, Tsz Wan Shan Road, KC. | 19/9          | DO             | 19/9        | Soil cut slope | Minor | Squatter              | 2 huts permanently evacuated                                 | No geotechnical problems<br>Case dealt with by GMS Consultant |
| K 9/3        | Tai Shing Village, KC.                       | 24/9          | H/K            | 22/9        | Soil cut slope | Minor | Squatter              | 4 huts permanently evacuated                                 |   |
| K 9/4        | Sau On Village, KC.                          | 24/9          | DO             | 23/9        | Hut collapsed  | -     | Squatter              |  |   |
| K 9/5        | Stonecutters Island (11 NW-C/C17)            | 3/9           | Fugro Consult. |             | Soil cut slope | Major | Building/water tank   | Water tank abandoned   |   |
| K 10/1       | Tai Shing Village, KC.                       | 4/10          | H/K            | 4/10        | Soil cut slope | Minor | Squatter              | 1 hut permanently evacuated                                  |   |
| K 10/2       | Man Kuk Village, KC.                         | 10/10         | HD             |             | Fill slope     | Minor | Squatter              | 2 huts permanently evacuated                                 |   |

Table A2 (Cont.) - List of Incidents in Kowloon Reported to GCO in 1984 (Sheet 5 of 5)

| Incident No. | Location                      | Call Received |      | Failure      |                |       | Area Affected | Consequence                   | Remarks  |
|--------------|-------------------------------|---------------|------|--------------|----------------|-------|---------------|-------------------------------|--|
|              |                               | Date          | From | Date (Time)  | Type           | Scale |               |                               |  |
| K 10/3       | Man Kuk Village, KC.          | 11/10         | H/K  | 11/10 (2 am) | Soil cut slope | Minor | Squatter      | 8 huts temporarily evacuated  | No geotechnical problems<br>Refer to case K7/3 |
| K 10/4       | Sau On Village, KC.           | 11/10         | H/K  | 11/10 (1 am) | Soil cut slope | Minor | Squatter      | 2 huts permanently evacuated  |  |
| K 10/5       | Tai Wong Shan Village, KE.    | 5/10          | DO   |              | Hut collapsed  | -     | Squatter      |                               |  |
| K 10/6       | 33, Inverness Road, NKIL 5279 | 11/10         | BOO  | 11/10 (am)   | Fill slope     | Minor | Access road   | Footpath closed               |  |
| K 10/7       | Tai Shing Village, KC.        | 17/10         | HD   |              | Retaining wall | Minor | Squatter      | 6 huts temporarily evacuated  | Water from fire-fighting                       |
| K 11/1       | Cheung Lung Tin Village, KE.  | 5/11          | H/K  | 1/11         | Soil cut slope | Minor | Squatter      | 2 huts temporarily evacuated  |  |
| K 11/2       | Cheung Lung Tin Village, KE.  | 6/11          | DO   | 1/11         | Soil cut slope | Minor | Squatter      | 10 huts permanently evacuated |  |
| K 11/3       | Sau On Village, KC.           | 19/11         | H/K  | 17/11        | Soil cut slope | Minor | Squatter      | 2 huts permanently evacuated  |  |
| K 11/4       | Cheung Lung Tin Village, KE.  | 21/11         | H/K  | 20/11        | Soil cut slope | Minor | Squatter      | 3 huts permanently evacuated  | Water from fire-fighting                       |

Table A3 - List of Incidents in Eastern New Territories Reported to GCO in 1984

| Incident No. | Location  | Call Received |        | Failure      |                      |       | Area Affected | Consequence      | Remarks        |
|--------------|---|---------------|--------|--------------|----------------------|-------|---------------|------------------|----------------|
|              |   | On            | From   | Date (Time)  | Type                 | Scale |               |                  |                |
| ME 2/1       | No. 247, Tai Po Tsai Village Clearwater Bay Road                        | 6/2           | Public |              | Soil cut slope       | -     | Carpark       |                  | Complaint only |
| ME 4/1       | Kwei Tei New Village, Sha Tin (7SE-A/C22)                               | 25/4          | DLO    |              | Soil cut slope       | Minor |               |                  |                |
| ME 5/1       | 50A, Pak Sek, Sha Tin   | 30/5          | H/NT   | 30/5 (8 am)  | Soil cut slope       | Minor | Access        |                  |                |
| ME 5/2       | 28, Second Street, Heung Fan Liu, Sha Tin                               | 31/5          | H/NT   | 30/5         | Fill under staircase | Minor | Staircase     |                  |                |
| ME 6/1       | To Fung Shan Road, Sha Tin  | 6/6           | H/NT   |              | Fill slope           | Minor | Road          |                  | GCMd 2/E2/84-3 |
| ME 6/2       | Sha Tin Tau Sun Tsuen, Sha Tin  | 6/6           | Police | 6/6          | Soil cut slope       | Minor | Squatter      |                  |                |
| ME 6/3       | Lion Rock Tunnel Road, Sha Tin  | 19/6          | H/NT   | 16/6 (10 am) | Soil/rock cut slope  | Minor | Road          |                  |                |
| ME 6/4       | 24, Siu To Yuen, Tseng Lan Shue, Sai Kung                               | 19/6          | DO     | 16/6         | Soil cut slope       | Minor | Footpath      | Footpath blocked |                |
| ME 6/5       | 22, Fan Long Wan, Sai Kung  | 21/6          | DLO    | 21/6 (6 pm)  | Soil/rock cut slope  | Minor | House         |                  |                |
| ME 6/6       | 2A, Lot 1465 in DD81, Sheung Wo Hang Tsuen, Sha Tau Kok, North District | 22/6          | H/NT   | 22/6 (5 am)  | Soil cut slope       | Minor | House         |                  |                |
| ME 6/7       | 25, DD39, Yim Tso Ha Tsuen, North District                              | 23/6          | H/NT   | 22/6 (9 pm)  | Soil/rock cut slope  | Minor | House         |                  |                |
| ME 7/1       | 330-332, Fai Tau, Sha Tin   | 10/7          | H/NT   |              | Retaining wall       | Minor | Footpath      |                  |                |
| ME 7/2       | 253, Fai Tau, Sha Tin   | 10/7          | DO     | 9/7 (6 am)   | Retaining wall       | Minor | House         |                  |                |
| ME 9/1       | 56A-58, Fui Yiu Ha, Sai Kung  | 7/9           | DO     | 7/9 (6 am)   | Soil cut slope       | Major | Houses        | Roof damaged     | GCMd 2/E2/84-6 |

Table A4 - List of Incidents in Western New Territories Reported to GCO in 1984

| Incident No. | Location   | Call Received |        | Failure      |                |       | Area Affected                              | Consequence  | Remarks                       |
|--------------|--|---------------|--------|--------------|----------------|-------|--|--|-------------------------------|
|              |  | On            | From   | Date (Time)  | Type           | Scale |  |  |                               |
| NW 5/1       | 121, Shek Tsai Poi, Tai O, Lan Tao Island                                      | 3/5           | BOO    |              | Rock cut slope | Minor | Service lane and access                    | Service lane closed  |                               |
| NW 6/1       | Squatter near Buddhist School, 9 $\frac{1}{2}$ MS. Castle Peak Road, Tsuen Wan | 5/6           | DLO    | 30/5 (am)    | Fill slope     | Minor | Squatter                                   | Footpath damaged   |                               |
| NW 6/2       | Tai Pak Tin Street, Kwai Chung   | 19/6          | H/NT   |              | Soil cut slope | Minor | Road                                       |  |                               |
| NW 6/3       | CLP substation, KCTL270 Wo Tong Tsui Street, Kwai Chung (75W-C/CR103)          | 26/6          | Police | 26/6 (5 pm)  | Soil cut slope | Major | Power substation, 132 KV cable and factory | Damages to the power substation and factory                  | GCMd 2/E2/84-5<br>DH 293/84/K |
| NW 9/1       | 20 MS Castle Peak Road, Tuen Mun   | 1/9           | H/NT   | 1/9 (4 pm)   | Soil cut slope | Minor | Road                                       | One lane closed  |                               |
| NW 9/2       | DD 131, Tseng Tau Chung Tsuen, Tuen Mun  | 6/9           | DO     | 1/9          | Soil cut slope | Minor | CLL house                                  | 6 huts permanently evacuated<br>5 huts temporarily evacuated |                               |
| NW 9/3       | Siu So Tsuen, Tuen Mun   | 6/9           | DO     | 12/8         | Retaining wall | Minor | Farm land                                  |  |                               |
| NW 9/4       | Kau Wah Keng Old Village, Tsuen Wan  | 24/9          | BOO    | 24/9 (11 pm) | Soil cut slope | Minor | Squatter                                   | 1 hut temporarily evacuated                                  | Water main burst              |
| NW 9/5       | Tung Chung Road, Lan Tao Island  | 19/9          | H/NT   |              | Soil cut slope | Minor | Road                                       | Footpath closed  |                               |
| NW 10/1      | Kwun Yun Wan, Cheung Chau Island   | 12/10         | H/NT   | 10/10        | Natural slope  | Minor | Sitting area                               | Sitting area closed  |                               |
| NW 11/1      | Fu Uk Road, Kwai Chung, Tsuen Wan  | 15/11         | H/NT   |              | Soil cut slope | Minor | Godown/store                               |  |                               |
| NW 11/2      | CCIL 44 SE, Peak Road, Cheung Chau Island                                      | 30/11         | DLO    |              | Soil cut slope | Minor | Service lane                               | Service lane partially closed                                |                               |

A P P E N D I X B  
RECORDS OF GCO RAINGAUGES

APPENDIX B

LIST OF FIGURES

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| B2            | Histograms of Hourly Rainfall Recorded by<br>GCO Raingauges on 16th June 1984  | 83          |
| B3            | Histograms of Hourly Rainfall Recorded by<br>GCO Raingauges in the Period from Noon<br>10th October 1984 to Noon 11th October 1984 | 87          |

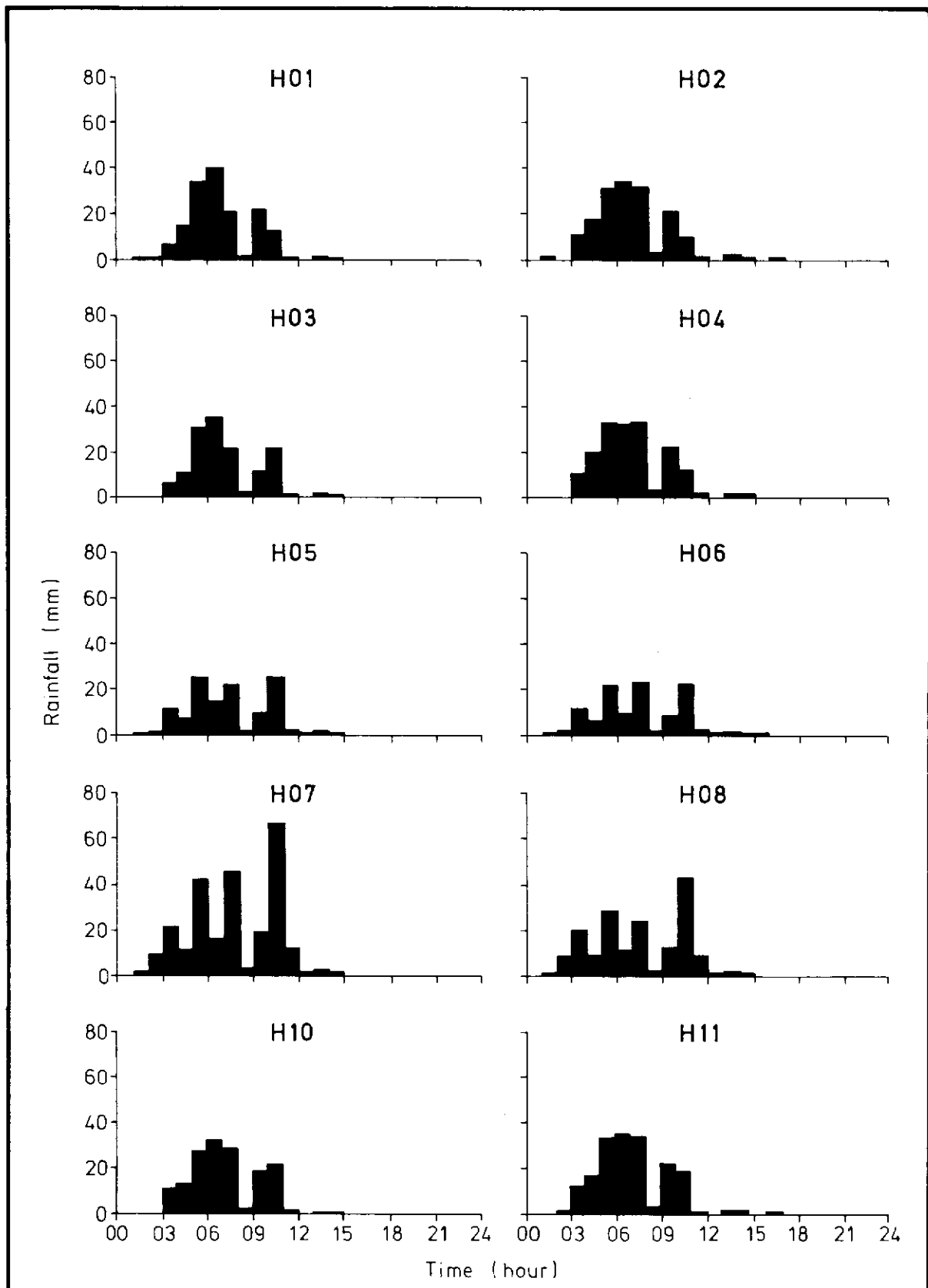


Figure B1 - Histograms of Hourly Rainfall Recorded by GCO Raingauges on 30th May 1984 (Sheet 1 of 4, See Raingauge Location in Figure 1)



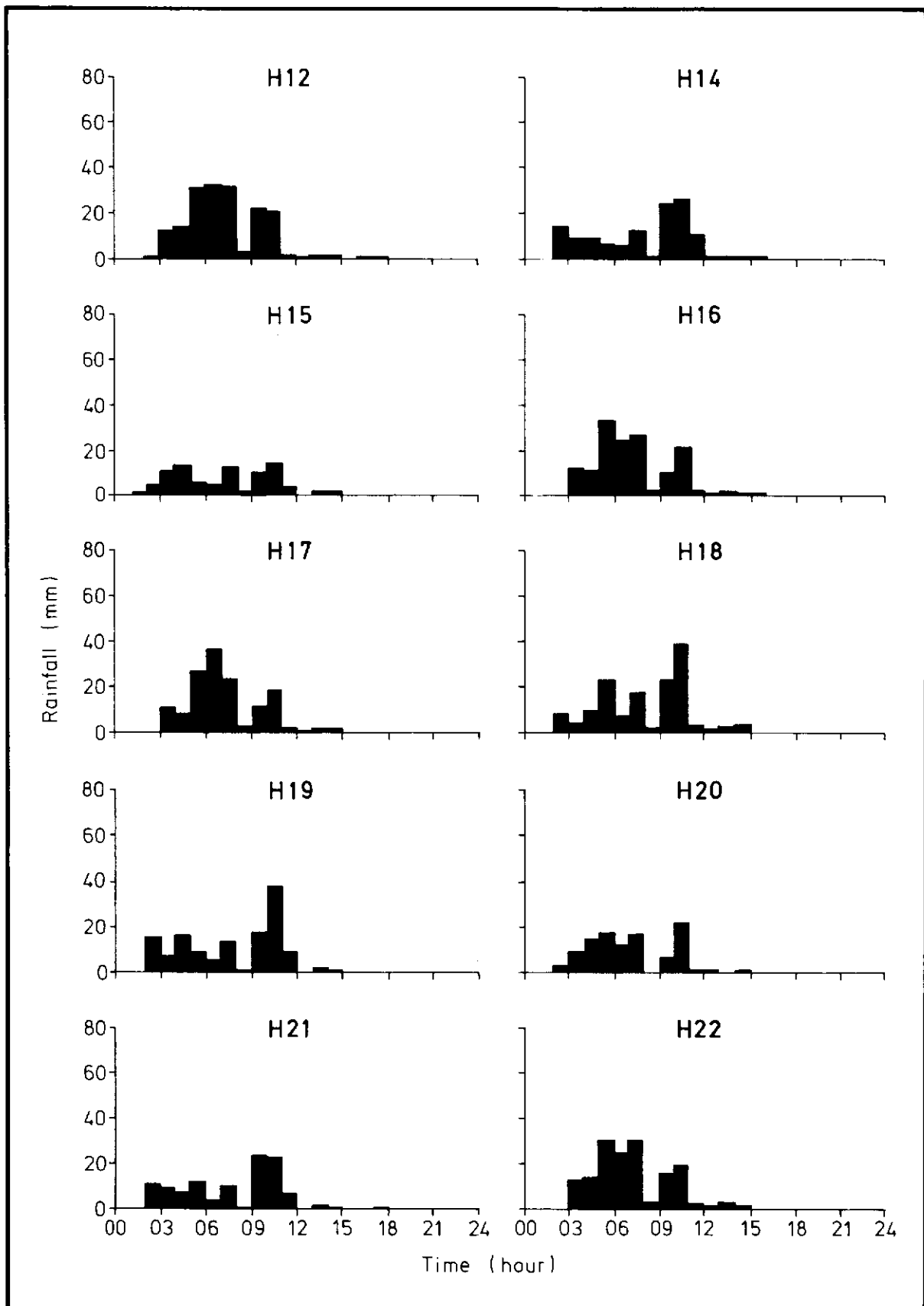


Figure B1 (Cont.) - Sheet 2 of 4

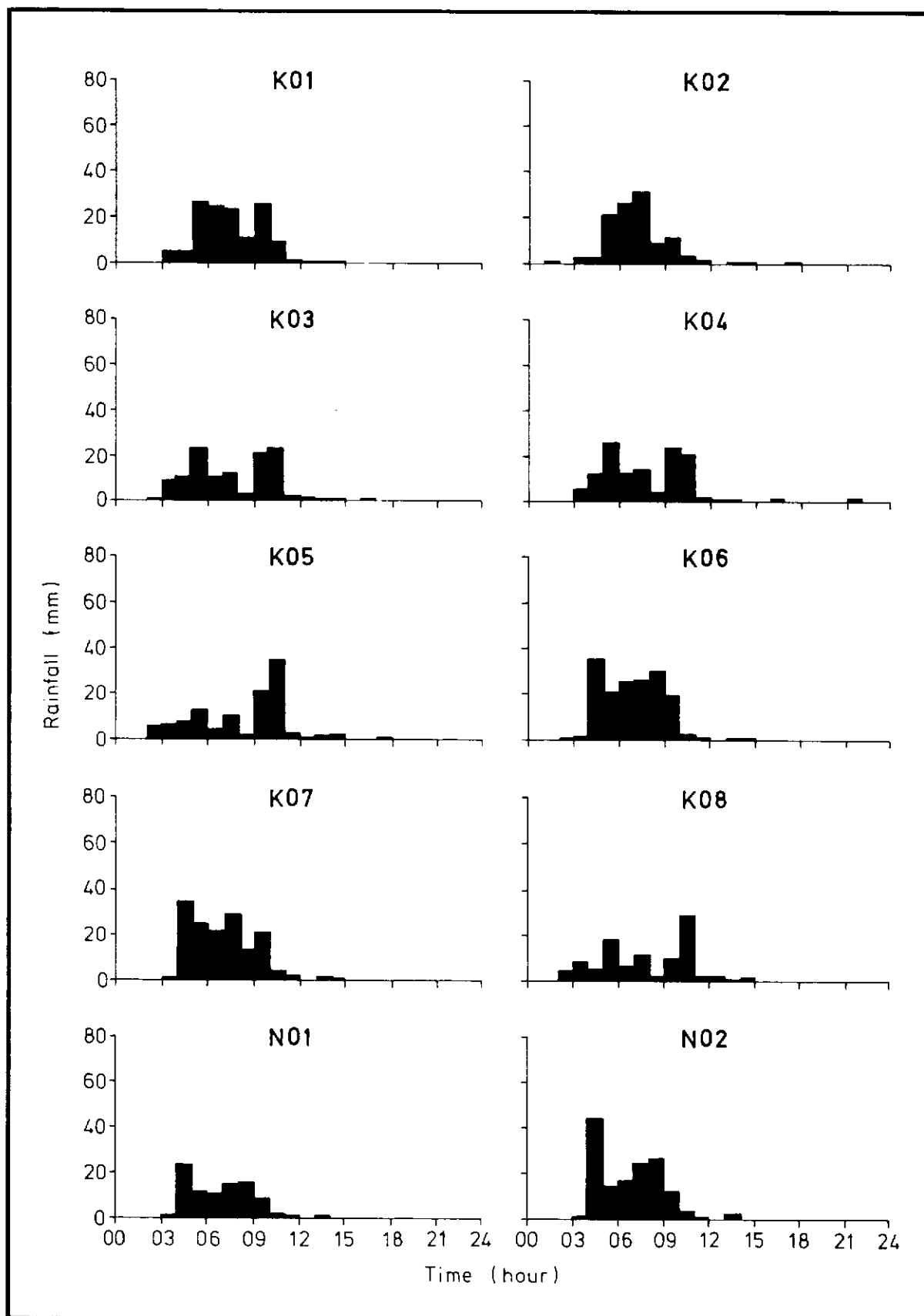


Figure B1 (Cont.) - Sheet 3 of 4

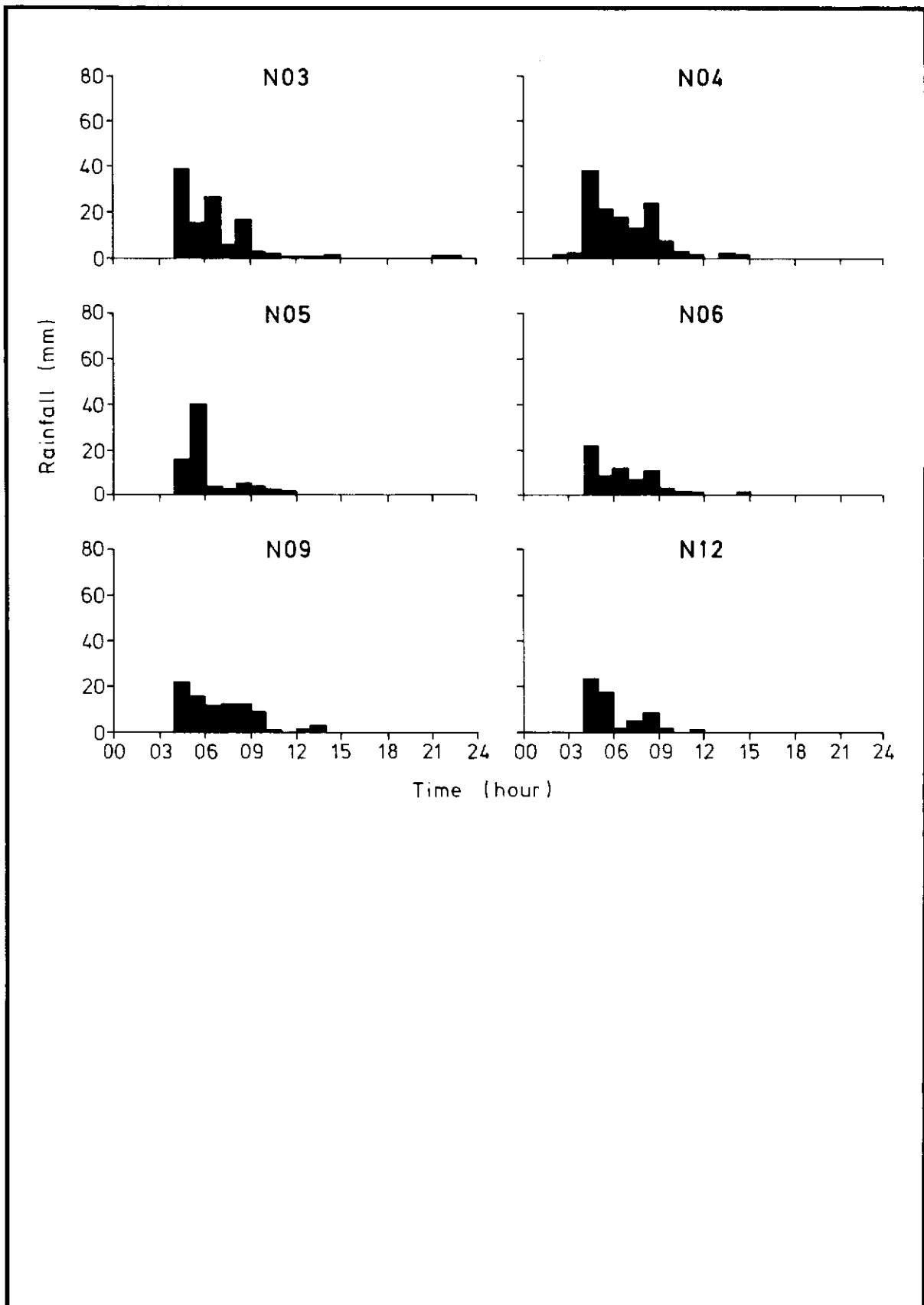


Figure B1 (Cont.) - Sheet 4 of 4

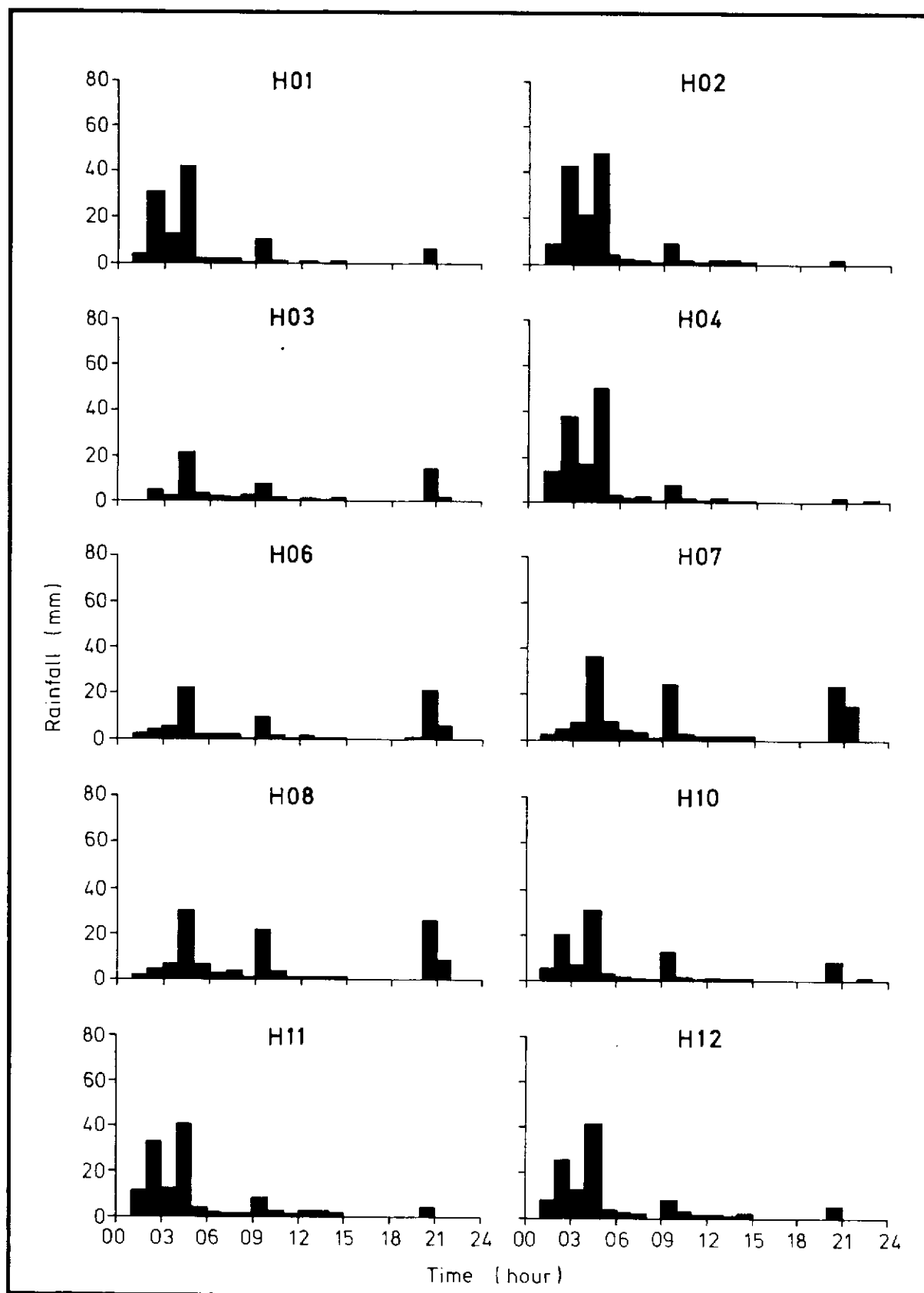


Figure B2 - Histograms of Hourly Rainfall Recorded by GCO Raingauges on 16th June 1984 (Sheet 1 of 4, See Raingauge Location in Figure 1)

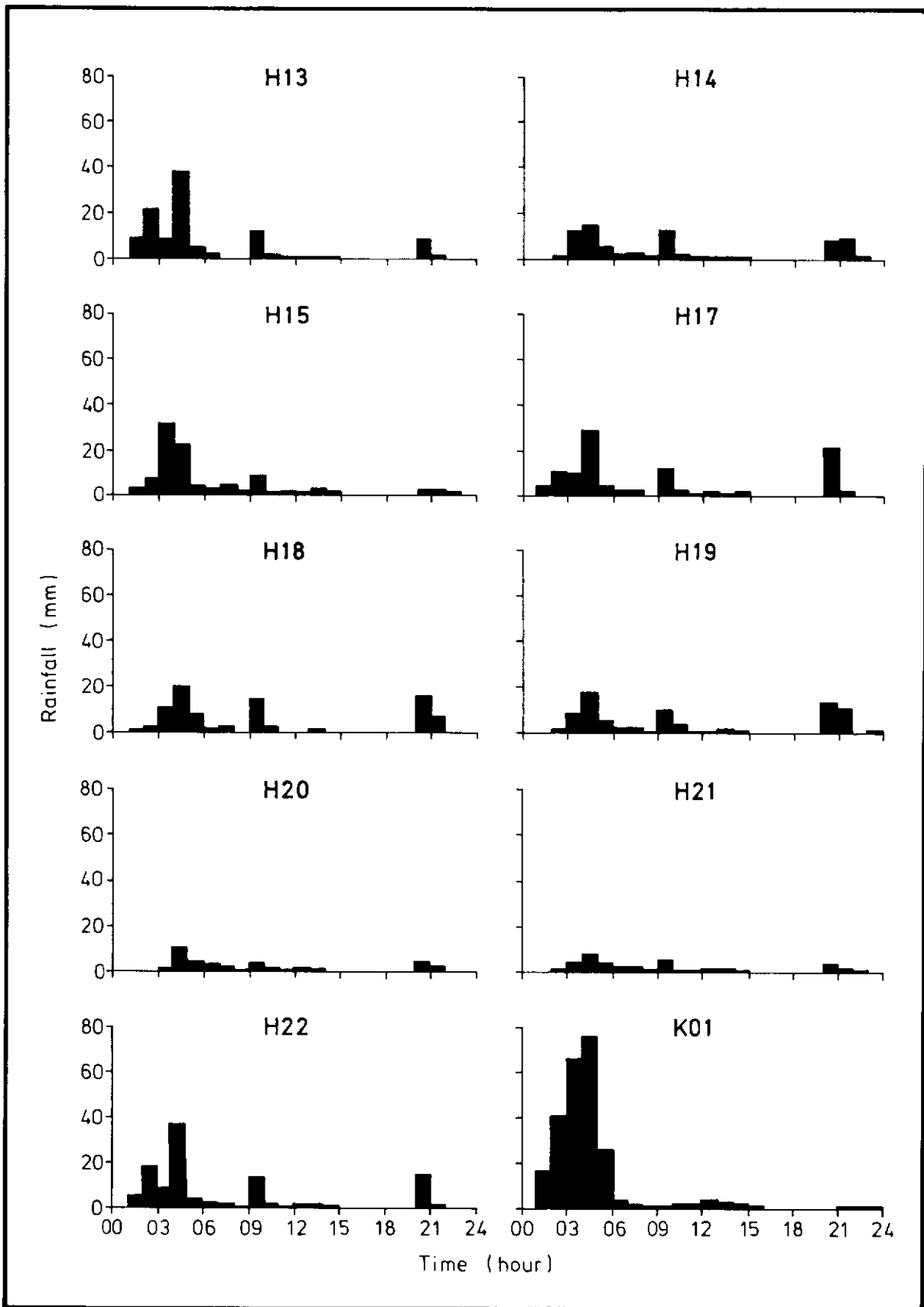


Figure B2 (Cont.) - Sheet 2 of 4

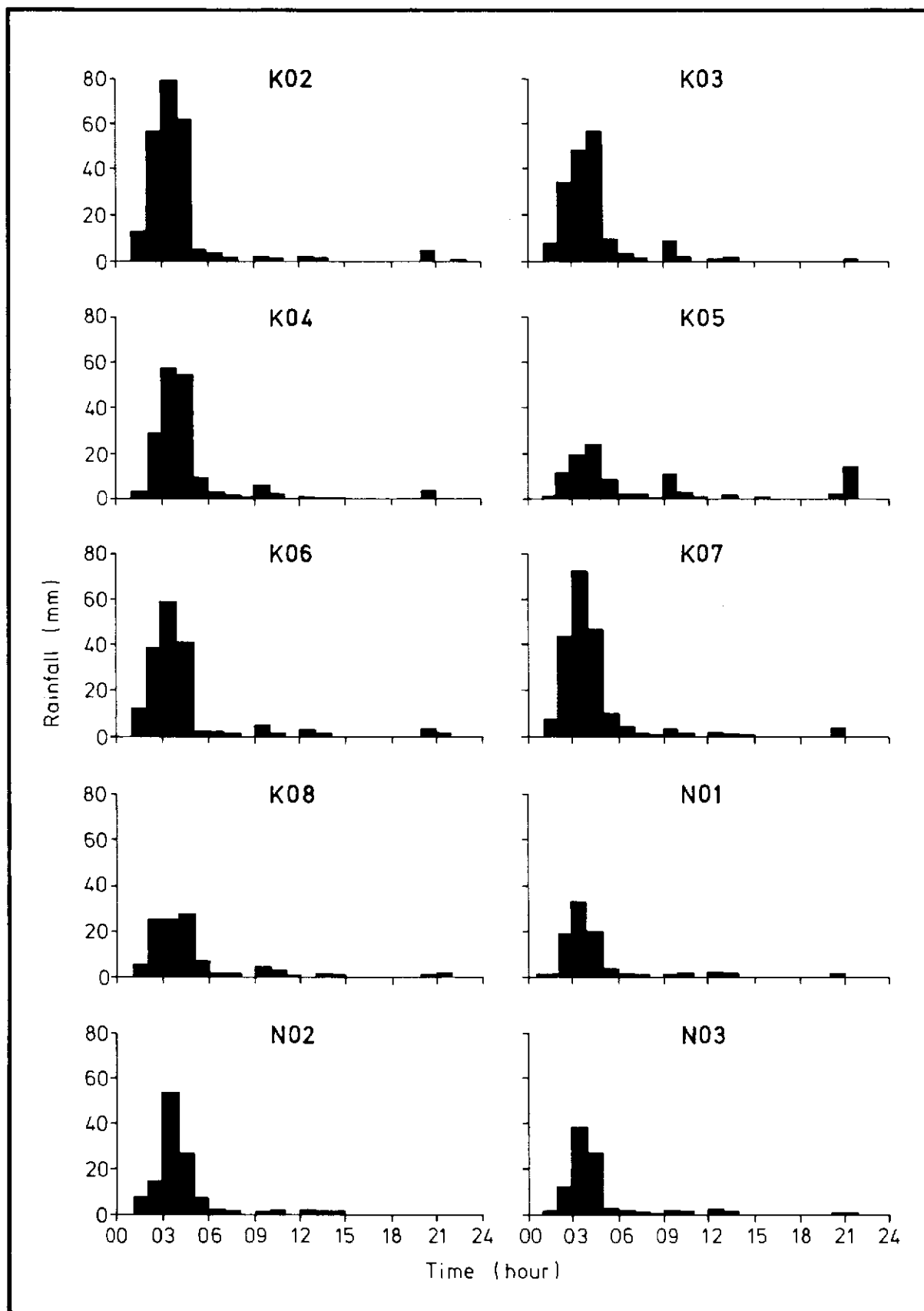


Figure B2 (Cont.) - Sheet 3 of 4



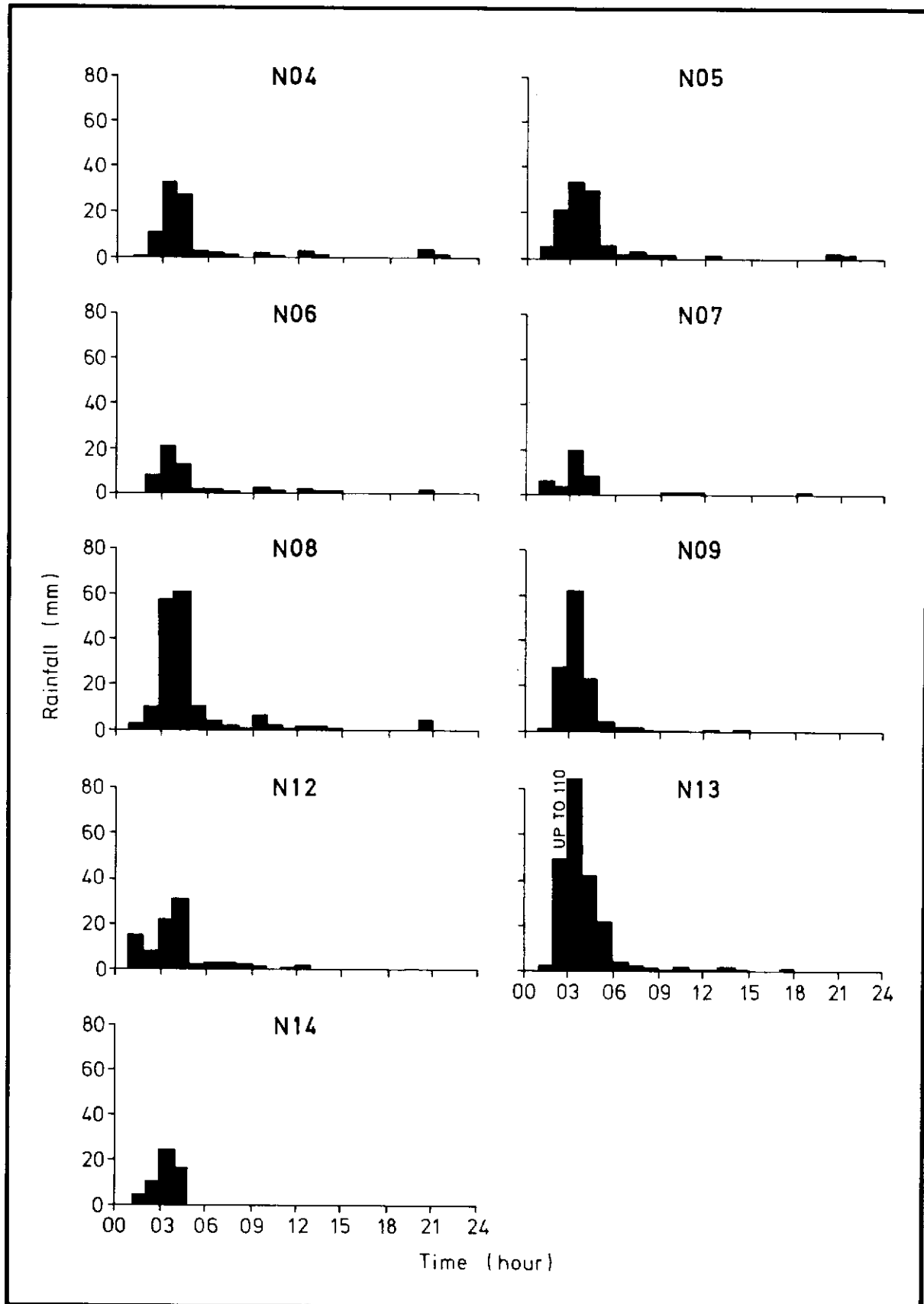


Figure B2 (Cont.) - Sheet 4 of 4

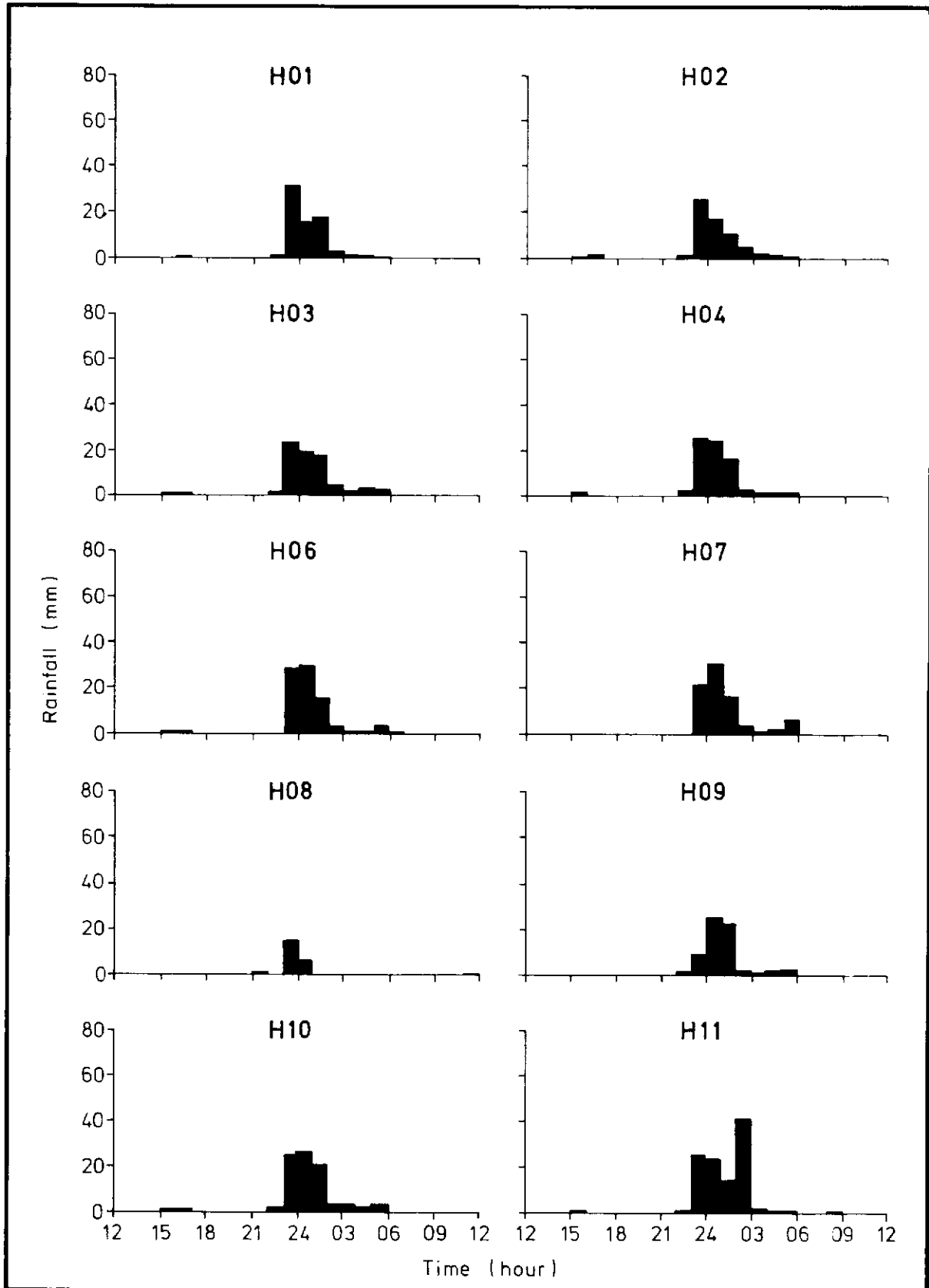


Figure B3 - Histograms of Hourly Rainfall Recorded by GCO Raingauges from noon 10.10.84 to noon 11.10.84 (Sheet 1 of 4, See Raingauge Location in Figure 1)

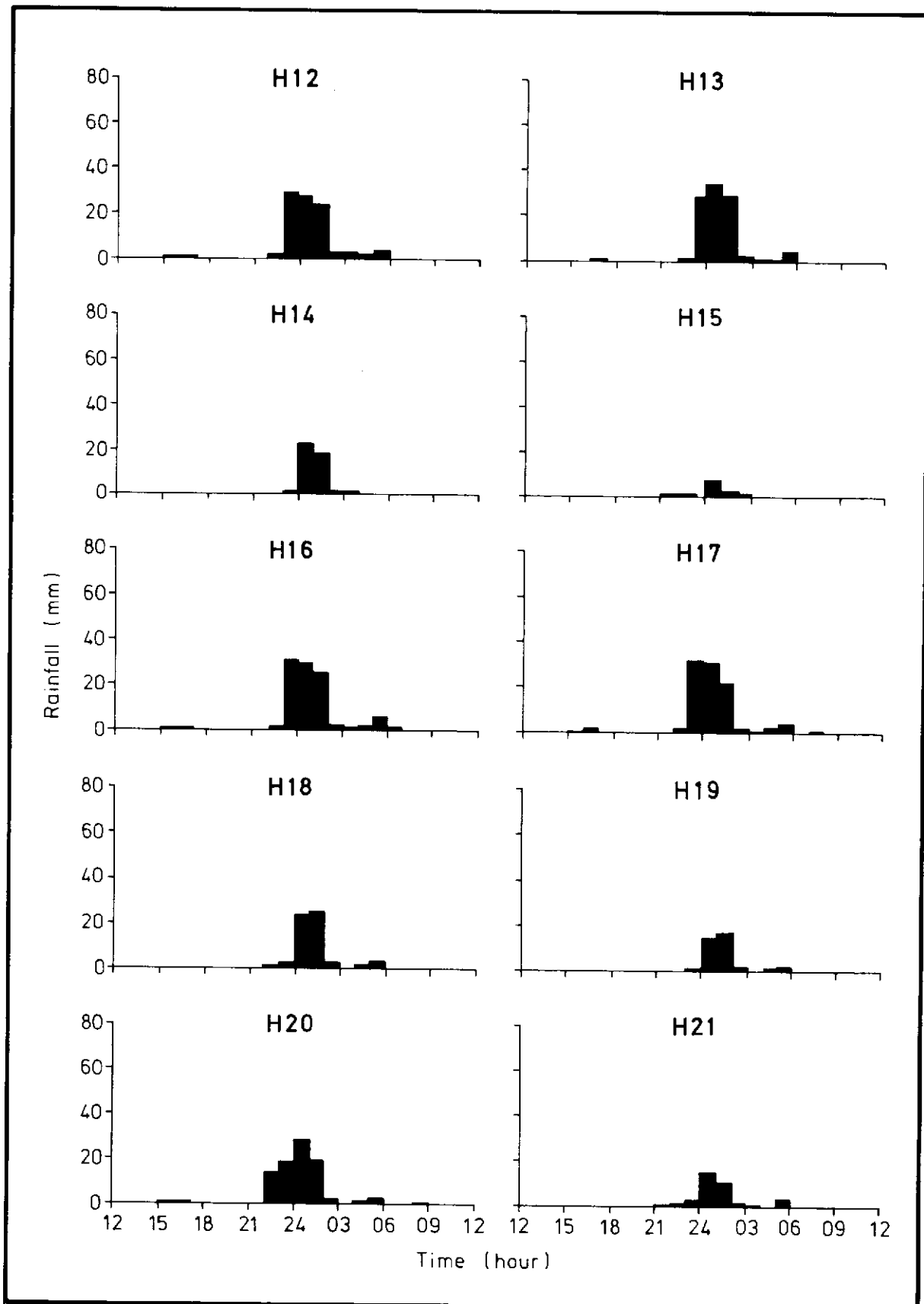


Figure B3 (Cont.) - Sheet 2 of 4

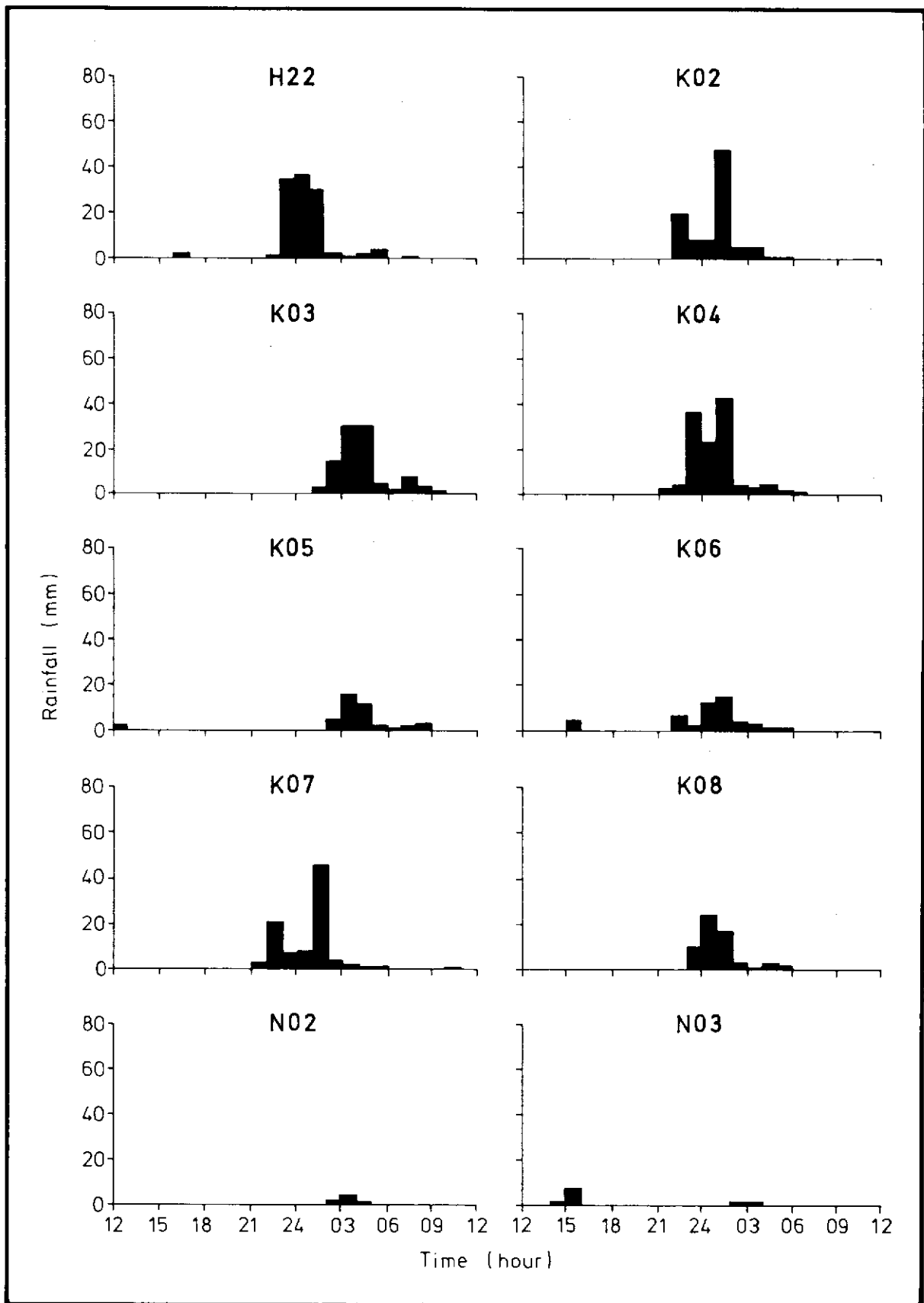


Figure B3 (Cont.) - Sheet 3 of 4

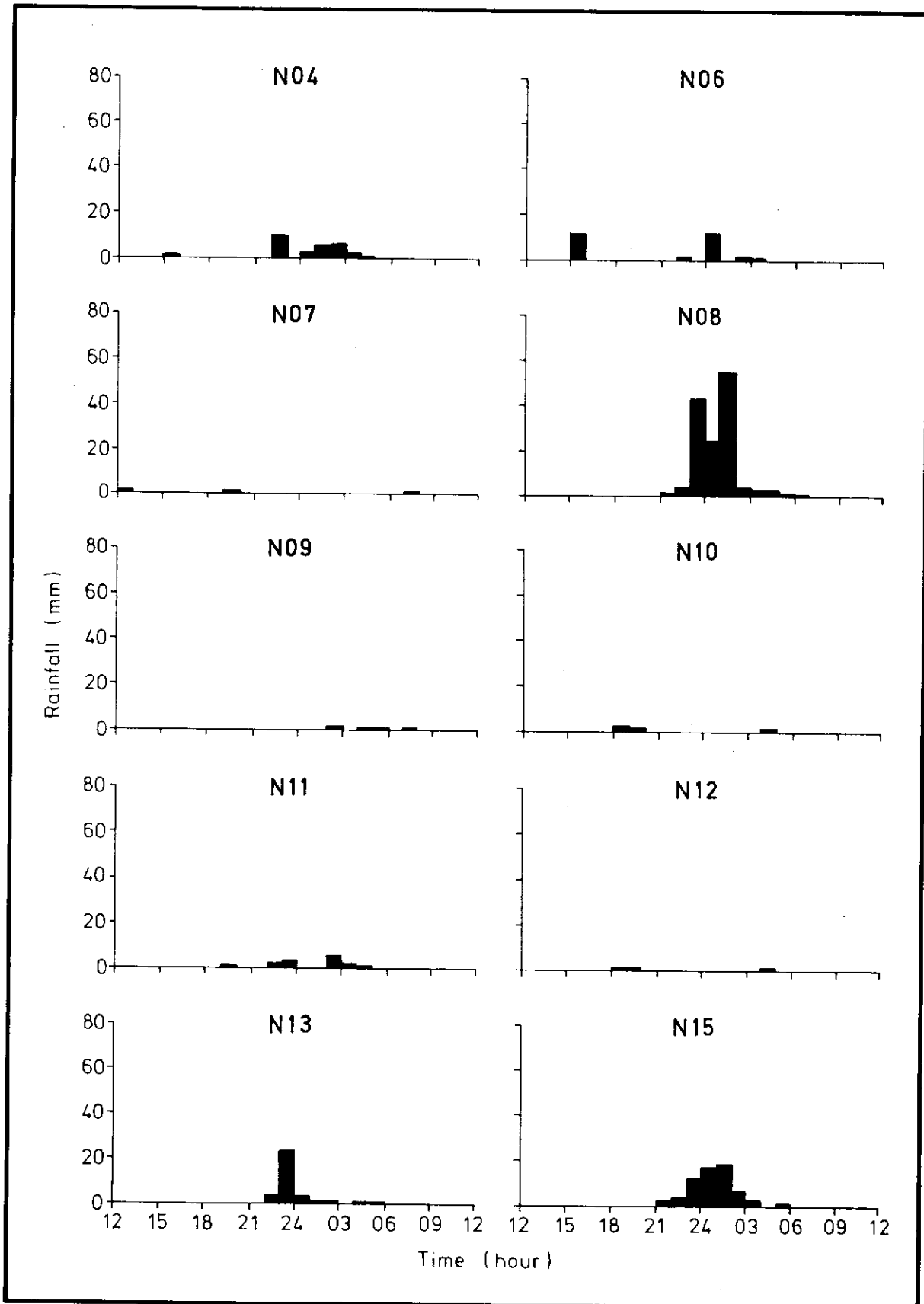


Figure B3 (Cont.) - Sheet 4 of 4

LIST OF DRAWING

Drawing  
No.

GCSP 8/1

Location Map of Landslide and Related  
Incidents in 1984