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EARTHQUAKE LOCATION MAPS OF HAWAII 1962-1985

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INTRODUCTION

The continuing expansion in instrumental seismic monitoring, and evolution in the methods in which the seismic data at the U.S. Geological Survey's Hawaiian Volcano Observatory (HVO) are processed on a daily basis, has led to an increasing collection of instrumental data for earthquakes in Hawaii. From 1962 to 1985, earthquake detection and determination capabilities improved considerably as the network of telemetered seismic stations expanded and data recording and processing methods changed to permit higher accuracy in timing of seismic signals. The purpose of this report is to describe the seismicity of the Hawaiian Islands based on earthquakes that were continually detected on the HVO seismographs and the related data compiled annually from 1962 to 1985.

Compilation of earthquakes beneath the Island of Hawaii is relatively complete for those above 2.0 in magnitude (M), and for earthquakes further along the chain of Hawaiian Islands the compilation is relatively complete for those above M=4.0. Some discontinuities in the data set are due to incomplete capture of intense seismic swarms or aftershock sequences, and to instrumental malfunction. The exceptionally high rate of aftershock activity beneath Kilauea's south flank following a 7.2 magnitude earthquake on 29 November 1975 allowed the HVO seismic analysts to read and process only the events of about M=2.7 or greater until the end of 1976 when aftershock levels were sufficiently reduced to allow return to the M=2.0 cutoff. Processing the backlog records is continuing slowly.

Hypocenter accuracy is dependent upon the seismometric coverage above the earthquake source region. The current seismic network provides for highest accuracy in the southern part of Hawaii Island, where seismicity and station density are both highest. Hypocenter determinations for earthquakes of magnitude 2.0 or greater are generally constrained to within a few km in standard error. However, for earthquakes that occur farther along the chain of islands and outside of the Hawaii Island seismic network, uncertainties of 10 km or more are possible. Determination of focal depth is particularly difficult for offshore earthquakes. The degree of hypocenter precision and completeness of the data set improves over the years as the seismic network was expanded and timing accuracy was improved. In examining the year-to-year changes in the seismicity of Hawaii one must consider the instrumental changes made.

Earthquake determinations were based on the hypocenter location program HYPOINVERSE (Klein, 1978). Seismic-velocity structure used and description of the current HVO seismic network operation are described in Hawaiian Volcano Observatory Summary 85 (Nakata and others, 1987). The history of seismograph operation at HVO from 1950 to 1979 is further described by Klein and Koyanagi (1980). For consistency, the entire set of data from 1962 to 1985 were processed using the same location procedure.

The graphical presentation of earthquake distribution for this report was formated in accordance with current concepts of earthquake generation associated with volcanic structure and processes in Hawaii. Accurately determined earthquakes are believed to provide a means of outlining the volcanic plumbing system and the regions of seismic energy release related to the accomodation of magma within the active volcanoes in the south Hawaii region. Classification of the earthquakes in space, time and magnitude define the magma transport mechanism (Klein, et. al., 1987), and the tectonic process of seismic energy release related to volcanism (Crosson and Endo, 1982). Swarms of shallow earthquakes less than 5 km in depth propagate in the eruptive zones along the summit-rift axis in immediate response to magma movement at Kilauea and Mauna Loa volcanoes (Fig. 1). Intermediate-depth earthquake at about 5 to 15 km in depth are distributed widely along the unstable flanks of the active volcanoes in tectonic response to the wedging effect from magma intruding into the rift zones. Deep earthquakes concentrate along the subvertical conduit system defining the passage of magma from a depth of about 60 km to the shallow storage complex beneath the summit region of the active volcanoes, and comparable deep earthquakes that scatter at decreasing rates northwestward along the archipelago define the volcanically induced stress system and differential loading in the lithosphere along the Hawaiian ridge.

Parameters for sampling the data set from 1962 to 1985 were selected to emphasize accuracy in focal determination for events near the center of the seismic net on the Island of Hawaii, and the overall pattern of strain release for strong earthquakes over the entire archipelago. Accordingly, a lower threshold magnitude of 2.0 and standard error for location of 2.0 km or less were used to select earthquakes to examine the pattern of seismicity beneath the Island of Hawaii. This would tend to maintain consistency in spatial distribution and sacrifice continuity in the number of earthquakes selected over the years of expansion and improvement of the seismic network. Alternatively, strong events of M=4.0 or greater without the restrictive limits in standard error were used to furnish a more continuous long-term guide for the overall pattern of seismic energy release over the entire chain of Hawaiian Islands. As a result, the increasing number of events beneath the Island of Hawaii over the years indicated by the catalogue is partly a function of the higher accuracy in focal determination of earthquakes attained due to the increase in instrumental coverage. Some of the large events over the entire chain of islands may not be included in the restricted list of earthquakes selected for the Island of Hawaii region, particularly for the earlier years of less instrumentation. Completeness and accuracy of the data improved notably from about 1970, marking the rapid advancement in instrumentation during the subsequent decade.

EARTHQUAKE GRAPHICS AND VOLCANIC ACTIVITY 1962-1985

Earthquake source parameters determined from HVO seismograph data from 1962 to 1985 are classified according to epicentral and depth regions and mapped in annual sequences. Attempt to maintain spatial and temporal continuity in mapping earthquake distribution is based on magnitude thresholds that assured instrumental detection for maximum epicentral distances from the Hawaii Island seismic network. Earthquakes of magnitude 4.0 or greater are considered in mapping the entire Hawaiian Islands region, and those of magnitude 2.0 or greater are mapped for the area beneath the Island of Hawaii. Symbols representing earthquake locations are varied according to focal depth, and their sizes are increased according to magnitude. Abbreviations for localities and events, annual highlights of volcanic and seismic activities, yearly statistics of earthquake number and seismic moment, and time-magnitude-location parameters of individual earthquakes based on magnitude threshold are listed in a series of tables to complement the subsequent sequence of figures on annual seismicity and volcanic activity

Figure 1 is a reference map of the Island of Hawaii showing pertinent volcanic features. Figures 2 to 25 illustrate the annual distribution of earthquakes and their temporal relation to significant volcanic events and damaging earthquakes. Part (a) of figures 2 to 25 includes the annual distribution of earthquakes of magnitude 4.0 and greater along the Hawaiian Islands within coordinates 18 to 23 degrees N-latitude and 154 to 161 degrees W-longitude. Ranges in focal depths and magnitudes are separated by symbols and symbol sizes, respectively. Part (b) furnishes map views of the seismic stations in operation and earthquakes of magnitude 2.0 or greater (box symbols varied in size according to magnitude ranges as referenced in the plot of shallow earthquakes for 1962) in three depth categories within 0 to 60 km beneath the Hawaii Island area (within map coordinates 18.67 to 20.50 degrees N-latitude and 154.17 to 156.67 degrees W-longitude) for each year.

Part (c) of figures 2-25 shows the temporal pattern of the Hawaii Island region earthquakes from part (b) relative to focal depth, damaging earthquakes and significant volcanic events, and seismic moment. Depth-time location of earthquakes are indicated by box symbols with sizes relative to magnitude (see index in 1962 depth-time plot). Above the depth-time plots are indicated times of damaging earthquakes of magnitude 5.5 or greater, significant volcanic eruptions, and noneruptive magma intrusions accompanied by pronounced seismic swarms or moderate tilt changes at the summit amounting to about 10 microradians or more. The rate of summit tilt during significant intrusive events are expected to be sustained at an anomalously high rate of about one microradian per hour. The times and durations of principal events are marked by solid bars. Times of continuously long eruptions from a common vent system lasting months to years are indicated by dotted bars. Codes used for the events and localities are explained in Table 1.

Cumulative seismic moment are plotted for (A) earthquakes of magnitude 4.0 or greater in the Hawaiian Islands region to describe the overall rate of energy release from tectonic compensations of stresses along the Hawaiian archipelago, and (B) earthquakes of magnitude 2.0 to 3.9 beneath the Hawaii Island area to emphasize energy release rate due to swarms of generally small earthquakes associated with volcanism in the southeastern part of the island chain. Seismic moment (Mo) was plotted using computer programs in EQPLT (Klein, 1981) based on the following earthquake-magnitude relation:

Mo = 10**(A+B*magnitude)

The values of A and B were set at A = -4 and B = 1.4 to plot seismic moment of small earthquakes of magnitude 2.0 to 3.9 beneath the Hawaii Island area, and at A = -6 and B = 1.4 to plot seismic moment of large earthquakes of magnitude 4.0 or greater beneath the Hawaiian Islands region. Seismic moment was plotted in units of 10**23 dyne-cm.

Seismic moment derived for the entire Hawaiian Islands region (A) were plotted cumulatively for the respective year in reference to the scale on the left side of the figures, and the seismic moment compilation for the region confined to near the Island of Hawaii (B) was plotted in reference to the scale on the right side. The plots reflect changes in seismic moment rate calculated for each earthquake relative to its magnitude, from the first event to the last event of the year.

Table 2 provides a general description of where and when earthquakes were most tightly centered at yearly intervals from 1962 to 1985. Relative density of the earthquake concentrations were numerically graded and listed in three depth categories sequentially according to regions beneath Kilauea, Mauna Loa, and the outlying localities.

Table 3 provides annual statistics of earthquakes recorded and processed for location and magnitude from 1962 to 1985, and the seismic moment derived from the earthquakes selected to portray the seismicity patterns for this report. Added to the bias anticipated from changes in instrumentation, were anomalies introduced by an incomplete catalogue of earthquakes of $M<2.7$ for the year 1976 and an exceptional earthquake of $M=6.0$ outside of the Hawaiian archipelago in 1984 that was included in the catalogue of Hawaiian earthquakes.

Table 4 is a summary listing of the time, location, magnitude, and parameters describing location quality for each of the magnitude 4.0 or greater earthquake beneath the Hawaiian Islands from 1962 to 1985. An exceptional earthquake of $M=6.0$ located north of the Hawaiian archipelago on February 13, 1984 is also included in the tabulation. The format is the the same as that published in the annual HVO summaries (see also, Nakata and others, 1987).

SUMMARY

Earthquakes define the internal processes and structure of the active volcanoes in Hawaii, and outline the stress system developed by volcanism and lithostatic loading along the growing chain of islands. Persistent families of earthquakes evolve with repeated volcanic activity. Episodic changes in magma movement and localities of volcanic eruptions interact with tectonic relief of stresses along adjacent structures, and the process is reflected in the temporal changes of earthquake locations and magnitudes. Forceful intrusion of magma result in rapid strain release with numerous small earthquakes localized near the source of stress. Accordingly, the swarms of small and shallow earthquakes identify times and places of shallow intrusions of magma and volcanic eruptions. This process causes gradual accumulation of compressional stress normal to the direction of magma propagation and accomodates the release of strain in a broader region along the unbuttressed flank of the volcano. The widespread distribution of intermediate-depth earthquakes at about 5 to 15 km in depth reflect the tectonic response to shallow magma pressure and regional stress along the unstable flanks of the active volcanoes. Consequently, the south flank of Kilauea moves outward from its volcanic center along a presumably incompetent sediment layer above the prevolcanic sea floor. These earthquakes range widely in magnitude, location and time, and provide the source of maximum strain release in Hawaii. A relatively steady rate of deep earthquakes occurs in the upper mantle at about 15 to 60 km in depth. These are densely located 25-45 km beneath Kilauea and scattered widely beneath the rest of the Island of Hawaii. Earthquakes in these depth catagories beneath Kilauea describe how buoyant forces and magma pressure interact in response to tectonic adjustments that accomodate the magma-transport and eruption processes (Koyanagi and others, in press; Klein and others, 1987).

To minimize bias in seismic mapping due to deterioration of detection and hypocenter determination at increasing distances outside the subaerial island network, only strong earthquakes of magnitude 4.0 or greater were considered in describing the regional seismicity of the entire Hawaiian Islands. Based on this selection seismic activity along the Hawaiian ridge appears highest in the southeastern part beneath the active volcanoes of Kilauea, Mauna Loa, and newly developing Loihi. The annual maps of earthquakes indicate the gradually decreasing number of events northwestward in the direction of progressively older volcanic systems. Seismicity decreases more abruptly from beyond 50 km southeast of the center of activity. The spatial distribution of the earthquakes could be generally explained by lateral stresses induced by magma pressures along subvertical conduit systems extending to at least 60 km beneath the active volcanoes, and by gravitational loading of the lithosphere along the archipelago. The influence of deep magma pressure probably decreases beyond an epicentral distance of about 100 km, as may be inferred by the rapid decrease of 30-60 km deep earthquakes from about one hundred km to the northwest and about 50 km to the southeast of the seismic and volcanic center. The scattered deep earthquakes farther northwestward along the ridge may be primarily tectonic strain-release due to long-term lithostatic loading.

Further details in seismicity are provided by more accurately determined earthquakes extending to lower magnitudes beneath the Island of Hawaii. Over one hundred thousand earthquakes above magnitude 0.1 are detected annually beneath the active volcanoes of Kilauea and Mauna Loa. In the Hawaii Island region several thousands of earthquakes at depths of 0 to 60 km and magnitudes greater than 1.5 are usually processed for locations each year. In exceptionally active years marked by significant earthquake swarms and aftershock sequences, many thousands of earthquakes occur above this magnitude threshold. In 1976 during a major aftershock sequence following a 7.2 magnitude Kalapana earthquake more than ten thousand earthquakes larger than 1.5 in magnitude were recorded. Over the extended period from 1962 to 1985 a total of 367 earthquakes of magnitude 4.0 to 7.2 from along the Hawaiian ridge was recorded on the HVO seismic network and processed for locations.

Cumulative seismic moment for large regional earthquakes of magnitude 4.0 or greater describes the episodically high long-term pattern of seismic energy release. Outstanding tectonic events marked by damaging earthquakes and high seismic moment occurred in 1962, 1973, 1975 and 1983. The seismic moment rate confined to the compilation of smaller earthquakes of 2.0 to 3.9 magnitude indicates more gradually changing pattern that better correlates with increasing numbers of earthquakes and volcanic activity. The seismic moment rate and frequency of crustal earthquakes clearly indicate times of significant renewals in intrusive and eruptive activity at Kilauea (such as in 1963, 1965, 1968, 1971, 1974, 1977, 1981, 1982, and 1983) and Mauna Loa (such as in 1974-1975 and 1980-1984). The high rate of volcanic activity at Kilauea generated a high background of persistent families of earthquakes, and long-term seismic changes associated with specific intrusive or eruptive events were difficult to identify. Rather, swarms of earthquakes hours or days before eruptions most reliably indicated the short-term probability of volcanic outbreaks. Volcanic activity at Mauna Loa was less frequent over the past three decades and long-term changes in seismicity associated with the influx of magma was more clearly indicated. Shallow seismicity continued for nearly a year before the summit eruption in 1975, and about four years before the summit and northeast rift eruption in 1984. Both Mauna Loa eruptions started at the summit with very short duration of precursory swarms that made short-term forcasting hours or days before the outbreaks very difficult.

Swarms of shallow earthquakes less than 5 km in depth, combined with rapid changes in summit tilt, are the most reliable indicators of increased movement of magma and possible eruptions at Kilauea or Mauna Loa. These occur as large numbers of generally small earthquakes that are concentrated beneath the volcanoes' summits or migrate along the rift zones in response to the movement of magma. Earthquakes increase as magma gradually accumulates in the summit storage complex months to years before eruption. The gradual summit inflation culminates in a swarm of earthquakes, indicating a rapid transfer of magma that relieves the confining pressure hours or days before an eruption. Thus, hypocenters of swarm earthquakes define the place and time of magma movement. The activity that intensifies to a swarm of earthquakes of magnitude 0.5 or larger and increasing in rate to several per minute, accompanied by increased rate of summit tilt amounting to about one microradian per hour, markedly raises the probability of eruption. The monitoring of downrift migration of earthquakes during such swarms, that averages about one km per hour, provides a means to project the time and place of the probable rift-eruption. As fissures open at the outbreak of lava, seismic signals assumes lower frequencies dominated by surface waves and continuous tremor. Such information has proved important for real-time hazard evaluation and scientific observations. Description of earthquake swarms associated with magma intrusions and eruptions at Kilauea from 1960 to 1983 were described in detail by Klein and others (1987). The increase of Mauna Loa summit earthquakes one year before the 1975 eruption and four years before the 1984 eruption for long-term eruptive probability was clearly indicated in the annual plots of shallow earthquakes.

Intermediate-depth earthquakes at 5 to 15 km describe the tectonic adjustments resulting from the volcanic processes at Kilauea and Mauna Loa. These earthquakes do not relate immediately to times and locations of intrusions and eruptions, but form the major component of strain release and damaging earthquakes in Hawaii. Compressional stresses generated by repeated intrusion of magma in the summit-rift conduit system that tend to wedge the volcanoes' flanks apart result in persistent earthquake activity. Significant release of strain along the flank may, alternatively, reduce confining pressure along the magma conduit system to accelerate magmatic movement. In this way, forceful intrusion of magma interacts with tectonic strain-release to accomodate the volcanic process. Major components of low-angle slip and strike-slip faulting occur along the subhorizontal separation zone between the prevolcanic oceanic floor and the base of the volcanic rocks that lie above. The most pronounced faulting of this kind is associated with the seaward displacement of Kilauea's south flank, and with compressional stresses induced by the expansion of Mauna Loa and Kilauea that are relieved in the Kaoiki region between the two active systems. An exceptional family of intermediate-depth "long-period" earthquakes characterized by their relatively narrow spectral content occur episodically in the summit region of Kilauea during times of increased tremor and magma activity.

Seismic and ground deformation data related to the major 7.2-magnitude Kalapana earthquake in November 1975 indicated widening of the summit-rift system and seaward displacement of the south flank of Kilauea. The reduced condition of stress within the volcano led to a relative increase of intrusions not associated with surface eruptions during the subsequent years. This earthquake and the associated pattern of aftershocks and ground deformation provided the data that developed the current model of the tectonic process along the south flank (see also, Crosson and Endo, 1982; Lipman and others, 1987).

The Kaoiki seismicity centered between Mauna Loa and Kilauea volcanoes was highlighted by a 6.6 magnitude earthquake on November 16, 1983 (Buchanan-Banks, 1987). This event may have influenced the time and place of the major eruption of Mauna Loa in March-April, 1984. The strike-slip earthquake (Endo, 1985) could have significantly reduced the confining pressure along the summit and northeast rift zone of Mauna Loa, which had been progressively inflating since 1980 (Decker and others, 1983). The relatively concentric pattern of epicentral distribution of Kaoiki earthquakes that persisted in 1962-1982, changed after the damaging earthquake in November 1983. Following the strong earthquake, the seismic zone expanded southward to near the lower southwest rift of Kilauea and Pahala, northward to near Mauna Loa's eruption site at Puu Ulaula on the northeast rift, and eastward to about 3 km west of Kilauea caldera. The central locality within 2 km of the mainshock hypocenter remained relatively aseismic during the subsequent two years.

Swarms of intermediate depth long-period events that accompany volcanic tremor are localized at about 6 to 12 km dominantly beneath the summit of Kilauea. Magnitude of these events are generally low and onset of signals is poorly defined, so that hypocenter locations are often poorly constrained. These events are more frequent during sustained eruption when there is a high rate of magma movement in the conduit system beneath the summit. These long-period events along with their deeper counterpart, when separated from the normal tectonic earthquakes, are believed to selectively provide a more definitive outline of the magma transport system and process (see also Koyanagi and others, 1987).

Relatively isolated concentrations of earthquakes at intermediate depths beneath the north flank of Mauna Kea occurred in 1969, 1977, 1981, and 1982. The earthquakes in this locality happened in swarms during November 1969 and November 1981, and in generally increased numbers throughout 1977 and 1982. These were not associated with volcanic tremor and eruptions, but rather appeared to be of tectonic origin unrelated to magma movement. The earthquakes measured less than 4.5 in magnitude; many exceeding 3.0 in magnitude were reported felt by residents along the northeast coast of Hawaii Island.

The primary concentration of *deep earthquakes* at about 25 to 40 km below the summit region of Kilauea are believed to track the volcano's magma transport system down into the mantle. More dispersed distribution of deep earthquakes radiate laterally to nearly one hundred km from Kilauea and extend to depths of at least 60 km outlining the minimum region of stress influenced by magma pressure and lithostatic loading in the upper mantle. Notable sources of deep earthquakes in the outlying region of the island lie beneath Hilo, Pahala and Hualalai.

A swarm of deep earthquakes located at a depth of about 55 km and a few km northeast of the summit of Kilauea, in a background of tremor, occurred three months prior to the major summit-flank eruption pair of 1959-60 (Eaton, 1962). Comparable swarms were reported in June 1954 and July 1958. Continuing improvements in seismic instrumentation indicated spatial and temporal changes in deep seismicity during the subsequent decades. Following the 1959-60 eruptions, a family of "30-km deep" earthquakes developed beneath the summit of Kilauea and persisted in frequent swarms during the early 1960s'. The activity evolved into recurrences of more isolated events or aftershock sequences from about the middle of that decade. Annual maps of 15-60 km deep earthquakes since 1962 generally indicate a tightly clustered source earthquakes beneath the summit region before 1968, followed by a wider distribution of earthquakes surrounding the clustered Kilauea-summit events from about 1969 to 1975, and eventually, the decreasing concentration of Kilauea summit earthquakes and increasing spread of activity southwest of Kilauea since 1976. Deep earthquakes were also widely scattered along the northern and western parts of the island during the past decade. In 1984 and 1985, during the years of high lava production accompanying the continuing Kilauea east-rift eruption at Puu Oo, the distribution of deep earthquakes lacked the high concentration of Kilauea-summit earthquakes. Alternatively, part of the increasing number of deep earthquakes beneath the northern and western margins of the island after 1969 may be due to the expanding network of telemetered seismic stations across the island, which improved the depth determinations of earthquakes at such distances from Kilauea. A 6.0 magnitude earthquake on 14 August 1955 was the last damaging earthquake to originate from the deep seismic region of Kilauea.

Beneath the Hilo area, earthquakes are generally confined to upper mantle events at about 30-60 km in depth. On April 26, 1973, a damaging 6.2 magnitude earthquake occurred north of Hilo at about 50 km in depth; analysis of this apparently tectonic earthquake and its aftershocks were reported by Unger and Ward (1979). More frequent shallow events that are reported in the Hilo area are mostly signals from rock-quarry explosives with signal strengths sometimes equivalent to about 3.0 in magnitude.

Beneath the Pahala area a unique family of long-period earthquakes associated with deep tremor occur intermittently at depths of 40-55 km (see also Koyanagi and others, 1987; Aki and Koyanagi, 1981). The events that center between the active volcanoes of Kilauea, Mauna Loa, and the newly developing submarine volcano Loihi, are believed to outline the source region and movement of magma that eventually feed eruptions of the Hawaiian volcanoes. Similar to their intermediate-depth counterpart, these long-period events are usually low in signal strength and emergent in onset and are often not included in the HVO catalog of well-located earthquakes. Long-period events increased generally during the sustained Mauna Ulu eruption in 1969-1974 and the Puu Oo eruption continuing since 1983. The deep activity also accelerated after the 7.2 magnitude Kalapana earthquake in 1975, that expectedly affected the magma-plumbing system.

During the past few decades isolated deep earthquakes were centered beneath Hualalai. A major swarm of Hualalai earthquakes that occurred in 1929 (Jaggar, 1929) appeared to be deep, based on the extent of felt and damage reports. Unfortunately this swarm predates instrumental coverage sufficient to constrain depth determination.

One of the most important development during this period of monitoring was the instrumental capability of detecting and locating Loihi earthquakes at about 50 km south of the Island of Hawaii. Loihi earthquakes were identified as volcanic swarms from beneath the seamount since 1971 (Klein, 1982), as an increasing number of critical seismic stations were installed along the south coast. This led to underwater research in the area that verified the existance of an active submarine volcano. The swarms of Loihi earthquakes recorded were notably in 1971-72, 1975, and 1984-85. The large epicentral distance of these offshore earthquakes located outside of the Hawaii Island seismic network places severe limitations on the degree of accuracy of hypocenter determination and detection of low-magnitude volcanic seismicity necessary for detailed analysis of the structure and state of the developing volcano. Ocean-bottom seismometry around the seismic zone is necessary to enhance monitoring capability.

Although most of the earthquakes are confined to beneath the volcanic deposits along the Hawaiian Islands, ocassional earthquakes occur outside of the archipelago. An isolated event on 13 February 1984 measured 6.0 in magnitude and was estimated to be nearly seven degrees north of the Hawaiian Islands.

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Table 1: Codes for volcanic events, damaging earthquakes of $M>5.5$, and localities of significant seismic and volcanic activity.

EVENT	
Eruption	E
Intrusion (without eruption)	I
Major Earthquake	Eq
LOCALITY	
Hilo	HIL
Hualalai West Flank	HWF
Kilauea East Rift	KER
Kilauea South Flank	KSF
Kilauea South Flank - Kalapana	KAL
Kilauea South Summit - Koae	KK
Kilauea Southwest Rift	KSW
Kilauea Summit	KS
Loihi Seamount	LOI
Mauna Kea North Flank	MKNF
Mauna Loa Northeast Rift	MNE
Mauna Loa Northwest Flank	MNWF
Mauna Loa South Flank - Hilea	HLA
Mauna Loa Southeast Flank - Kaoiki	KAO
Mauna Loa Southwest Rift	MSW
Mauna Loa Summit	MS
Mauna Loa West Flank - Kona	KON

Table 1 (continued):

EARTHQUAKE DESCRIPTION	
June 27, 1962, M=6.1 Kaoiki	6.1-KAO
April 26, 1973, M=6.2 Hilo-Honomu	6.2-HIL
November 29, 1974, M=5.5 Kaoiki	5.5-KAO
November 29, 1975, M=7.2 Kalapana	7.2-KAL
November 16, 1983, M=6.6 Kaoiki	6.6-KAO

Table 2: Localities of seismic concentrations in three depth zones beneath the Island of Hawaii region, as indicated by annual locations of M>2.0 earthquakes with standard errors of 2.0 km or less. Codes for locations are as listed in Table 1. Concentrations are rated according to relative density of earthquakes within each region separated in annual increments and in three depth zones referenced to the Hawaii Island seismicity maps in part b of figures 2-25; (1) low, (2) moderate, and (3) high. Shallow events in the Hilo region are usually signals from rock-quarry blasting (#).

YEAR	SHALLOW (0-5 KM)	INTERMEDIATE-DEPTH (5-15 KM)	DEEP (15-60 KM)
1962	------------	KAO(2)	KS(3)
1963	KER(2), KK(2), KS(2)	KSF(1) KAO(3)	KS(3)
1964	------------	KSF(2) KAO(2)	KS(3)
1965	KK(2), KSF(2)	KSF(2) HLA(1), KAO(2)	KS(3)
1966	-------------	KSF(2) KAO(2)	KS(3)
1967	KSF(1), KSW(1), KS(1)	KSF(2) KAO(2)	KS(3)
1968	KER(2), KS(2)	KSF(3) KAO(2)	KS(3)
1969	KER(2), KSW(2) KS(2)	KSF(2), KSW(2) HLA(1), KAO(2) MKNF(2)	KSF(1), KS(3)
1970	KER(1), KS(3)	KSF(2) HLA(1), KAO(2), KON(1)	KSF(1), KS(3) HLA(1)
1971	KSW(3), KS(2)	KSF(3) HLA(1), KAO(2) LOI(1)	KS(3)
1972	KS(1)	KSF(2) HLA(2), KAO(2) LOI(1)	KS(3)
1973	KK(2)	KSF(2) MNWF(2), HLA(1), KAO(2) MKNF(1)	KS(3) HIL(2)
1974	KSW(3), KS(3) MS(3)	KSF(2) MNWF(1), HLA(1), KAO(3), KON(1)	KSF(1), KS(3)
1975	KSF(2), KSW(3), KS(2) MS(3)	KSF(3) MNE(2),MNWF(2),HLA(1), KAO(2), KON(1)	KSW(1), KS(3) HLA(1)

Table 2 (continued):

1976	KER(2), KSF(1)	KSF(3) HLA(1),KAO(2), KON(1)	KS(1) HLA(1)
1977	KER(2), KS(3)	KSF(3) HLA(1), KAO(2), KON(1) MKNF(1)	KS(2) HLA(1)
1978	KER(1), KS(2)	KSF(2) MNWF(1), HLA(1), KAO(2), KON(1) MKNF(1)	KS(1) HLA(1), MS(1)
1979	KER(2), KS(3)	KSF(2) HLA(1), KAO(2), KON(1)	KSF(1), KS(1) HLA(1)
1980	KER(2), KS(3) MSW(1)	KSF(2) HLA(1), KAO(2), KON(1)	KS(1) HLA(1)
1981	KSW(3), KS(3) MS(2)	KSF(2) MNF(1), HLA(1), KAO(2), KON(1) MKNF(2)	KS(2)
1982	KER(1), KSW(1), KS(3) MS(3)	KSF(2) MNWF(2), HLA(3), KAO(2), KON(1) MKNF(1)	KS(2) HLA(1)
1983	KER(2) MNWF(2), MS(3)	KSF(2) MNWF(2), HLA(2), KAO(3), KON(1)	KS(2) HLA(1) MKNF(1), HWF(1)
1984	MNE(2), MSW(2), MS(3)	KSF(2) HLA(1),KAO(3), MS(1), KON(1) MKNF(1), LOI(1)	HLA(1) HWF(1), MKNF(1)
1985	KS(2) HIL(2)#	KSF(2) KAO(2), KON(1) LOI(2)	KS(1) HWF(1), MKNF(1)

Table 3: Annual statistics of seismicity in Hawaii based on earthquakes processed for locations at HVO. Earthquakes constrained by location, magnitude, and standard error (ER) were selected to portray the pattern of seismicity. Boundary limits for the earthquake selections are consistant with those in figures 2-25. Due to the large number of aftershocks in 1976, many earthquakes of about M<2.7 are not yet processed for location (#). An exceptional earthquake of M=6.0 north of the Hawaiian Archipelago in February 1984 was included in the catalogue and account for the high seismic moment from the M>3.9 events(##).

Year	Number Earthquakes			Seismic Moment (10**23 Dyne-Cm)	
	Total Processed; Maximum Magnitude	Hawaiian Islands (M>3.9)	Island of Hawaii (M>2.0) (ER<2km)	Hawaiian Islands (M>3.9)	Island of Hawaii (2.0<M<4.0)
1962	998; M=6.1	13	164	347	0.18
1963	1150; M=4.7	9	287	18	0.38
1964	631; M=5.3	8	181	34	0.22
1965	812; M=4.6	6	214	5	0.33
1966	509; M=4.6	11	204	5	0.32
1967	688; M=4.6	10	235	9	0.37
1968	1678; M=4.5	13	325	8	0.37
1969	3929; M=4.7	14	542	15	0.68
1970	4342; M=4.8	11	574	14	0.52
1971	6908; M=4.7	17	712	25	0.61
1972	3167; M=5.1	12	425	40	0.31
1973	3035; M=6.2	15	500	424	0.54
1974	4946; M=5.5	23	962	113	0.95
1975	6399; M=7.2	51	2063	14368	2.90
1976	2351; M=5.0	24	1785#	42	2.63
1977	2934; M=5.3	20	1788	60	1.98
1978	2329; M=4.4	10	1482	10	1.32
1979	4820; M=5.6	15	1116	133	1.21
1980	3853; M=4.5	7	1039	5	1.14
1981	4023; M=5.2	23	1213	42	1.12

Table 3 (continued):

1982	5087; M=5.5	16	1188	100	1.18
1983	4380; M=6.6	18	1192	2088	1.54
1984	2428; M=6.0	10	798	271##	0.97
1985	2045; M=4.8	10	568	15	0.62

HVO EARTHQUAKE SUMMARY LIST 1962 1985

Table 4:

YEAR	MON	ORIGIN TIME DA	HRMN	SEC	LAT N DEG	MIN	LON W DEG	MIN	DEPTH KM	AMP MAG	DUR MAG	NR	NS	GAP DEG	RMS SEC	MIN DIS	ERH KM	ERZ KM	NO FM	REMK	
1962	JAN	7	257	53.36	19	26.69	155	3.29	9.91	4.1		10	3	188	.22	13	1.2	5.4	7	GLN	*
	FEB	10	16 0	48.30	19	13.46	154	23.89	2.80	4.5		7	2	350	.30	93	23.4	15.8	5	DIS	*
	MAR	9	2346	16.70	19	55.30	156	0.22	20.01	4.1		8	1	308	.15	80	2.9	17.2	5	KOH	*
		30	1815	55.02	19	25.91	155	18.54	30.32	4.0		10	4	176	.08	2	2.6	1.1	4	DEP	
	APR	24	3 4	50.19	19	23.19	155	26.31	10.01	4.1		10	3	247	.12	8	1.3	0.7	7	KAO	
	MAY	10	556	5.05	19	25.18	155	14.44	29.22	4.0		11	4	133	.10	5	1.7	1.0	7	DEP	
	JUN	13	1634	56.02	19	24.91	155	16.49	25.71	4.1		9	2	92	.12	1	1.7	3.1	6	DEP	
		27	1827	14.18	19	23.97	155	27.25	10.22	6.1		10	0	141	.06	10	0.8	0.8	9	KAO	
	JUL	24	1748	15.83	19	32.42	155	57.69	2.17	4.7		14	3	169	.39	60	2.7	1.4	8	KON	
	AUG	18	1658	42.63	19	16.84	155	12.15	9.49	4.4		10	3	192	10	12	0.8	2.2	7	SF3	
	SEP	8	358	55.71	18	50.14	154	58.50	17.33	4.1		12	3	290	.18	67	2.2	99.0	8	DIS	*
	NOV	22	518	21.11	19	21.02	155	2.90	0.57	4.4		11	1	208	09	19	1.7	0.9	10	SSF	
	DEC	30	1747	19.78	19	11.94	155	37.80	8.99	4.0		10	2	234	.27	16	3.6	2.2	7	LSW	
1963	JAN	8	939	45.03	19	23.39	155	13.08	31.22	4.6		9	2	230	.06	5	2.4	2.4	7	DEP	
		8	1541	6.04	19	24.12	155	13.75	28.38	4.1		8	2	225	10	6	3.8	1.7	6	DEP	
	MAR	24	2231	51.61	19	48.09	155	32.89	4.58	4.2		12	3	167	.08	30	0.7	2.6	8	KEA	
	JUN	6	2225	38.65	19	12.66	155	40.06	6.88	4.1		8	1	255	.09	18	2.8	3.4	7	LSW	
	AUG	26	849	18.15	19	22.48	155	22.22	6.36	4.7		12	2	139	.68	5	3.5	5.7	10	KAO	
	SEP	19	624	26.60	19	20.45	155	25.48	10.43	4.4		11	2	163	.08	4	1.3	0.5	9	KAO	
		21	624	20.61	19	25.68	155	49.38	7.54	4.7		9	2	325	.10	47	7.3	1.5	7	KON	
	OCT	11	1652	48.10	19	5.91	155	2.92	11.94	4.1		14	3	254	.09	33	0.9	0.9	11	LOI	
		23	1024	6.87	19	22.56	155	24.95	8.77	4.6		12	0	129	.26	5	1.2	1.9	9	KAO	
1964	JAN	7	1 6	25.51	19	18.23	155	12.50	8.53	4.4		14	3	185	.14	8	0.9	0.8	10	SF2	
	FEB	20	2232	45.43	20	34.04	155	59.59	7.46	4.2		17	6	187	.17	35	2.3	3.9	11	DIS	
	JUN	8	12 0	50.49	19	41.63	155	28.64	11.88	4.1		12	2	239	.07	25	0.8	0.9	7	KEA	
	JUL	17	13 9	56 77	19	56.97	155	52.40	7.67	4.1		12	3	154	.10	48	2.0	2.8	9	KOH	
	AUG	13	627	39.47	19	31.41	155	14.79	19.89	4.0		14	2	120	.22	12	1.2	2.1	9	DEP	
	OCT	11	0 6	43.58	18	51 38	156	31.00	6.12	5.3		15	2	291	.11	97	15.7	22.4	11	DIS	*
	DEC	2	2228	41.03	19	24 33	155	16.65	24.81	4.5		13	2	78	.14	1	1.1	2.2	10	DEP	
		10	153	44.64	19	15.95	155	8.32	8.15	4.6		12	1	240	.19	12	2.2	1.4	9	SF4	
1965	JAN	1	457	44.82	19	50.36	155	23.79	35.38	4.1		14	1	168	.09	35	1.1	2.9	9	KEA	
	FEB	13	13 6	29.61	18	45.22	155	18.86	14.66	4.6		10	1	312	.09	65	7.0	10.7	9	LOI	*
	MAR	6	112	12.21	19	13.73	155	9.03	4.28	4.0		10	1	243	.19	20	2.5	3.9	7	SSF	
		22	933	13.92	19	15.32	155	32.52	13.46	4.2		11	2	127	.25	22	1.8	1.2	6	DLS	
	APR	29	10 8	28.21	20	36.45	157	28.63	15.11	4.4		6	0	316	.24	129	22.2	23.2	6	DIS	*
	JUL	22	1227	5.12	19	16.54	155	28.07	11.20	4.2		14	3	137	.11	11	1.2	0.5	9	LSW	
1966	JAN	19	244	12.41	19	23.76	155	29.74	24.00	4.1		12	3	127	.08	13	0.9	1.6	12	DML	
		19	14 1	37.96	19	22.83	155	30.30	21.45	4.1		13	3	135	.15	13	1.1	2.0	13	DML	
		21	21 2	25.39	19	33.16	156	4.81	15.56	4.4		13	2	303	.23	17	2.8	1.5	13	KON	
	FEB	21	1559	33.51	19	59.33	155	42.92	16.84	4.0		17	5	146	.32	56	1.6	32.5	17	KOH	*
		28	20 0	11.16	19	24.91	155	28.09	9.54	4.0		13	3	149	.16	12	0.9	1.3	13	KAO	
	MAR	10	1959	43.54	20	1.93	157	34.42	6.12	4.0		12	3	302	.23	160	16.9	21.6	12	DIS	*
		14	14 4	54.11	19	18.94	155	25.41	9.87	4.0		11	3	134	.14	4	1.1	1.4	11	LSW	
	JUL	30	1658	22.94	19	26.11	155	27.01	11.40	4.1		11	1	132	.14	9	1.1	0.7	11	KAO	
	AUG	19	521	39.52	18	32.22	155	5.23	51.48	4.6		13	0	312	.63	79	46.0	11.4	11	DIS	F

Table 4 (continued):

HVO EARTHQUAKE SUMMARY LIST 1962-1985

YEAR	MON	DA	HRMN	SEC	LAT N DEG	LAT N MIN	LON W DEG	LON W MIN	DEPTH KM	AMP MAG	DUR MAG	NR	NS	GAP DEG	RMS SEC	MIN DIS	ERH KM	ERZ KM	NO FM	REMK	
1966	OCT	30	1849	26.23	19	22.23	155	28.80	12.06	4.2		16	3	91	.13	10	0.7	0.6	16	KAO	
	DEC	31	17 4	51.43	19	25.03	155	17.85	28.05	4.2		14	4	82	.11	1	0.9	1.0	14	DEP	
1967	JAN	23	1659	15.64	19	27.31	155	24.76	9.91	4.1		13	0	75	.13	5	0.7	0.9	13	KAO	
	FEB	1	2330	41.86	19	20.43	155	4.15	7.84	4.2		11	0	205	.12	10	1.2	1.1	11	SF5	
	MAR	24	1458	37.29	19	46.48	155	40.15	10.45	4.3		16	3	130	.21	29	0.9	1.7	16	KEA	
	MAY	3	19 0	33.72	19	21.53	155	26.45	12.46	4.4		12	1	92	.16	6	0.9	0.7	5	KAO	
	JUL	1	5 3	50.04	19	27.69	155	12.96	24.61	4.0		15	1	120	.05	9	0.8	0.9	14	DEP	
		2	929	19.45	18	54.84	155	19.81	16.84	4.0		15	2	271	.21	32	5.4	80.1	15	LOI	*
		5	251	10.84	19	21.19	155	27.33	12.59	4.2		15	1	138	.09	7	0.9	0.6	15	KAO	
		21	2134	10.15	20	45.18	156	7.29	8.25	4.6		10	2	219	***	13	59.6	79 1	10	DIS	*
	SEP	8	222	32.52	19	25.55	155	16.15	18.01	4.1		16	1	63	.09	2	0.8	1.2	15	DEP	F
	OCT	29	334	37.22	20	2.75	155	32.60	14.76	4.1		21	4	169	.23	16	1.1	1 5	21	KEA	
1968	FEB	22	920	40 28	19	13.39	156	17 84	5.18	4.5		20	2	258	.12	77	4.2	5 9	18	KON	
	MAR	31	056	15.02	21	43.69	157	2 30	17 13	4.4		21	3	246	.13	107	4.2	98.9	8	DIS	*
	APR	3	15 6	11.28	19	43.43	155	33.48	52.22	4.2		15	2	210	.31	31	4.2	3.9	14	KEA	
		10	1 0	26.55	19	47.88	155	23.51	7.41	4.0		18	2	204	***	34	10.1	11.5	14	KEA	*
	AUG	1	034	38.40	19	19.67	155	6.80	9.20	4.0		14	0	194	.08	5	1.0	0.8	14	SF4	
		2	1836	55.06	19	55.80	155	50.71	2.19	4.0		19	3	146	.21	46	0.8	0.8	18	KOH	
		7	1058	25.51	19	16.99	155	51.53	7.12	4.3		17	2	259	.13	27	2.3	1.4	15	KON	
		7	12 5	1.51	19	20.22	155	49.29	10.26	4.0		15	1	193	.08	23	1.5	1.0	12	KON	
		16	1623	38.78	19	50.46	155	24.85	8.95	4.0		15	5	165	.18	37	0.7	1.2	8	KEA	
	SEP	23	1811	54.44	20	9.73	155	48.68	15.39	4.2		22	5	293	.10	72	3.7	5.9	15	KOH	
	NOV	18	2353	0.24	19	13.68	154	59.06	12.35	4.2		19	0	244	.14	21	2.6	0.9	19	DIS	
	DEC	13	637	54.52	19	58.06	157	40.49	0.73	4.0		16	1	234	.13	166	3.2	1.6	9	DIS	
		16	1633	3.89	19	19.10	155	12.20	9.09	4.0		21	1	132	.11	5	0.6	0.9	20	SF3	
1969	JAN	1	247	28.45	20	14.62	157	39.80	0.01	4.0		23	3	224	.17	136	5.6	0.8	18	DIS	*
	FEB	9	1624	42.42	19	19.40	155	7.36	9.49	4.2		17	1	193	10	4	0.9	1.0	16	SF4	
		22	1224	27.21	19	24.47	155	59.80	4.43	4.2		10	0	308	.05	56	19.8	5.3	6	KON	*
	APR	9	730	58.77	20	47.33	155	47.07	7.05	4.0		20	4	322	.25	139	22.4	27.1	17	DIS	*
	MAY	7	436	0.31	20	42.98	155	33.29	4.29	4.3		23	5	226	.23	73	2.8	3.1	19	DIS	
		9	1533	28.05	19	21.56	155	4.40	12.68	4.3		13	0	217	.09	10	1.6	2.7	13	SF5	
		24	1638	28.44	21	30.74	157	19.85	7.00	4.3		8	1	223	***	72	99.0	31.6	7	DIS	*
	JUN	6	1155	33.17	19	23.14	155	16.64	32.89	4.0		18	2	58	.12	1	1.3	1.2	18	DEP	
	JUL	13	122	3.70	19	11.50	155	35.94	9.64	4.3		18	2	133	.14	15	0.7	1.6	14	LSW	
	SEP	3	940	9.69	19	20.53	155	25.63	31.38	4.4		20	1	114	.07	4	0.8	1.3	18	DML	
	OCT	14	1255	32.29	19	20.88	155	2.83	8.44	4.1		17	2	204	.08	13	0.7	1.1	15	SF5	
	NOV	9	1912	12.85	19	11.24	155	32.51	9.97	4.6		18	0	144	.15	11	0.9	0.9	18	LSW	
		22	14 5	44.02	19	36.44	155	5.80	15.51	4.3		21	2	125	.12	13	1.0	1.2	13	HIL	
		24	912	21.60	19	43.89	156	5.93	2.37	4.7		20	2	300	.11	67	7.6	4.1	18	HUA	
1970	MAR	18	623	31.10	19	20.72	155	2.20	8.44	4.2		20	2	198	.12	14	0.7	0.9	18	SF5	
		30	235	27.03	19	33.53	155	15.77	25.32	4.3		24	1	84	.11	13	0.7	1.4	6	DEP	
	APR	12	913	44.12	19	23.93	155	26.18	10.12	4.2		23	2	63	.12	9	0.5	0.7	20	KAO	
		17	1212	14.05	19	33.25	155	53.46	9.49	4.0		18	0	159	.09	5	1.3	1.0	8	KON	
	MAY	10	530	53.67	19	20.51	155	2.22	9.26	4.1		21	2	196	.10	14	0.7	1.1	18	SF5	
	JUN	22	1238	42.31	19	23.64	155	27.83	10.65	4.3		16	0	157	.05	10	0.7	0.8	15	KAO	

Table 4 (continued):

YEAR	MON	ORIGIN TIME DA	HRMN	SEC	LAT N DEG	MIN	LON W DEG	MIN	DEPTH KM	AMP MAG	DUR MAG	NR	NS	GAP DEG	RMS SEC	MIN DIS	ERH KM	ERZ KM	NO FM	REMK	
1970	AUG	16	741	53.74	19	26.29	154	46.54	45.63	4.3		23	3	291	.10	12	1.1	1.7	20	LER	
	SEP	21	126	36.50	19	19.90	155	12.20	10.73	4.5		23	1	172	.08	5	0.7	0.5	18	SF3	
	OCT	25	832	54.28	19	24.28	155	13.40	26.89	4.1		21	1	62	.16	4	1.0	2.1	15	DEP	
		25	955	29.10	21	8.79	156	36.71	11.20	4.8		18	1	336	.22	57	17.0	21.0	16	DIS	*
	NOV	12	1946	14.42	20	5.43	155	48.87	18.45	4.3		21	2	287	.10	14	1.2	1.6	17	KOH	
1971	APR	25	8 3	2.08	19	22.26	155	15.56	10.59	4.0		17	2	81	.05	1	0.6	0.5	15	INT	
		25	2356	13.31	19	24.85	155	15.52	24.30	4.4		19	1	60	.10	3	0.8	1.4	16	DEP	
	MAY	13	2029	6.14	19	54.49	156	15.29	12.16	4.2		27	2	211	.17	60	1.3	3.6	20	HUA	
	JUN	11	1529	2.09	22	10.56	154	55.28	7.05	4.3		6	0	359	.35	309	99.0	98.7	3	DIS	*
	JUL	2	1726	11.45	19	47.62	154	21.79	14.55	4.4		24	0	319	.16	65	21.0	99.0	23	DIS	*
		7	2016	48.84	19	38.54	156	4.87	10.68	4.1		26	2	253	.11	53	2.3	4.4	19	KON	
	AUG	1	852	39.50	18	24.11	154	32.69	6.88	4.6		24	2	315	.16	116	16.1	20.0	19	DIS	*
		15	1536	9.13	19	22.05	155	16.71	34.18	4.8		25	1	100	.09	2	0.8	0.9	21	DEP	
	DEC	9	215	57.63	19	20.28	155	6.72	8.08	4.3		19	0	147	.11	6	0.8	1.5	17	SF4	
		24	1611	13.41	19	11.03	155	21.02	9.03	4.0		21	1	181	.11	12	1.0	0.7	20	SWR	
		24	1738	12.68	19	11.35	155	20.93	8.03	4.1		22	0	181	.14	13	0.9	1.2	21	SWR	
		26	114	1.97	19	15.06	155	21.93	7.33	4.0		23	0	152	.12	8	0.7	1.0	19	SWR	
		27	1511	51.83	19	15.72	155	22.30	0.07	4.7		22	1	144	.20	8	0.8	1.5	19	SWR	*
		27	17 9	54.95	19	16.15	155	22.41	7.08	4.0		22	1	140	.10	8	0.6	0.9	21	SWR	
		28	1659	12.01	19	14.90	155	22.95	7.68	4.6		21	0	146	.12	7	0.7	1.0	20	SWR	
		29	042	3.15	19	15.26	155	22.33	6.83	4.1		25	1	148	.11	8	0.6	0.9	23	SWR	
		29	138	43.09	19	14.93	155	21.79	7.42	4.6		23	1	153	.12	9	0.6	0.8	20	SWR	
1972	JAN	13	1359	33.18	18	49.83	155	17.80	14.26	4.3		29	2	264	.08	41	2.7	4.2	24	LOI	
		29	214	49.55	18	46.67	155	17.02	11.90	4.0		29	2	273	.09	46	3.2	4.9	26	LOI	
	FEB	17	1317	56.87	19	22.81	155	25.61	11.22	4.1		22	0	53	.10	6	0.5	0.9	22	KAO	
		29	12 8	23.91	19	21.63	156	21.05	7.67	4.9		21	1	243	.04	78	2.4	4.1	16	DIS	
	MAR	3	8 9	2.37	18	46.64	155	20.04	14.28	4.0		14	2	291	.07	42	6.4	8.1	11	LOI	
		31	1620	35.01	19	20.26	155	3.41	10.13	4.0		21	1	134	.05	1	0.6	0.6	18	SF5	
	APR	19	1016	40.35	18	59.66	155	38.86	42.19	4.0		27	1	175	.06	2	2.0	2.7	24	DLS	
	JUL	14	936	57.69	19	1.96	155	19.82	37.52	4.5		27	1	220	.08	20	1.4	1.8	23	LOI	F
	SEP	5	131	33.85	19	19.84	155	12.37	10.47	5.0		23	0	143	.07	5	0.6	0.4	20	SF2	F
		5	2341	6 39	19	20.35	155	6.44	10.57	4.0		23	0	139	.08	6	0.8	0.5	17	SF4	
	DEC	23	9 4	52.74	19	35.35	155	55.57	14.93	5.1		25	0	204	.15	36	1.4	99.0	22	KON	*
		24	1043	7.04	19	34.68	155	56.17	15.21	4.6		25	0	207	19	35	1.7	67.2	21	KON	*
1973	FEB	12	1946	58.33	19	21.56	155	20.73	31.95	4.0		27	0	60	.09	4	0.7	1.3	25	DEP	
	MAR	6	1849	46.27	19	26.27	155	26.91	12.03	4.0		26	0	43	.12	9	0.5	0.7	25	KAO	
	APR	15	059	39.16	19	19.61	155	7.10	10.11	4.3		25	0	183	.08	7	0.9	0.5	23	SF4	F
		22	21 7	53.06	19	57.81	154	40.30	31.55	4.8		17	1	317	.09	51	2.2	2.8	15	KEA	
		26	1026	31.53	19	51.96	155	9.09	39.96	6.2	6.2	26	0	213	.11	18	2.5	4.0	22	KEA	
		26	2333	39.09	19	54.67	155	36.12	12.46	4.1		25	0	130	.10	21	2.0	0.7	24	KEA	
	MAY	5	736	4.38	22	48.73	155	8.42	7.03	4.1		9	0	353	***	368	99.0	99.0	7	DIS	*
	JUN	21	1426	6.42	19	17.41	155	15.73	9.28	4.0		29	0	146	.09	5	0.5	0.9	29	SF1	
	OCT	9	153	45.27	19	20.30	155	16.03	32.52	4.6		33	0	83	.09	2	0.6	1.1	27	DEP	F
		9	2 1	2.48	19	20.07	155	16.56	32.68	4.3		33	0	88	.09	1	0.6	1.0	30	DEP	F
		13	611	11.89	20	35.36	155	58.00	11.87	4.3		25	2	196	.04	35	2.3	3.0	19	DIS	F*

HVO EARTHQUAKE SUMMARY LIST 1962-1985

Table 4 (continued):

YEAR	MON	ORIGIN TIME DA	HRMN	SEC	LAT N DEG	MIN	LON W DEG	MIN	DEPTH KM	AMP MAG	DUR MAG	NR	NS	GAP DEG	RMS SEC	MIN DIS	ERH KM	ERZ KM	NO FM	REMK	
1973	OCT	26	753	20.02	19	13.35	155	30.73	8.90	4.3		27	0	68	.17	9	0.7	1.0	26	LSW	
	NOV	3	1112	42.05	19	23.72	155	26.67	9.19	4.0		29	1	56	.12	3	0.5	0.9	27	KAO	
		10	2338	58.09	20	20.38	155	26.05	38.81	4.2		28	3	209	.12	78	1.5	2.6	22	KEA	
	DEC	13	425	56.07	19	22.47	155	17.53	34.94	4.6		34	1	33	.09	2	0.6	1.2	29	DEP	F
1974	JAN	12	6 4	34.21	19	19.92	155	7.18	9.01	4.7		29	0	107	.09	5	0.6	0.7	26	SF4	F
		15	22 6	46.77	19	47.55	155	36.37	34.81	4.1		34	1	93	.10	16	0.7	1.8	33	KEA	
	FEB	4	1816	55.04	19	32.53	155	53.95	10.14	4.1		28	0	171	.11	6	0.9	0.7	28	KON	F
	MAY	5	137	24.03	19	21.62	155	15.49	15.85	4.3		29	0	67	.12	2	0.6	0.5	15	DEP	F
	JUN	3	13 2	9.41	19	26.19	155	26.55	8.18	4.1		30	0	46	.14	7	0.4	1.0	26	KAO	F
		19	5 5	42.63	19	22 79	155	25.33	10.40	4.7		30	0	53	12	4	0.4	0.6	28	KAO	F
		20	2050	26.60	19	19.81	155	12.57	9.71	4.2		30	0	78	.08	5	0.5	0.5	29	SF2	F
	AUG	8	112	59.56	19	23.05	155	18.31	29.34	4.1		35	2	30	.12	2	0.6	0.9	33	DEP	F
		27	2149	41.00	19	19.68	155	12.29	10.49	4.5		32	0	84	.07	5	0.5	0.5	32	SF3	
	OCT	31	10 1	48.94	19	21.65	155	2.08	9.09	3.9	4.1	28	0	206	.10	4	1.0	0.6	28	SF5	F
	NOV	10	153	14.97	19	24.75	155	25.74	10.69	4.1	4.0	34	1	40	.13	5	0.4	0.6	32	KAO	
		21	2149	14.67	19	21.52	155	18.64	32.32	4.3	4.2	35	0	39	.08	3	0.6	1.1	35	DEP	
		30	354	23.82	19	26.52	155	24.96	7.91	5.4	5.6	27	0	69	.12	7	0.5	1.4	27	KAO	
	DEC	15	1053	47.60	19	28.15	155	36.69	1.59	4.6	4.3	32	0	130	.12	2	0.5	0.3	31	MLO	
		15	2317	29.79	19	24.38	155	26.02	9.19	4.7	4.6	31	0	49	.11	4	0.5	0.8	31	KAO	
		25	747	49.42	19	20.90	155	16.83	32.29	4.6	4.7	37	1	71	.08	2	0.6	1.1	33	DEP	F
		25	1813	21.30	19	13.91	155	18.10	9.77	4.1	4.2	31	0	164	.09	8	0.5	0.7	30	SWR	F
		25	1824	14.78	19	13.85	155	18.37	10.01	4.3	4.3	30	0	164	.09	12	0.5	0.6	30	SWR	F
		31	1240	48.42	19	18.29	155	21.96	5.54	5.4		24	0	118	.15	4	0.6	1.6	21	SWR	
		31	1449	15.21	19	16.92	155	22.09	5.59	4.1		26	0	129	.12	6	0.6	1.3	22	SWR	
		31	1528	59.71	19	0.46	155	12.32	17.13	4.4		28	0	235	.18	32	2.2	30.4	24	LOI	*
		31	2043	55.65	19	18.03	155	22.92	5.40	4.1		14	0	117	.12	8	0.7	3.3	9	SWR	
		31	2141	54.58	19	15.87	155	21.50	5.64	4.2		17	0	148	.09	6	0.7	2.0	11	SWR	
1975	JAN	1	1 2	7.60	19	10.96	155	20.81	3.78	4.1		22	0	175	.15	13	0.9	28.3	18	SWR	*
		1	241	11.13	19	13.06	155	21.36	4.94	4.6		19	0	164	.12	10	0.8	5.2	12	SWR	*
		1	946	45.83	19	14.29	155	24.13	6.54	4.3	4.0	22	0	154	.09	6	0.7	1.5	19	SWR	
		1	1046	49.29	19	15.26	155	24.16	8.21	4.4	4.2	25	0	136	.12	9	0.7	1.1	23	SWR	
		1	2326	58.23	19	13.88	155	23.33	6.37	4.1	4.1	25	0	155	.13	8	0.7	2.3	23	SWR	
		2	327	43.43	19	13.91	155	23.47	8.78	4.9	4.7	23	0	155	.13	7	0.8	1.3	23	SWR	
		3	732	49.54	19	12.44	155	21.85	10.37	4.9	4.7	26	0	163	.14	11	0.6	0.8	22	SWR	
		3	2035	52.53	19	19.89	155	7.45	9.24	4.4	4.2	26	0	102	.09	5	0.6	0.7	24	SF4	
		4	1532	5.54	19	14.83	155	22.39	6.70	4.9	4.8	26	0	150	.13	8	0.6	2.0	23	SWR	
		5	048	39.21	19	14.46	155	22.87	0.03	4.0	4.0	23	0	154	.14	8	0.7	3.2	23	SWR	*
		6	1747	3.09	19	16.38	155	24.13	8.17	4.4	4.3	26	0	122	.15	5	0.7	1.3	24	SWR	F
		8	552	50.38	19	15.11	155	20.15	9.15	4.1	4.0	27	1	158	.08	6	0.6	0.7	26	SWR	F
	MAR	26	10 6	7.60	19	26.65	155	35.18	0.05	4.3	4.0	25	0	88	.10	2	0.5	0.9	24	MLO	F*
		29	1456	26.48	19	16.99	155	22.46	5.77		4.6	15	0	126	.14	6	0.7	2.5	14	SWR	
	MAY	10	1932	52.01	19	19.82	155	7.30	10.45	3.9	4.1	29	0	107	.08	5	0.6	0.5	28	SF4	F
		21	2232	58.40	20	17.26	155	39.44	12.24	4.7	4.5	39	4	183	.09	55	0.8	2.2	34	KOH	
		28	2 2	8.75	18	38.46	154	16.36	41.63	4.1	5.1	30	0	326	.11	112	21.4	4.0	29	DIS	*
	JUL	4	1740	54.98	19	22.51	155	19.04	32.18	4.2	4.4	37	1	39	.08	3	0.6	1.1	32	DML	

HVO EARTHQUAKE SUMMARY LIST 1962-1985

Table 4 (continued):

YEAR	MON	ORIGIN TIME DA	HRMN	SEC	LAT N DEG	MIN	LON W DEG	MIN	DEPTH KM	AMP MAG	DUR MAG	NR	NS	GAP DEG	RMS SEC	MIN DIS	ERH KM	ERZ KM	NO FM	REMK	
1975	JUL	5	2318	19.58	19	26.60	155	35.83	3.19	4.3	4.2	11	0	167	.04	25	1.1	5.5	7	MLO	
		5	2325	45.93	19	27.15	155	37.57	1.05	4.1	4.1	7	0	206	.14	46	1.7	34.0	5	MLO	*
		7	1447	42.58	19	32.18	155	30.25	2.51	4.7	4.4	28	0	119	.18	11	0.9	27.9	27	MLO	*
		7	1839	52.55	19	31.57	155	27.66	4.46	4.2	4.1	32	0	67	.12	8	0.5	4.7	29	MLO	
		9	840	3.67	19	31.82	155	28.49	7.18	4.5	4.2	32	0	69	.10	8	0.5	1.0	31	MLO	F
		22	1512	35.43	19	42.47	156	1.14	29.16	4.2	4.7	22	1	272	.15	19	1.5	2.2	22	HUA	
	AUG	18	7 8	56.85	19	37.02	156	2.79	44.44	3.9	4.4	29	1	232	.09	20	1.3	2.0	25	KON	F
	OCT	31	450	54.40	19	13.89	155	37.69	10.74	3.8	4.2	30	0	232	.13	2	1.3	0.8	30	LSW	F
	NOV	6	2 5	28.36	19	20.59	155	18.81	31.89	4.5	4.9	38	2	51	.10	3	0.6	1.1	36	DEP	F
		6	321	18.62	19	20.05	155	18.69	32.49	4.1	4.1	36	1	57	.09	2	0.6	1.1	35	DEP	F
		10	126	30.05	19	21.30	155	1.53	9.59	4.2	4 6	28	0	224	.08	4	1.0	0.5	28	SF5	F
		14	123	25.82	19	20.63	155	20.55	33.59	3.7	4.3	32	0	67	.10	5	0.6	1.4	27	DEP	F
		15	1255	21.43	19	18.76	155	13.50	10.87	4.3	4.4	29	1	74	.09	3	0.5	0.5	27	SF2	F
		29	335	40.68	19	21.75	155	2.34	9.69	5.9	5 9	28	0	149	.07	4	0.8	0.4	27	SF5	F
		29	447	40.10	19	20.45	155	0.25	9.26	7.2	7.3	24	0	204	.08	5	1.1	0.7	23	SF5	F
		29	842	12.93	19	20.20	155	4.61	6.07	4.3	4.0	13	0	129	.07	3	0.7	1.2	6	SF5	
		29	844	0.20	19	8.73	155	15.15	4.60	4.8	3.8	10	0	203	.18	16	2.2	23.7	3	LOI	*
		29	1442	45.03	19	22.40	154	59.87	8.78	4.0	4.4	10	0	269	.13	17	4.1	1.6	3	LER	
		29	18 9	1.14	19	16.69	155	20.19	9.70		4.0	19	0	141	.12	4	0.7	0.9	15	SWR	
		29	1823	37.46	19	14.87	154	57.36	11.60		4.4	18	0	257	.17	19	3.2	0.7	11	DIS	
		29	1852	55.51	19	22.32	154	56.94	6.55	3.9	4.1	7	0	271	.05	19	5.4	1.4	2	LER	
		29	2015	27.44	19	25.17	155	22.36	11.81	4.5	4.1	22	0	79	.10	5	0.5	0.7	9	KAO	
		30	121	41.32	19	20.50	155	6.35	10.08		4.0	26	0	106	.06	6	0.6	0.4	26	SF4	
	DEC	3	538	1.07	19	23.09	154	58.49	7.10	4.1	4.3	18	1	200	.09	9	0.7	0.7	17	LER	F
		3	1119	23 09	19	21.48	154	58.65	3.42	3.9	4.1	10	0	212	.12	12	2.1	37.2	8	SLE	*
		3	1250	23.05	19	21.82	155	1.28	7.91	4.1	4.2	22	0	192	.09	12	1.1	0.8	17	SF5	
		4	1 9	8.72	19	23.86	154	57.78	8.30	3.9	4.3	22	1	197	.28	7	1.3	1.4	18	LER	
		9	1355	54.66	19	21.26	155	7.50	9.81	4.0	4.1	24	0	80	.07	4	0.5	0.5	22	SF4	
		10	1543	17.13	19	19.62	155	12.07	9.06	4.0	4.0	27	2	87	.08	5	0.4	0.7	25	SF3	F
		12	1536	54.82	19	20.62	155	8.34	8.98	4.0	4.1	26	1	76	.10	4	0.4	0.7	22	SF4	F
		13	053	36.48	19	22.41	155	2.88	8.80	4.1	4.3	25	0	129	.08	5	0.6	0.8	25	SF5	F
		23	1641	40.23	19	25.92	155	17.98	15.16	4.0	4.2	36	0	39	.11	3	0.5	0.3	33	DEP	F
		26	2255	25.01	19	56.47	155	51.17	13.05	4.2		19	0	154	.10	22	1.0	0.8	17	KOH	F
1976	JAN	1	854	23.48	18	53.07	155	5.85	11.19	4.4	4.4	18	0	290	.08	49	5.2	14.1	18	LOI	F*
		11	14 5	40.27	19	30.98	155	16.30	26.24	4.2	4.4	32	0	60	.10	11	0.6	1.4	30	DEP	F
		15	1241	45.43	19	24.72	155	17.66	16.12	4.3	4.5	35	0	45	.11	1	0.4	0.5	32	DEP	F
		15	1259	26.23	19	24.81	155	17.72	17.44	4.5	4.7	34	0	46	.11	1	0.5	0.8	30	DEP	F
		21	1141	21.34	19	21.34	155	6.95	8.82	4.0	4.2	24	0	185	.07	5	0.9	0.6	23	SF4	F
		27	2226	28.33	19	20.19	155	6.50	9.77	3.9	4.1	32	0	112	.09	6	0.6	0.4	32	SF4	F
		29	1019	56.60	19	22.41	154	59.31	9.61	4.7	4.9	34	0	194	.11	8	0.9	0.5	33	LER	F
	FEB	20	1951	17.38	20	16.03	155	59.38	20.63	5.0	5.0	37	3	306	.13	27	1.5	3.3	34	KOH	F
		24	550	19.31	19	21.77	155	6.37	9.40	4.2	4.2	30	1	80	.07	6	0.4	0.4	28	SF4	F
		25	1348	20.53	19	21.84	155	6.24	9.29	3.9	4.2	33	2	79	.06	6	0.3	0.5	31	SF4	F
	MAR	19	1324	30.47	19	21.08	155	3.17	8.38	4.0	4.1	30	0	120	.09	2	0.6	0.6	30	SF5	F
	APR	2	814	6.66	19	20.51	155	6.35	9.91	4.5	4.6	34	0	106	.08	6	0.6	0.4	34	SF4	F

HVO EARTHQUAKE SUMMARY LIST 1962 1985

Table 4 (continued):

YEAR	MON	DA	ORIGIN TIME HRMN	SEC	LAT N DEG	MIN	LON W DEG	MIN	DEPTH KM	AMP MAG	DUR MAG	NR	NS	GAP DEG	RMS SEC	MIN DIS	ERH KM	ERZ KM	NO FM	REMK	
1976	APR	21	1813	35.87	18	48.98	155	1.94	12.14	4.5	4.4	28	0	275	.14	54	3.8	99.0	28	LOI	F*
		23	1229	53.93	19	21.78	155	4.93	9.41	4.2	4.3	28	0	79	.09	5	0.6	0.5	27	SF5	F
	MAY	23	1731	20.31	19	20.13	155	6.60	10.17	4.0	4.1	31	0	112	.09	6	0.6	0.4	31	SF4	F
		23	2324	7.83	20	57.32	156	21.70	20.10	4.1	4.9	45	7	208	.16	24	1.8	2.0	40	DIS	F
		31	832	12.59	20	2.77	155	45.27	0.01	4.0	4.0	11	2	307	.33	43	9.6	2.2	0	KOH	*
	JUN	4	2250	51.43	19	21.28	155	6.95	9.98	4.1	4.4	32	0	85	.08	5	0.5	0.4	32	SF4	F
	JUL	27	714	26.97	19	21.99	155	4.56	10.37	4.0	4.1	33	0	87	.08	5	0.6	0.3	31	SF5	F
		30	5 9	43.80	19	19.95	155	6.46	8.83	3.9	4.1	33	0	119	.07	6	0.5	0.4	32	SF4	F
	AUG	31	1041	8.70	19	23.45	155	29.81	10.18	4.1	4.0	35	0	40	.10	4	0.4	0.7	33	KAO	F
	NOV	9	1533	3.42	19	19.65	155	3.56	8.81	3.8	4.2	35	3	174	.11	1	0.5	0.4	30	SF5	F
	DEC	18	4 1	0.75	19	19.83	155	6.88	9.80	4.8	4.9	32	0	115	.08	5	0.6	0.4	32	SF4	F
		30	047	41.86	18	27.41	155	18 21	16.10	3.8	4.5	33	1	307	.12	70	8.3	27.0	31	DIS	*
1977	JAN	12	3 5	59.47	19	24.32	155	17.66	17.25	3.9	4.2	36	1	28	.11	2	0.4	0.7	33	DEP	F
		14	1326	42.53	19	19.77	155	7.17	10.08	4.7	4.6	31	0	111	.08	5	0.6	0.4	28	SF4	F
		22	1236	27.95	21	18.26	160	34 51	6.93	5.1	5.6	26	4	333	.22	265	59.2	77.3	1	DIS	*
		23	1049	1.97	19	20.13	155	11.90	9.07	4.0	4.3	35	1	80	.10	5	0.4	0.4	33	SF3	F
		29	2248	49.91	19	21.69	155	4.71	9.04	4.1	4.3	34	0	81	.08	5	0.6	0.3	33	SF5	F
	FEB	3	1520	49.86	19	20.83	155	4.42	9.98	4.5	4.7	37	1	102	.09	3	0.6	0.4	33	SF5	F
	MAR	9	029	17.12	19	22.82	155	30.60	49.99	4.1	4.5	30	1	49	.09	5	0.8	2.3	15	DML	F
	APR	20	1849	23.19	19	56.38	155	19.51	12.05	5.0	4.5	34	2	247	.11	6	1.3	0.7	24	KEA	F
		22	944	0.27	19	19.03	155	15.61	10.18	4.0	4.2	35	1	95	.10	4	0.5	0.4	32	SF1	F
	JUN	5	2342	19.10	19	21.75	155	4.89	9.35	5.1	4.7	35	0	80	.10	5	0.6	0.4	35	SF5	
	JUL	5	759	42.20	19	26.12	155	27.23	11.99	4.1	4.3	35	2	46	.12	7	0.3	0.4	29	KAO	F
	AUG	7	2154	20.47	19	19.98	155	13.34	10.37	4.1	4.3	37	2	66	.09	5	0.3	0.4	35	SF2	F
		13	1224	29.47	20	6.33	155	38.46	6.66	4.1	4.0	37	2	205	.34	15	1.6	1.4	29	KOH	F
		19	819	13.50	19	19.64	155	7.07	10.21	4.2	4.2	35	1	116	.10	5	0.5	0.4	32	SF4	F
	SEP	7	1351	6.86	19	22.40	155	19.33	31.42	4.5	4.5	34	0	42	09	3	0.6	1.3	28	DML	F
		15	1850	5.60	19	20.47	155	3.57	9.45	4.0	4.1	36	1	161	.11	7	0.7	0.5	26	SF5	F
		19	9 1	45.27	19	21.42	155	7.81	8.89	4.0	4.2	38	2	74	.10	4	0.4	0.5	33	SF4	F
		23	2 8	44.16	19	21.09	155	2.74	8.49	3.9	4.3	39	2	142	.11	2	0.5	0.4	35	SF5	F
	OCT	9	1438	52.05	19	23.99	155	15.16	25.16	4.0	4.3	38	1	60	.10	2	0.6	0.7	28	DEP	F
	NOV	1	1338	23.56	19	21.33	155	6.83	9.33	3.8	4.2	35	2	85	.09	5	0.4	0.5	31	SF4	F
1978	APR	7	1643	43.29	19	52.38	155	7.68	39.27	4.0	4.3	35	0	235	.11	22	2.0	3.4	32	KEA	F
	JUN	23	147	58.56	19	19.16	155	15.46	10.51	4.4	4 5	38	2	91	.10	4	0.4	0.4	31	SF1	F
	JUL	1	918	13.27	19	18.47	155	6.73	7.97	4.2	4.3	23	2	160	.11	3	0.5	1.0	2	SF4	F
	AUG	31	13 7	20.97	18	58.73	155	29.29	38.51	4.3	4.6	36	0	223	.07	19	1.3	2.0	32	DLS	F
	SEP	11	2016	6.11	19	20.00	155	6.52	9.60	4.1	4.3	37	1	117	.10	6	0.6	0.4	33	SF4	F
	OCT	28	1237	34.70	21	34.97	157	44.49	1.22	4.1	4.5	38	6	242	.30	33	6.3	1.8	27	DIS	F*
	NOV	23	316	15.88	19	14.16	155	32.81	11.40	4.2	4.2	33	0	122	.09	8	0.5	0.6	33	LSW	F
	DEC	12	1844	31.65	19	21.75	155	4.60	8.72	3.9	4.2	37	1	81	.09	4	0.6	0.4	32	SF5	
		14	412	45.04	19	18.69	155	13.51	10.49	4.1	4.2	37	1	74	.10	3	0.5	0.4	31	SF2	
		27	040	55.83	19	20.13	155	12.94	9.93	4.3	4.6	35	0	70	.08	5	0.4	0.4	34	SF2	
1979	FEB	13	1652	51.05	19	20.60	155	4.25	8.58	3.9	4.3	36	0	109	.10	3	0.6	0.4	36	SF5	F
	MAR	6	5 7	58.54	19	31.21	155	16.18	27.43	4.7	4.9	38	0	50	.09	11	0.5	1.3	34	DEP	
		10	355	14.65	19	20.05	155	6.68	9.57	4.5	4.4	37	0	113	.10	5	0.6	0.4	36	SF4	F

Table 4 (continued):

HVO EARTHQUAKE SUMMARY LIST 1962 1985

YEAR	MON	ORIGIN TIME DA	HRMN	SEC	LAT N DEG	MIN	LON W DEG	MIN	DEPTH KM	AMP MAG	DUR MAG	NR	NS	GAP DEG	RMS SEC	MIN DIS	ERH KM	ERZ KM	NO FM	REMK	
1979	MAR	21	2046	59.79	20	5.99	155	50.44	16.22	4.5	4.5	37	1	144	.11	46	0.7	17.6	32	KOH	F*
		27	2130	9.80	20	5.42	155	50.08	12.31	4.9	4.6	36	0	285	.09	45	3.2	5.9	32	KOH	F
		29	23 6	44.78	20	48.35	158	41.18	0.07	5.5	5.7	37	1	285	.18	98	13.2	2.3	34	DIS	*
	JUL	31	330	51.28	19	27.98	155	25.89	11.65	4.3	4.2	42	1	40	.11	5	0.4	0.4	40	KAO	
	AUG	14	251	42.19	20	48.87	156	17.42	24.48	4.5	4.9	44	4	328	.12	7	1.6	0.8	43	DIS	F
	SEP	21	2159	37.62	19	20.81	155	4.24	9.19	5.5	5.4	43	0	101	.11	3	0.6	0.4	39	SF5	F
		21	2329	12.34	19	21.18	155	2.27	9.21	4.3	4.3	43	1	160	.11	3	0.6	0.4	39	SF5	F
		27	535	45.49	19	19.76	155	7.23	10.05	4.3	4.6	39	1	110	.11	5	0.6	0.4	38	SF4	F
	OCT	6	046	12.24	19	20.15	155	12.90	10.38	3.9	4.1	38	1	70	10	5	0.4	0.3	34	SF2	F
		14	737	16.92	19	54.38	155	10.73	40.57	4.0	4.3	38	1	213	10	17	1.0	1.7	37	KEA	F
		30	1935	11.68	19	53.07	156	20.68	0.02	4.2	4.3	39	1	281	.13	57	2.3	0.9	37	DIS	F*
	DEC	13	1744	3.08	19	24.82	155	24.50	11.44	4.0	4.1	43	0	38	.13	1	0.4	0.4	43	KAO	F
1980	JAN	19	1528	48.56	19	18.72	155	32.46	26.88	4.6	4.4	39	1	59	.07	11	0.6	1.2	38	DLS	
	MAR	1	1938	28.20	19	46.78	156	41.42	16.27	4.2	4.5	31	0	298	.12	87	5.9	99.0	23	DIS	*
		12	257	52.71	19	21.51	155	14.18	1.92	3.9	4.5	35	0	57	.13	3	0.2	0.5	33	KOA	
	AUG	11	2042	33.11	19	20.07	155	6.22	10.20	4.2	4.3	42	1	120	.09	5	0.6	0.4	40	SF4	F
		13	2127	16.70	19	21.12	155	25.24	10.71	4.1	4.0	46	2	77	.13	4	0.4	0.4	43	KAO	F
	NOV	12	1138	2.64	21	28.17	158	15.77	13.74	4.0	4.2	34	1	326	.26	26	4.6	1.6	21	DIS	
		23	131	55.92	19	21.43	155	2.93	9.12	4.2	4.1	46	1	120	.10	3	0.6	0.4	45	SF5	F
1981	JAN	3	3 4	40.11	20	15.69	155	52.39	27.57	3.9	4.3	47	3	160	.12	18	0.9	1.1	43	KOH	F
		6	1814	5.43	18	54.01	155	6.75	51.98	4.1	4.4	46	2	256	.09	43	1.8	2.3	44	LOI	F
		12	418	10.63	19	21.35	155	18.28	31.06	4.5	4.6	43	0	40	.10	3	0.6	1.0	43	DEP	F
		12	430	17.11	19	17.60	155	18.31	33.28	4.0	4.3	43	0	132	.09	1	0.6	1.0	43	DEP	F
		12	5 7	48.91	19	19.68	155	17.26	33.42	4.0	4.4	45	1	92	.10	1	0.6	0.9	44	DEP	F
		12	1121	41.15	19	31.27	155	18.18	32.92	4.3	4.5	44	0	50	.10	8	0.6	1.2	44	DEP	F
		13	1820	16.51	19	22.08	155	19.42	28.88	4.3	4.8	44	0	44	.10	3	0.6	0.9	44	DML	F
	MAR	1	7 1	21.26	19	21.52	155	2.05	9.07	4.3	4.3	48	1	148	.10	3	0.6	0.4	44	SF5	F
		4	1556	45.69	19	24.90	155	28.42	11.09	4.1	4.1	49	2	30	.12	5	0.3	0.4	45	KAO	F
		5	4 9	40.85	21	25.94	156	47.79	0.00	5.1	5.3	45	7	226	.50	93	6.8	0.8	42	DIS	F*
		5	1643	36.41	21	9.52	156	54.58	0.31	4.5	4.8	44	2	197	.12	81	1.6	0.3	35	DIS	
		6	1756	0.74	19	44.34	156	26.57	15.01	4.0	4.1	51	5	234	.13	62	1.1	3.1	45	DIS	F
		15	2017	19.59	19	22.49	155	14.03	31.32	4.0	4.1	49	1	50	.12	2	0.6	1.0	47	DEP	F
	JUL	28	10 0	44.86	19	21.53	155	1.61	8.59	4.1	4.1	43	1	160	.10	4	0.6	0.4	40	SF5	F
	AUG	10	542	9.38	19	23.09	155	16.51	2.08	4.2	3.8	44	1	42	.16	1	0.3	0.4	33	SSC	
		10	820	8.74	19	19.07	155	21.11	4.67	4.2	3.9	40	0	106	.14	4	0.4	2.0	27	SWR	
		10	940	34.97	19	18.39	155	21.56	4.05	4.5	3.8	39	0	123	.20	5	0.6	1.3	33	SWR	
		22	12 5	20.33	20	11.17	156	25.66	10.32	4.4	4.7	46	5	226	.12	67	0.8	1.5	43	DIS	F
	SEP	22	650	23.72	19	19.40	155	7.25	10.18	3.9	4.1	44	1	117	.11	4	0.6	0.4	40	SF4	F
	OCT	27	2333	32.26	19	22.60	155	17.21	32.88	4.0	4.2	49	2	38	.12	2	0.6	1.0	47	DEP	F
	NOV	10	3 2	56.58	19	20.58	155	12.67	10.31	4.4	4.9	47	1	67	.11	4	0.3	0.3	43	SF2	F
		19	1932	58.14	19	57.41	155	21.27	11.84	3.8	4.2	53	5	195	.12	8	0.7	0.6	47	KEA	F
	DEC	7	1739	27.19	19	48.79	156	3.87	41.12	4.0	4.0	47	4	239	.10	28	1.0	1.1	41	HUA	F
1982	JAN	21	1152	41.17	19	13.91	155	35.53	10.32	5.4	5.6	41	0	218	.12	3	0.9	0.5	40	LSW	F
		21	1229	13.88	19	13.11	155	33.10	13.73	5.4	5.4	36	1	126	.12	8	0.6	0.5	33	DLS	F
		21	13 1	9.69	19	12.16	155	32.48	10.44	4.1	4.0	44	1	87	.17	7	0.6	0.6	41	LSW	F

HVO EARTHQUAKE SUMMARY LIST 1962-1985

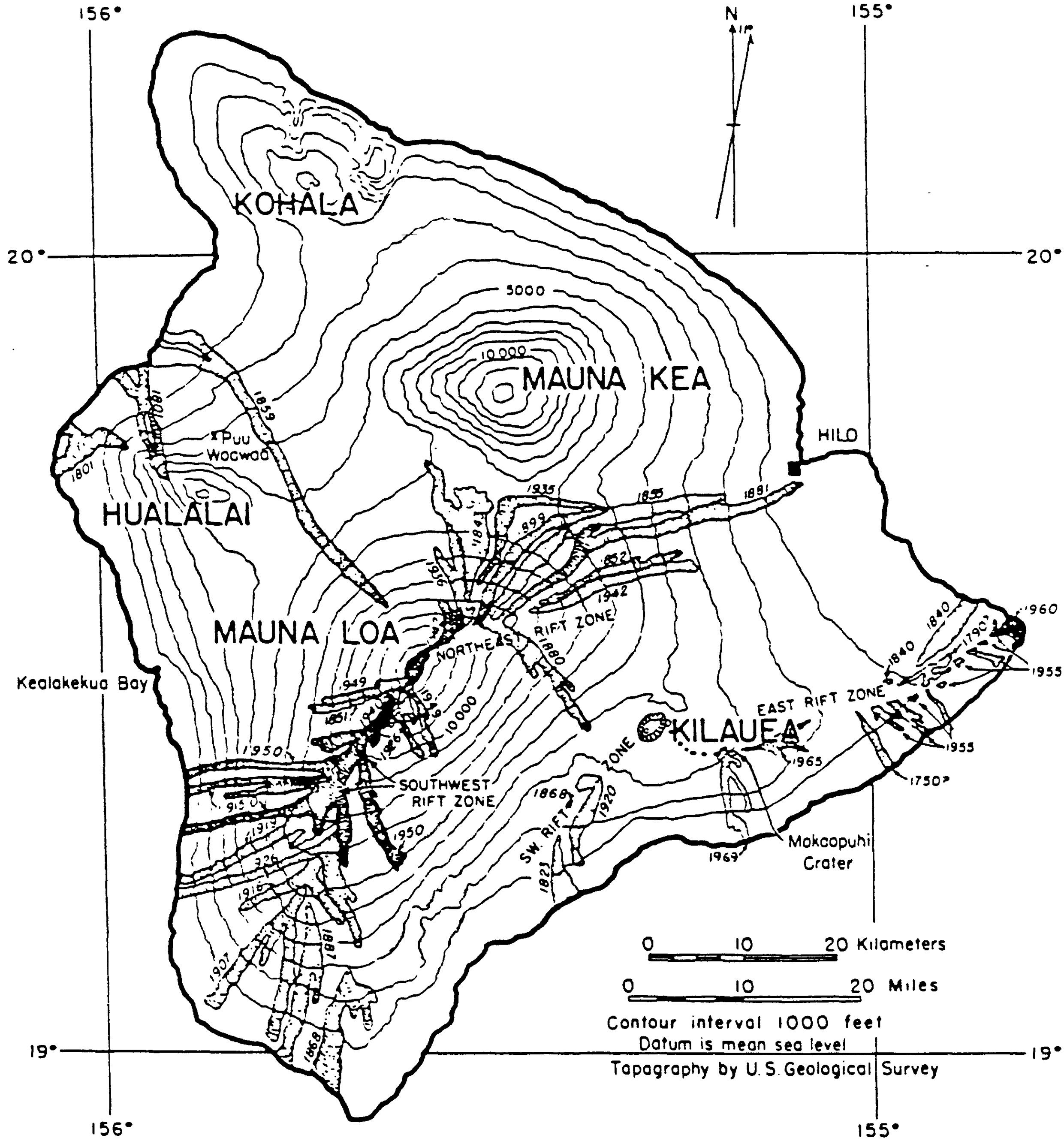
Table 4 (continued):

YEAR	MON	DA	HRMN	SEC	LAT N DEG	LAT N MIN	LON W DEG	LON W MIN	DEPTH KM	AMP MAG	DUR MAG	NR	NS	GAP DEG	RMS SEC	MIN DIS	ERH KM	ERZ KM	NO FM	REMK
1982	JAN	21	1337	17.41	19	13.79	155	33.31	12.23	4.2	4.3	41	2	117	.14	6	0.5	0.6	39	LSW
		22	1745	8.12	19	14.16	155	34.01	9.54	4.3	4.2	49	4	76	.14	6	0.4	0.6	46	LSW F
	FEB	2	629	49.85	19	12.83	155	35.30	11.18	4.3	4.1	43	2	201	.15	5	0.9	0.5	37	LSW F
		15	1736	28.23	19	21.49	155	20.25	32.05	4.2	4.3	46	2	51	.11	4	0.6	1.0	42	DEP F
	MAR	20	1310	22.30	19	20.53	155	16.84	36.16	3.9	4.3	45	2	77	.10	1	0.6	1.1	42	DEP F
	APR	11	16 4	2.40	19	19.82	155	6.69	9.18	4.2	4.2	45	3	118	.12	5	0.5	0.4	42	SF4 F
	MAY	14	626	31.75	20	0.07	155	51.82	19.88	4.8	4.5	47	3	205	.11	17	1.4	3.8	44	KOH F
		18	1736	19.80	19	57.25	156	26.16	1.36	4.8	4.5	49	3	229	.11	69	1.3	0.6	45	DIS F
	AUG	12	043	35.76	19	24.90	155	16.09	16.17	4.0	4.3	41	1	46	.09	2	0.4	0.3	40	DEP F
		17	857	39.61	18	54.31	155	16.34	13.73	3.9	4.2	39	0	248	.08	35	1.6	1.1	28	LOI
	OCT	5	1139	36.83	18	54.48	155	15.61	16.71	3.9	4.1	37	1	247	.08	35	1.7	36.0	25	LOI *
	NOV	12	1618	58.25	19	27.32	155	26.47	14.93	4.1	4.1	50	4	38	.12	4	0.4	0.3	42	DML F
		29	1450	38.05	19	21.12	155	20.03	31.99	4.0	4.4	47	0	54	.10	5	0.6	1.0	47	DEP F
1983	JAN	23	18 0	24.92	19	21.49	155	1.85	9.53	4.3	4.3	47	2	155	.11	4	0.6	0.4	45	SF5 F
	FEB	7	16 2	45.49	19	21.47	155	14.44	28.01	4.1	4.2	44	0	59	.10	3	0.6	0.9	44	DEP F
	MAR	8	641	3.40	19	11.97	155	35.58	11.49	4.5	4.3	39	1	207	.14	6	0.9	0.5	38	LSW F
		16	1610	7.13	18	27.17	154	16.71	39.46	4.3	5.0	42	0	318	.11	127	13.6	2.9	42	DIS
		20	1718	39.21	19	21.43	155	2.99	6.88	4.8	5.0	45	1	169	.11	6	0.7	0.6	43	SF5 F
	APR	27	2334	32.86	19	19.79	155	7.55	8.40	4.0	4.1	45	3	102	.09	5	0.4	0.3	38	SF4 F
	MAY	13	030	7.96	19	10.24	155	34.95	9.40	4.4	4.1	48	4	107	.20	9	0.6	0.8	43	LSW F
	JUN	5	1854	31.04	19	9.17	155	32.44	33.11	4.1	4.4	49	3	130	.08	8	0.6	1.2	46	DLS F
	AUG	18	543	59.52	19	58.49	155	8.24	31.30	4.0	4.2	46	4	262	.10	23	1.1	1.9	41	KEA F
	SEP	9	630	55.35	19	19.89	155	7.32	9.02	5.4	5.2	46	1	105	.10	5	0.5	0.4	45	SF4 F
		13	1939	57.53	19	21.25	155	3.14	8.89	4.0	4.0	50	1	110	.11	3	0.6	0.4	48	SF5 F
		16	922	12.22	19	30.19	155	39.19	7.68	4.0	4.1	46	2	50	.12	6	0.4	0.6	43	MLO F
		16	15 9	53.21	19	30.08	155	39.06	8.23	4.2	4.2	45	1	50	.13	6	0.4	0.5	44	MLO F
	OCT	7	1721	36.29	19	44.52	155	28.38	15.84	3.9	4.2	53	6	118	.10	5	0.4	0.7	45	KEA F
		25	11 2	35.36	19	29.69	155	38.85	8.21	4.0	4.1	45	2	80	.11	5	0.5	0.4	43	MLO F
	NOV	16	613	0.15	19	25.76	155	27.11	10.92	6.6	6.7	36	0	56	.12	4	0.4	0.9	36	KAO
		16	1330	47.55	19	29.14	155	23.77	11.75		4.2	45	4	44	.11	6	0.3	0.4	43	KAO F
		19	137	51.72	19	17.40	155	15.65	10.49	4.1	4.1	49	3	146	.13	5	0.5	0.5	47	SF1 F
1984	JAN	2	1410	20.10	20	35.30	154	54.93	0.03	3.7	4.3	48	4	312	.11	90	9.3	2.4	44	DIS *
	FEB	13	2110	12.47	30	58.05	157	35.31	29.58	6.0		45	2	344	.15	500	18.0	3.9	17	DIS L*
	APR	9	1313	39.85	19	18.62	155	13.55	10.49	3.9	4.1	56	10	73	.11	3	0.4	0.3	46	SF2 F
	MAY	1	355	23.08	19	12.67	155	34.14	13.22	4.0	4.1	45	6	123	.15	7	0.5	0.5	39	DLS F
	JUN	8	1734	10.64	20	3.31	157	52.51	29.55	5.0	5.3	52	5	238	.13	142	1.5	2.5	41	DIS
		16	822	10.03	20	44.51	157	30.32	34.00	4.0	5.1	38	2	189	.12	83	2.3	1.9	19	DIS F
	AUG	14	1010	2.12	19	47.13	154	54.77	47.71	3.7	4.3	54	10	233	.10	20	0.8	1.1	43	KEA F
	SEP	24	2127	48.20	19	18.97	155	54.17	12.37	4.3	4.3	49	3	208	.11	6	0.9	0.4	44	KON F
	OCT	8	0 0	25.11	20	7.02	156	51.65	29.58	3.9	4.3	54	7	314	.11	113	1.6	2.5	47	DIS
	NOV	11	534	6.20	18	55.84	155	13.30	8.85	4.0	4.2	47	7	244	.12	36	0.9	0.6	39	LOI F
	DEC	25	1722	11.48	19	58.77	155	5.93	34.63	4.3	4.4	55	8	229	.12	27	0.9	1.8	47	KEA F
1985	FEB	21	1948	29.39	19	19.68	155	12.65	9.45	4.8	4.7	48	3	80	.10	5	0.4	0.4	43	SF2 F
		25	1827	46.41	19	47.23	156	4.40	10.68	3.9	4.3	47	2	240	.12	27	1.1	0.7	46	HUA F
	MAR	22	7 7	54.85	19	53.99	156	36.64	1.56	4.1	4.3	55	7	298	.12	84	5.2	2.3	39	DIS

HVO EARTHQUAKE SUMMARY LIST 1962-1985

Table 4 (continued):

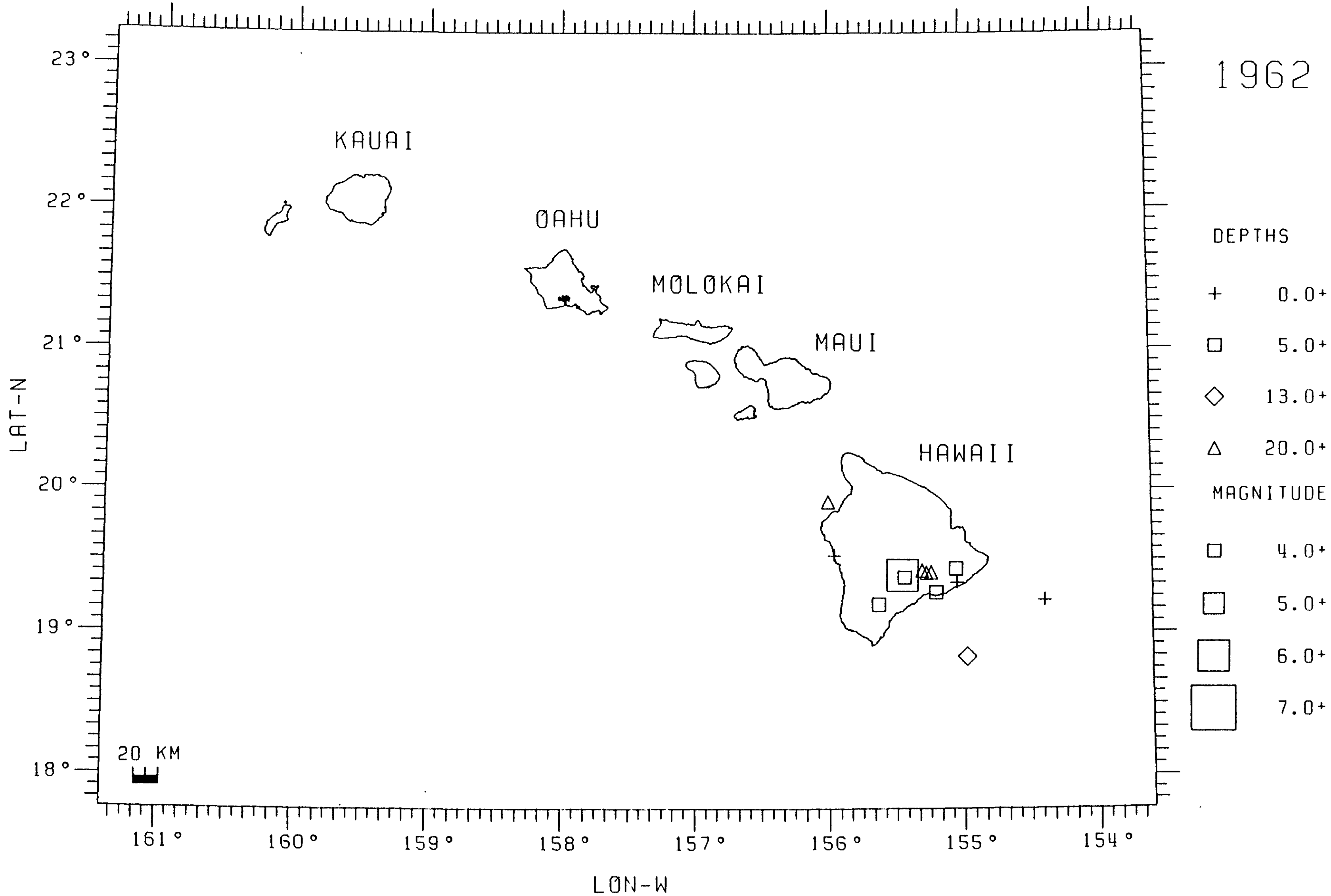
YEAR	MON	ORIGIN TIME DA	HRMN	SEC	LAT N DEG	MIN	LON W DEG	MIN	DEPTH KM	AMP MAG	DUR MAG	NR	NS	GAP DEG	RMS SEC	MIN DIS	ERH KM	ERZ KM	NO FM	REMK
1985	APR	1	1131	18.48	19	21.70	155	5.08	9.00	4.1	4.3	58	10	82	.11	5	0.4	0.3	50	SF5 F
	JUN	30	1112	24.05	19	22.42	155	17.87	26.87	4.2	4.6	51	2	27	.12	2	0.5	0.8	47	DEP F
	JUL	7	2 0	37.46	19	10.14	155	35.92	10.81	4.3	4.5	57	11	105	.18	9	0.5	0.5	48	LSW F
	AUG	22	628	0.16	19	18.55	156	4.22	40.04	4.2	4.7	62	14	248	.09	21	0.7	0.6	51	KON F
	DEC	12	9 1	22.87	20	34.68	155	45.31	25.05	4.7	4.9	55	8	208	.11	50	0.9	3.0	49	DIS F
		12	1118	39.33	19	30.96	155	54.45	11.80	4.0	4.3	57	13	171	.13	3	0.6	0.3	52	KON F
		13	1320	57.37	19	19.67	155	7.76	9.34	4.0	4.1	56	10	99	.11	4	0.4	0.3	48	SF4 F



156°
155°
N
20°
20°
KOHALA
5000
10 000
MAUNA KEA
HILO
Puu Waawaa
HUALALAI
MAUNA LOA
NORTHEAST RIFT ZONE
Kealakekua Bay
EAST RIFT ZONE
KILAUEA
SOUTHWEST RIFT ZONE
SW. RIFT ZONE
Makaopuhi Crater
0 10 20 Kilometers
0 10 20 Miles
Contour interval 1000 feet
Datum is mean sea level
Topography by U.S. Geological Survey
19°
19°
156°
155°

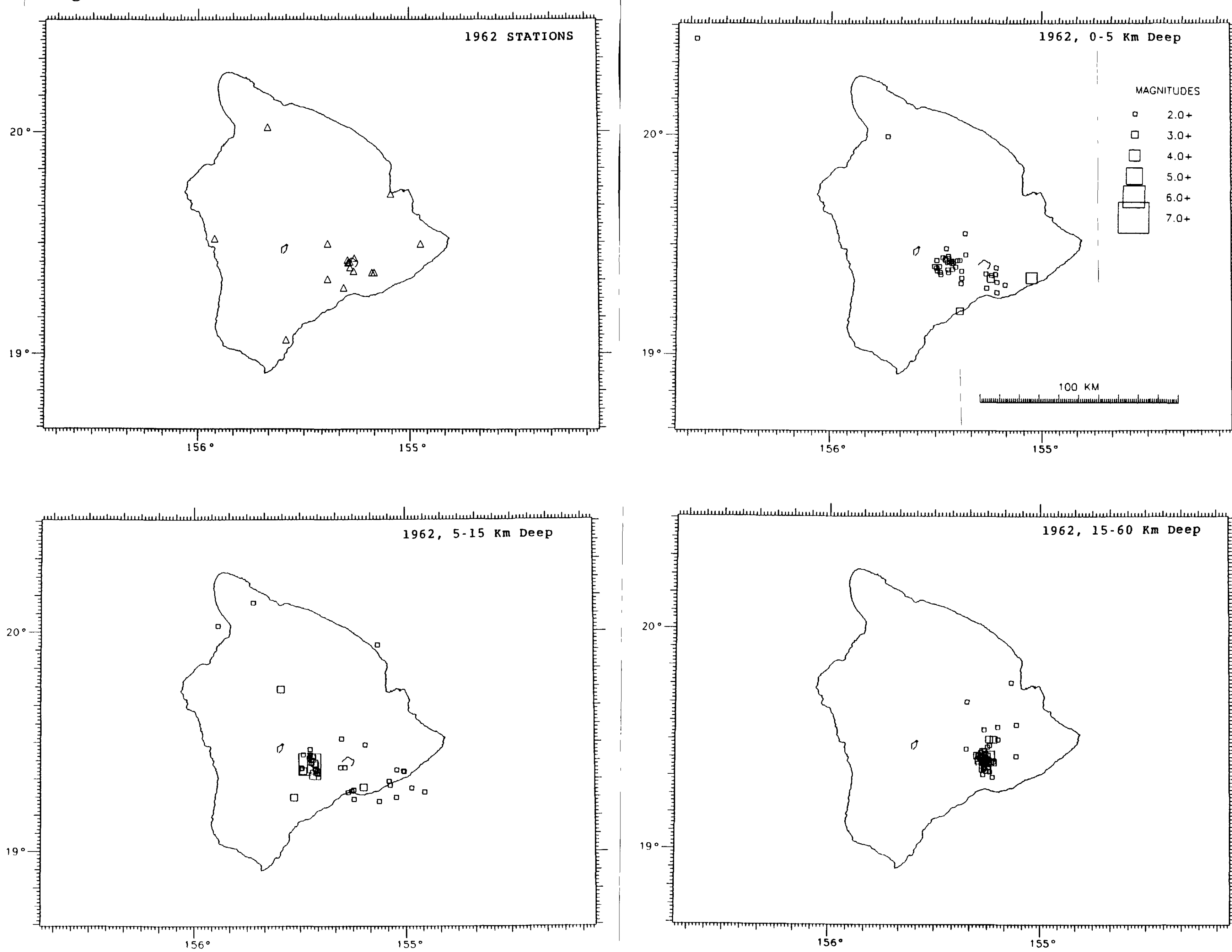
Figure 1:

Figure 2a:

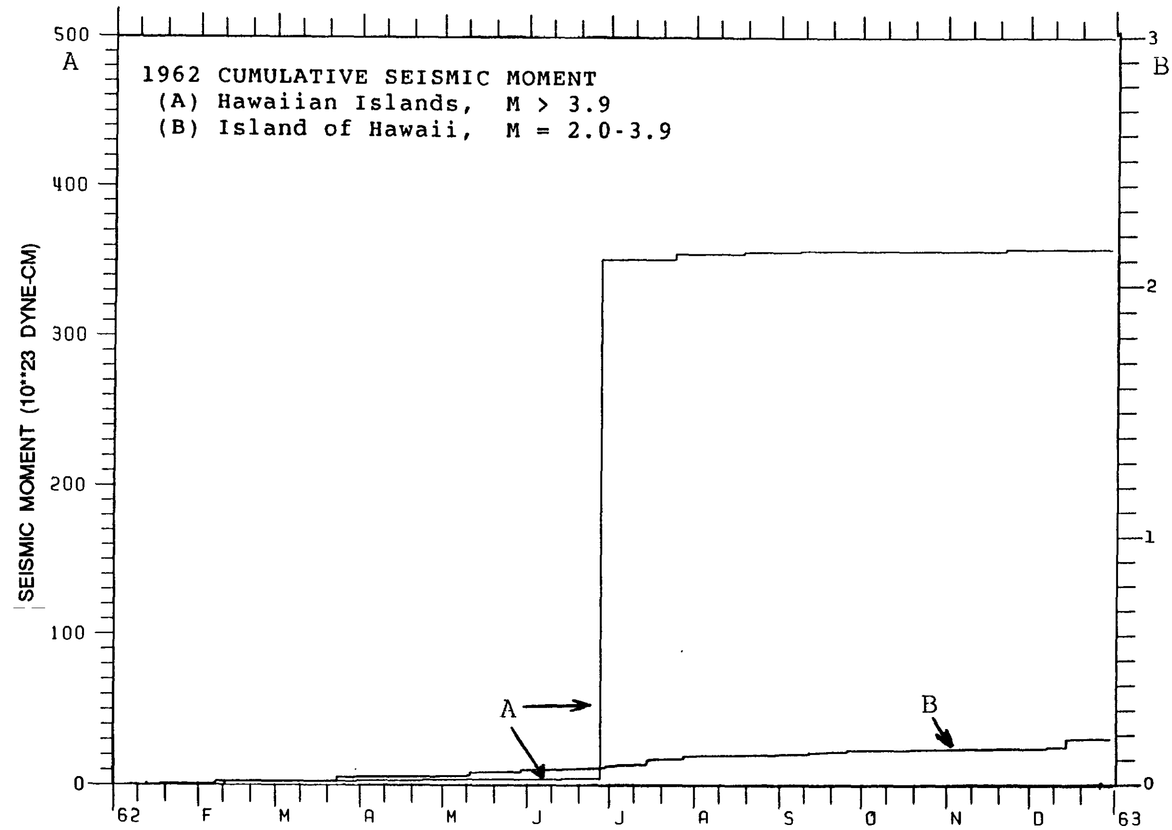


1962
KAUAI
OAHU
MØLØKAI
MAUI
HAWAII
DEPTHS
0.0+
5.0+
13.0+
20.0+
MAGNITUDES
4.0+
5.0+
6.0+
7.0+
20 KM
23°
22°
21°
20°
19°
18°
LAT-N
161°
160°
159°
158°
157°
156°
155°
154°
LØN-W

Figure 2b:



1962 STATIONS
1962, 0-5 Km Deep
MAGNITUDES
2.0+
3.0+
4.0+
5.0+
6.0+
7.0+
100 KM
1962, 5-15 Km Deep
1962, 15-60 Km Deep
20°
19°
156°
155°


1962 CUMULATIVE SEISMIC MOMENT
(A) Hawaiian Islands, M > 3.9
(B) Island of Hawaii, M = 2.0-3.9
SEISMIC MOMENT (10**23 DYNE-CM)
500
400
300
200
100
0
3
2
1
0
A
B
62 F M A M J J A S O N D 63

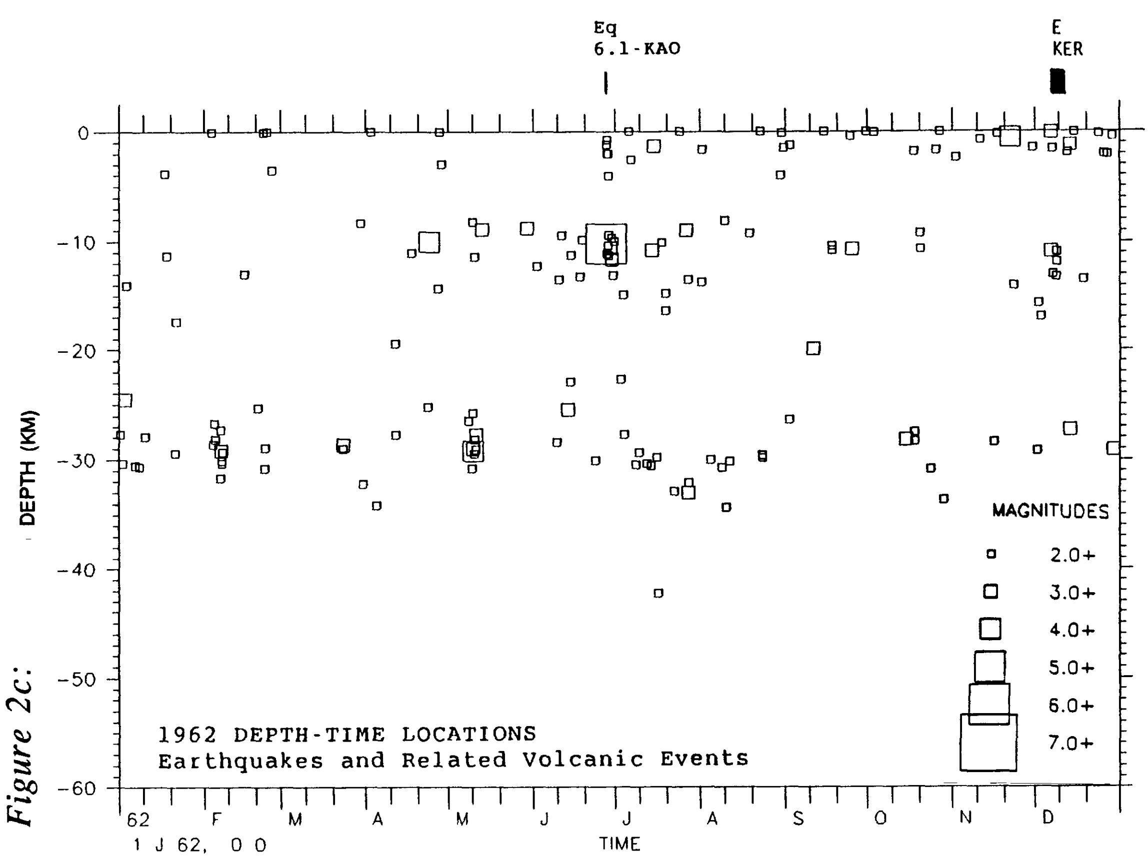

Eq
6.1-KAO
E
KER
DEPTH (KM)
0
-10
-20
-30
-40
-50
-60
MAGNITUDES
2.0+
3.0+
4.0+
5.0+
6.0+
7.0+
1962 DEPTH-TIME LOCATIONS
Earthquakes and Related Volcanic Events
62 F M A M J J A S O N D
1 J 62, 0 0
TIME

Figure 2c:

Figure 3a:

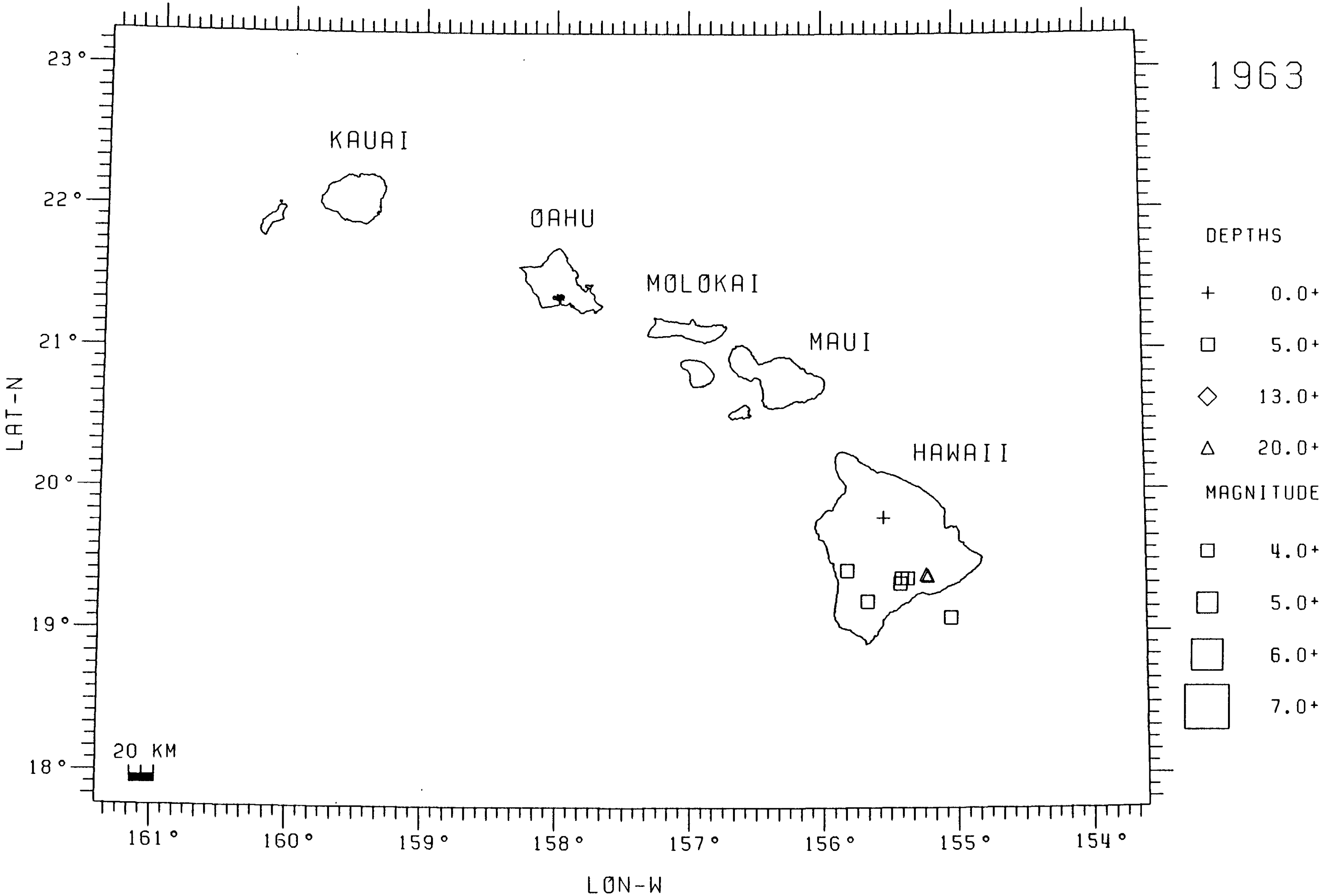
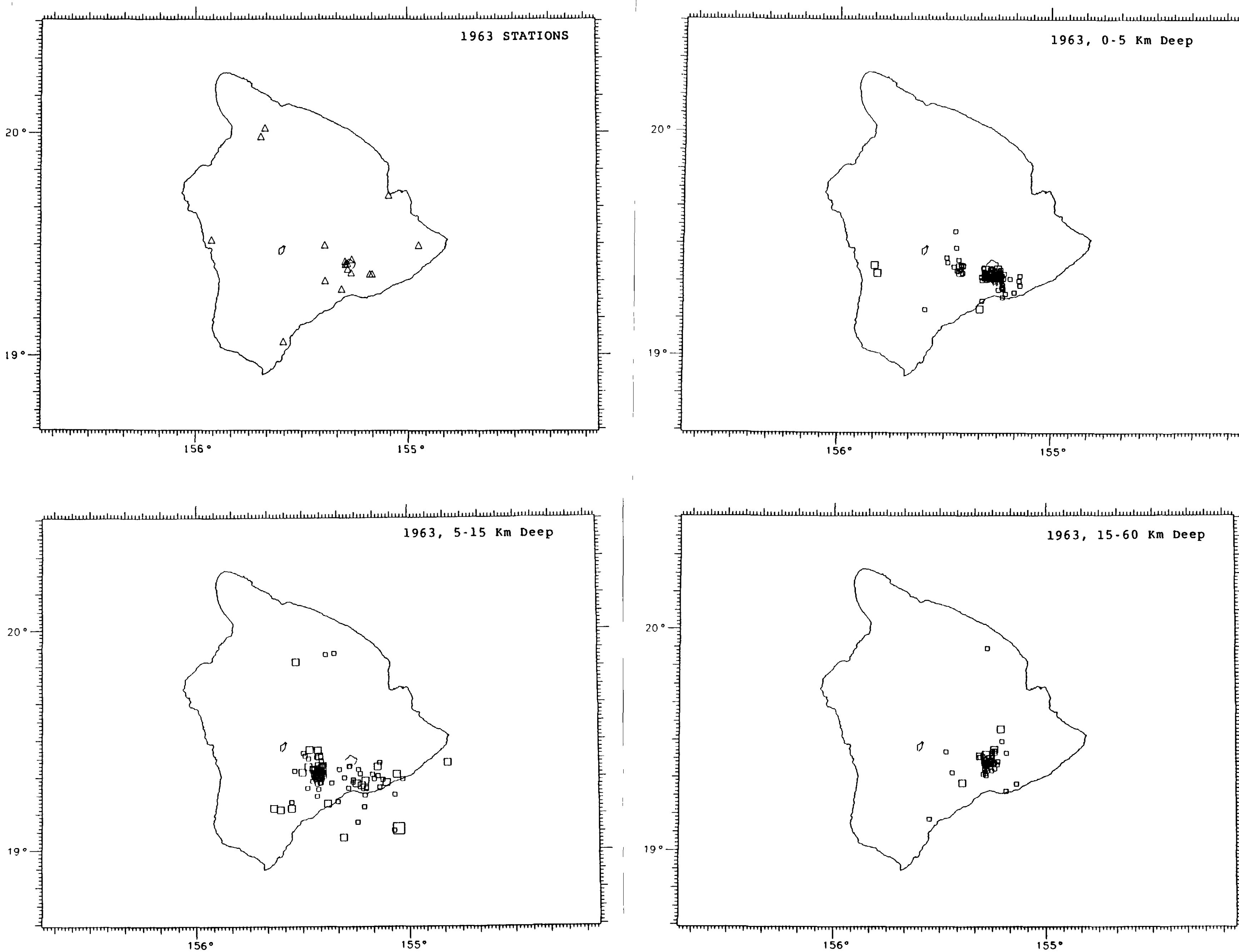
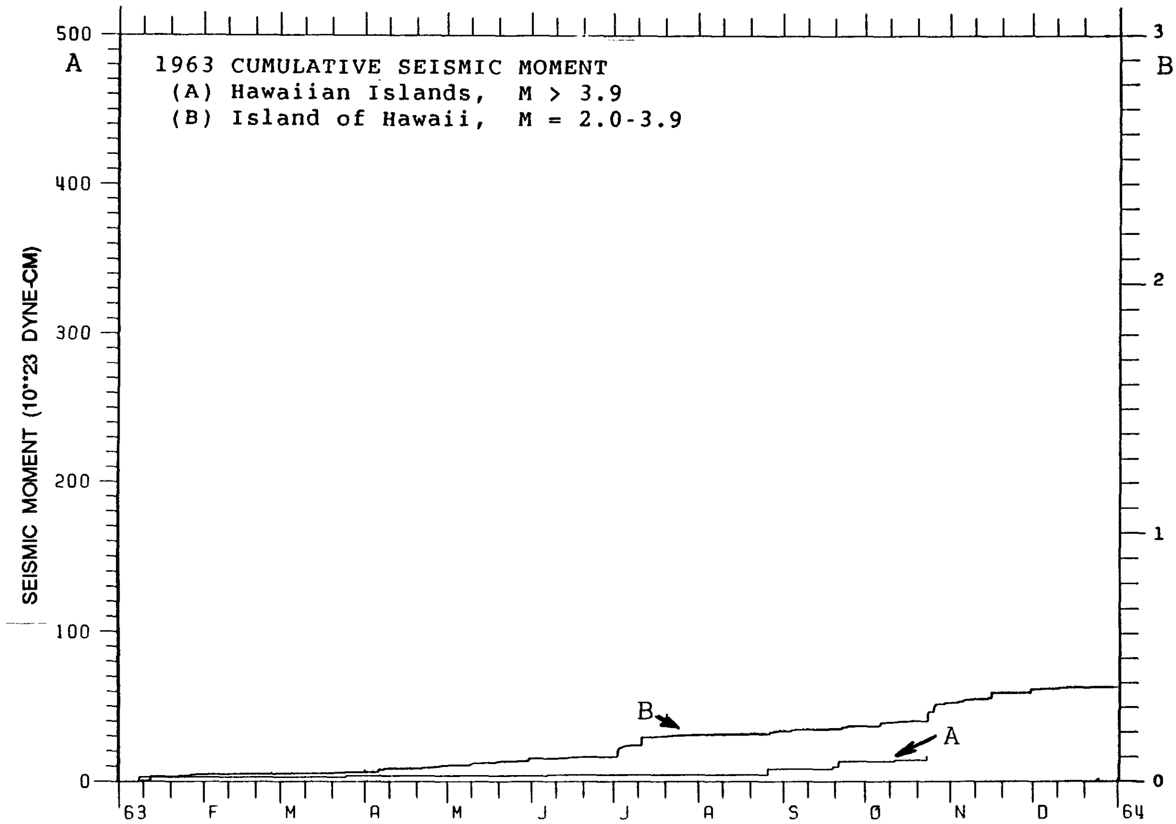

1963
KAUAI
ØAHU
MØLØKAI
MAUI
HAWAII
DEPTHS
0.0+
5.0+
13.0+
20.0+
MAGNITUDES
4.0+
5.0+
6.0+
7.0+
23°
22°
21°
20°
19°
18°
LAT-N
161°
160°
159°
158°
157°
156°
155°
154°
LØN-W
20 KM

Figure 3b:


1963 STATIONS
1963, 0-5 Km Deep
1963, 5-15 Km Deep
1963, 15-60 Km Deep
20°
19°
156°
155°


1963 CUMULATIVE SEISMIC MOMENT
(A) Hawaiian Islands, M > 3.9
(B) Island of Hawaii, M = 2.0-3.9
A
B
SEISMIC MOMENT (10**23 DYNE-CM)
500
400
300
200
100
0
3
2
1
0
63
F
M
A
M
J
J
A
S
O
N
D
64

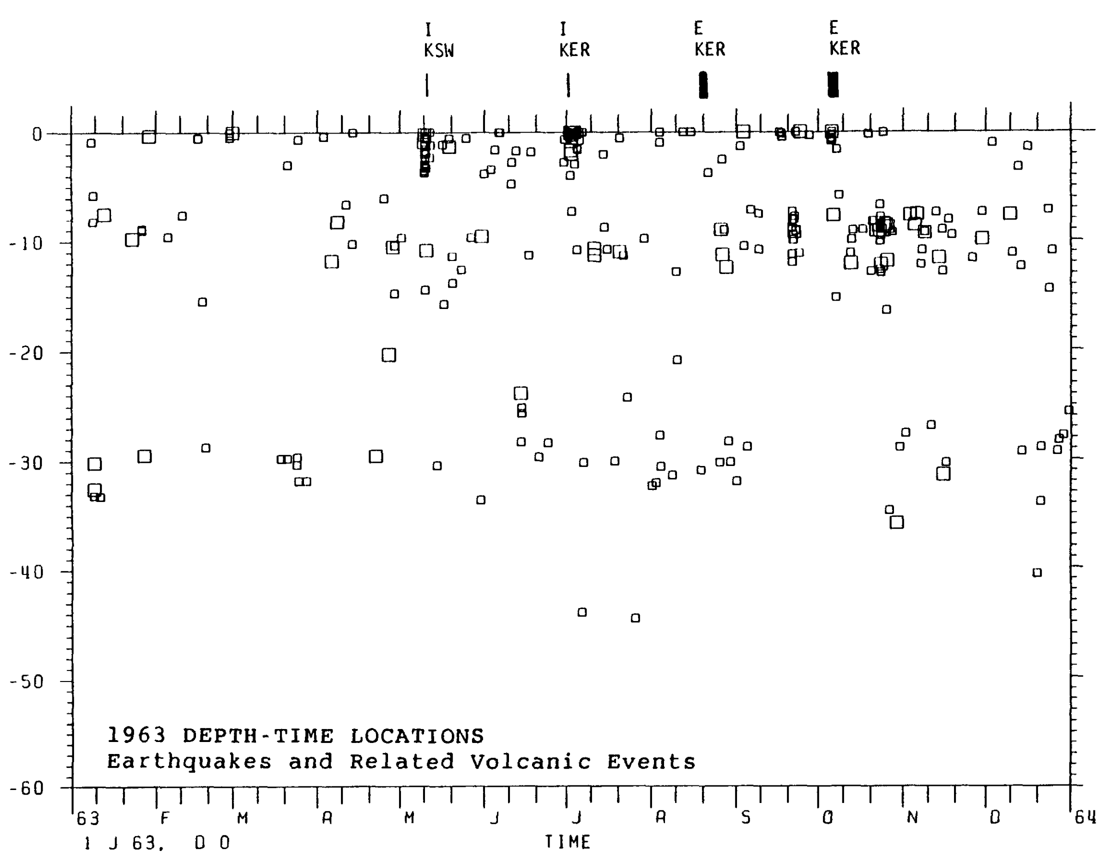

I
KSW
I
KER
E
KER
E
KER
0
-10
-20
-30
-40
-50
-60
DEPTH (KM)
1963 DEPTH-TIME LOCATIONS
Earthquakes and Related Volcanic Events
63
F
M
A
M
J
J
A
S
O
N
D
64
1 J 63, 0 0
TIME

Figure 3c:

Figure 4a:

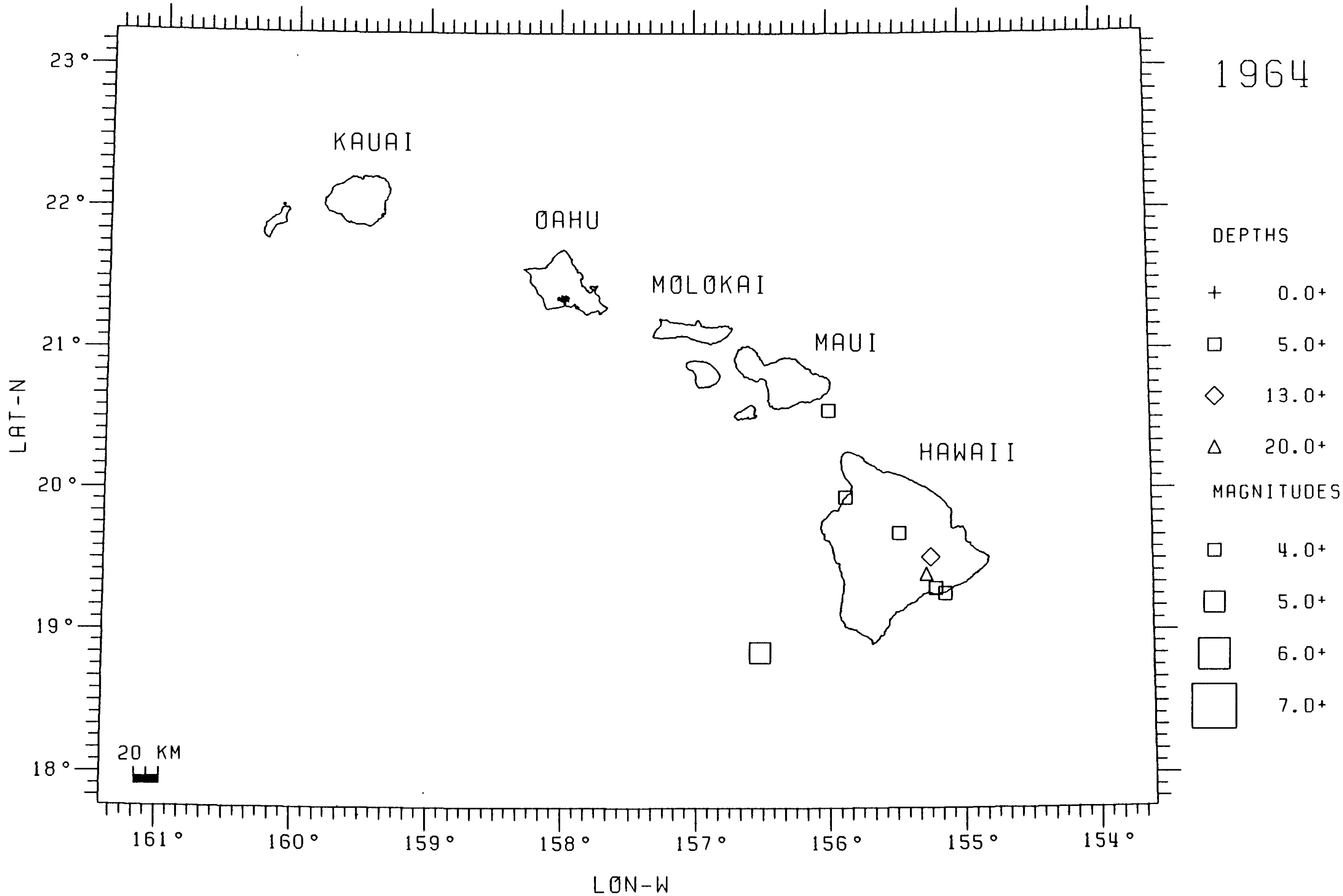
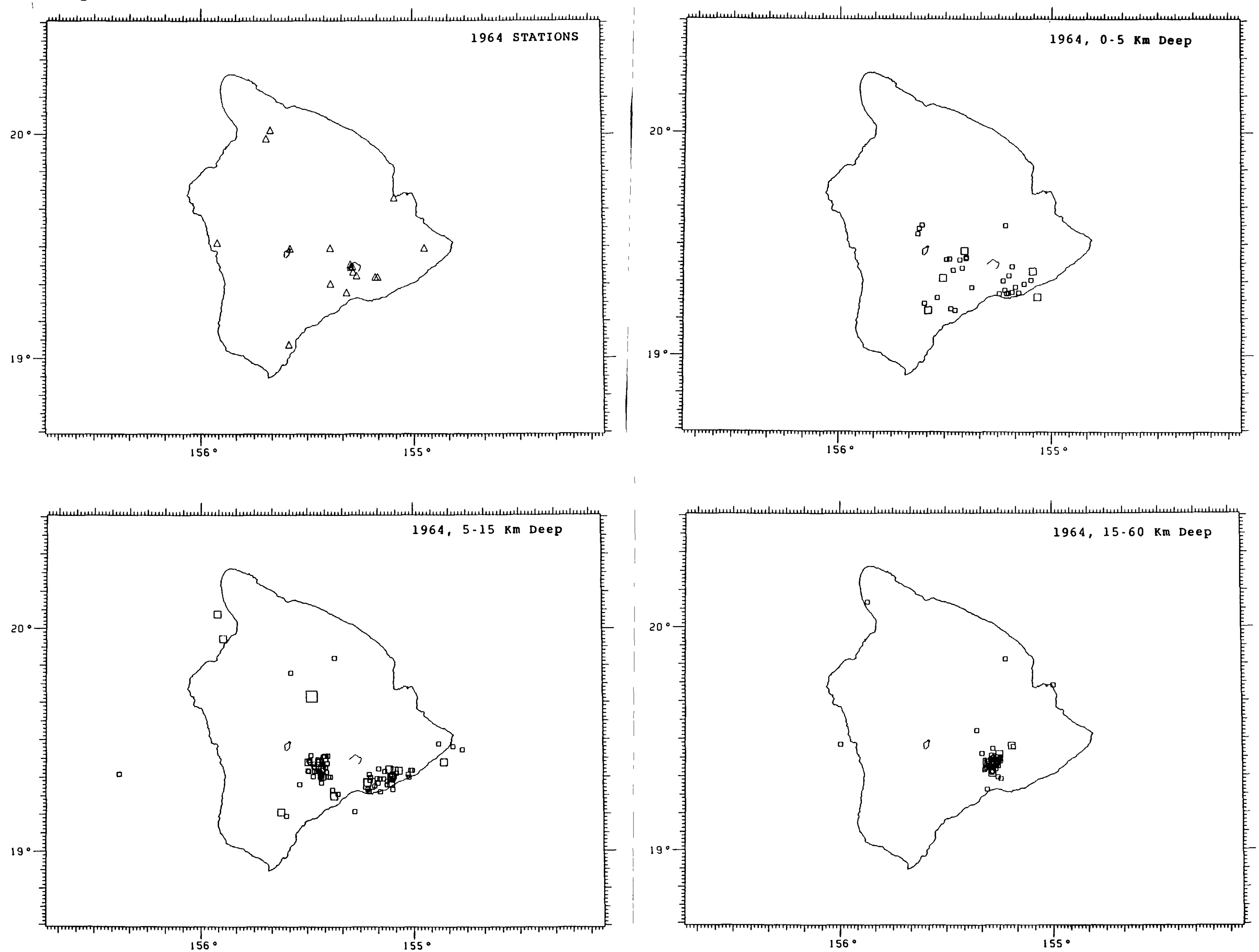
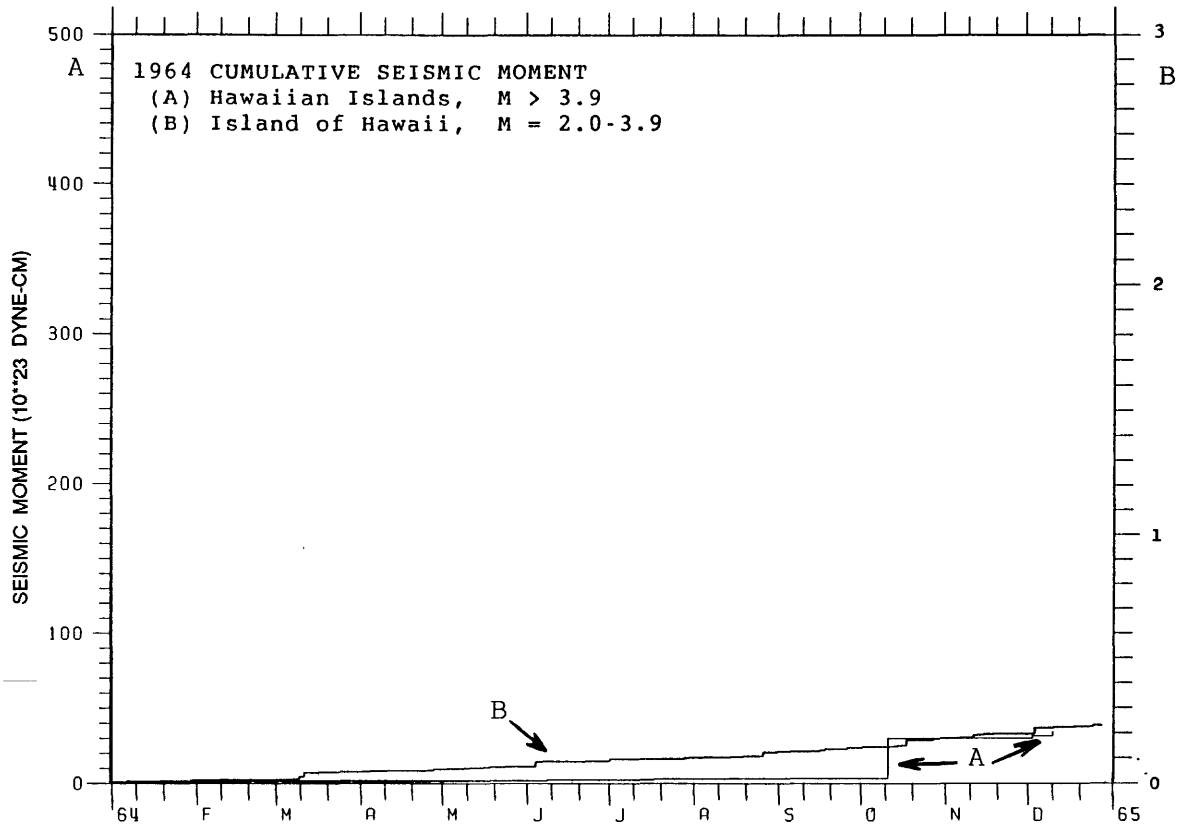

1964
DEPTHS
0.0+
5.0+
13.0+
20.0+
MAGNITUDES
4.0+
5.0+
6.0+
7.0+
KAUAI
OAHU
MØLOKAI
MAUI
HAWAII
23°
22°
21°
20°
19°
18°
LAT-N
161°
160°
159°
158°
157°
156°
155°
154°
LØN-W
20 KM

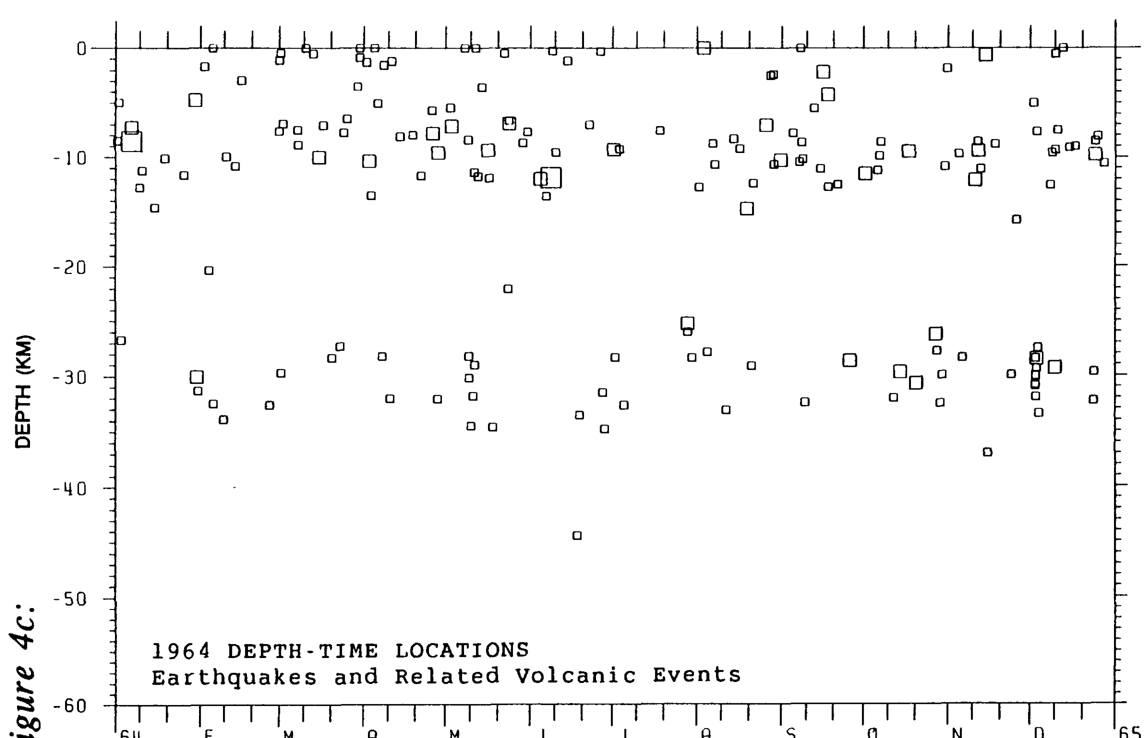
Figure 4b:



1964 STATIONS
1964, 0-5 Km Deep
1964, 5-15 Km Deep
1964, 15-60 Km Deep
20°
19°
156°
155°



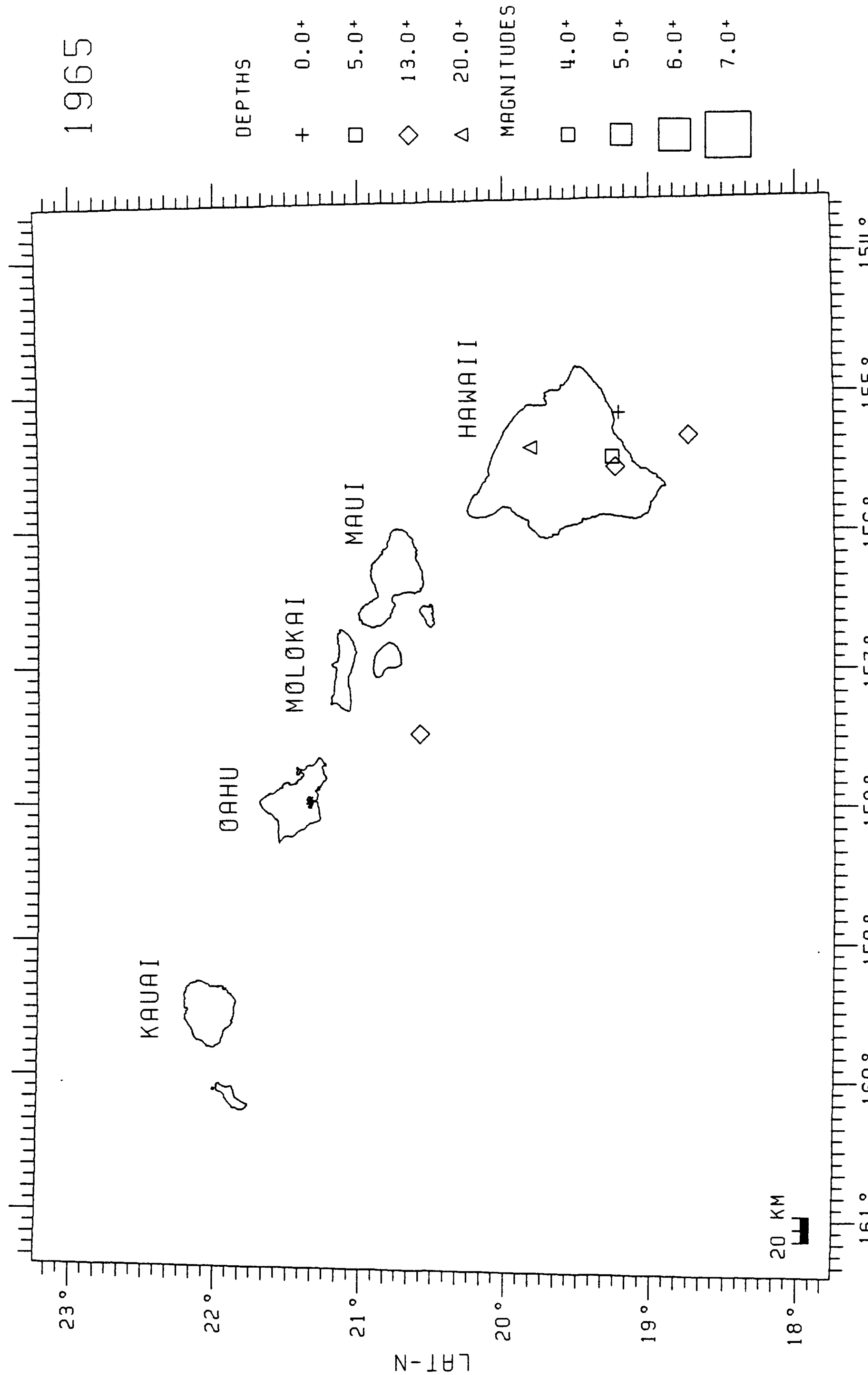
1964 CUMULATIVE SEISMIC MOMENT
(A) Hawaiian Islands, M > 3.9
(B) Island of Hawaii, M = 2.0-3.9
SEISMIC MOMENT (10**23 DYNE-CM)
A
B
500
400
300
200
100
0
3
2
1
0
64 F M A M J J A S O N D 65



1964 DEPTH-TIME LOCATIONS
Earthquakes and Related Volcanic Events
DEPTH (KM)
0
-10
-20
-30
-40
-50
-60
64 F M A M J J A S O N D 65
1 J 64, 0 0
TIME

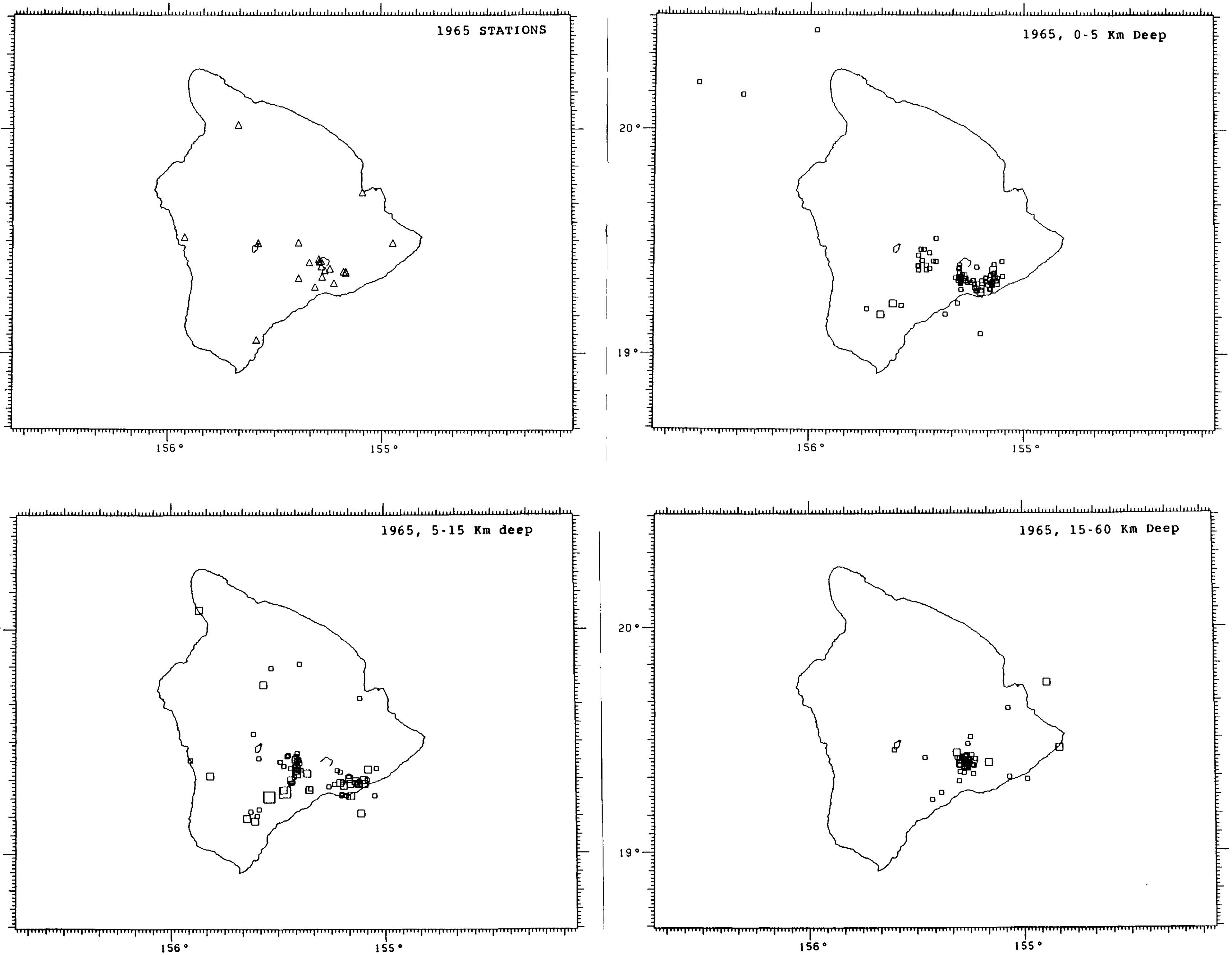
Figure 4c:

Figure 5a:

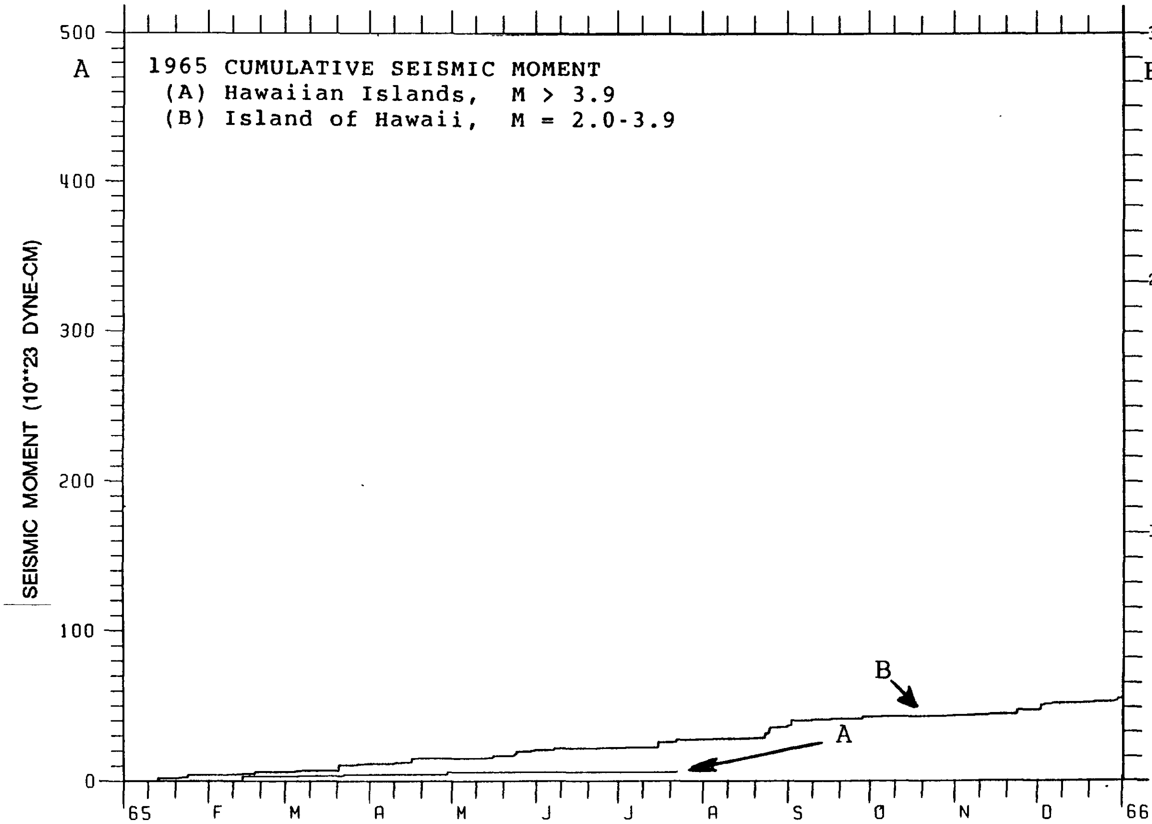


1965
DEPTHS
0.0+
5.0+
13.0+
20.0+
MAGNITUDES
4.0+
5.0+
6.0+
7.0+
KAUAI
ØAHU
MØLØKAI
MAUI
HAWAII
20 KM
23°
22°
21°
20°
19°
18°
LAT-N
161°
160°
159°
158°
157°
156°
155°
154°
LØN-W

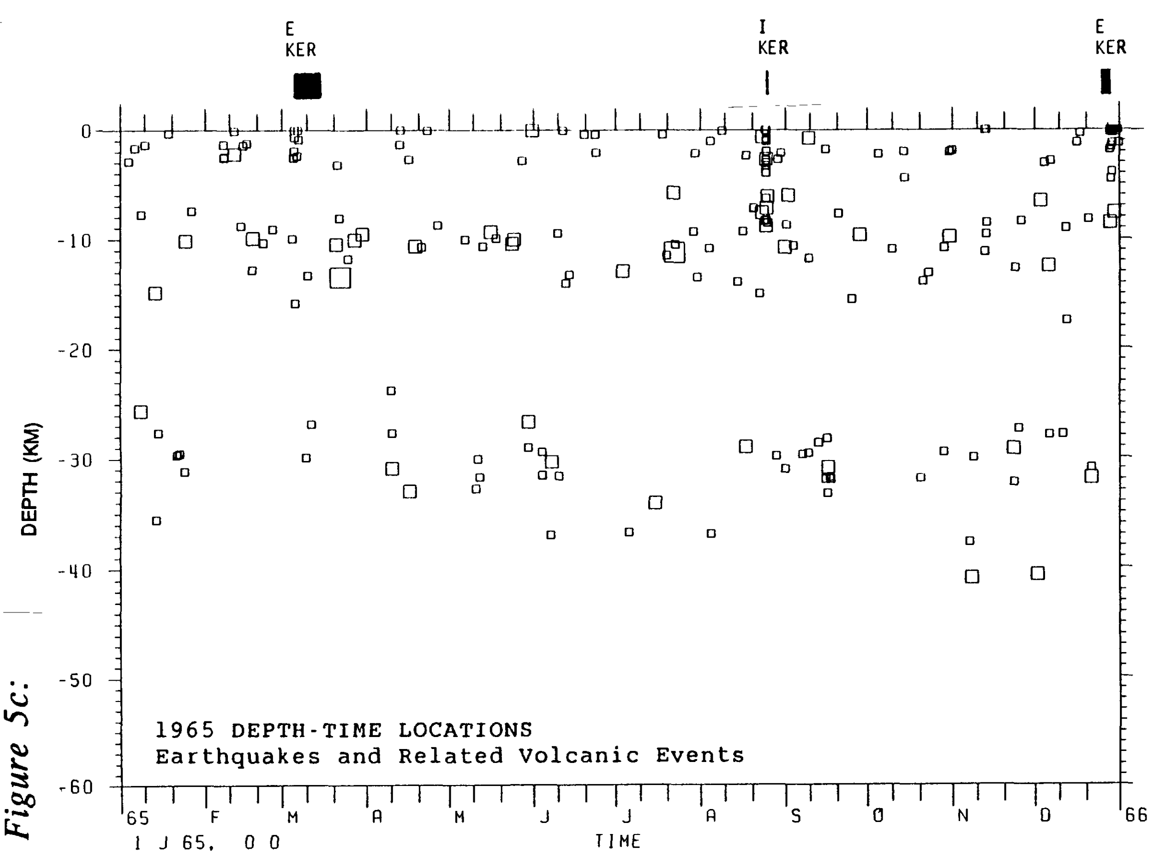
Figure 5b:



1965 STATIONS
1965, 0-5 Km Deep
1965, 5-15 Km deep
1965, 15-60 Km Deep
20°
19°
156°
155°



1965 CUMULATIVE SEISMIC MOMENT
(A) Hawaiian Islands, M > 3.9
(B) Island of Hawaii, M = 2.0-3.9
SEISMIC MOMENT (10**23 DYNE-CM)
500
400
300
200
100
0
A
B
3
2
1
0
65 F M A M J J A S O N D 66



E KER
I KER
E KER
1965 DEPTH-TIME LOCATIONS
Earthquakes and Related Volcanic Events
DEPTH (KM)
0
-10
-20
-30
-40
-50
-60
65 F M A M J J A S O N D 66
1 J 65, 0 0
TIME

Figure 5c:

Figure 6a:

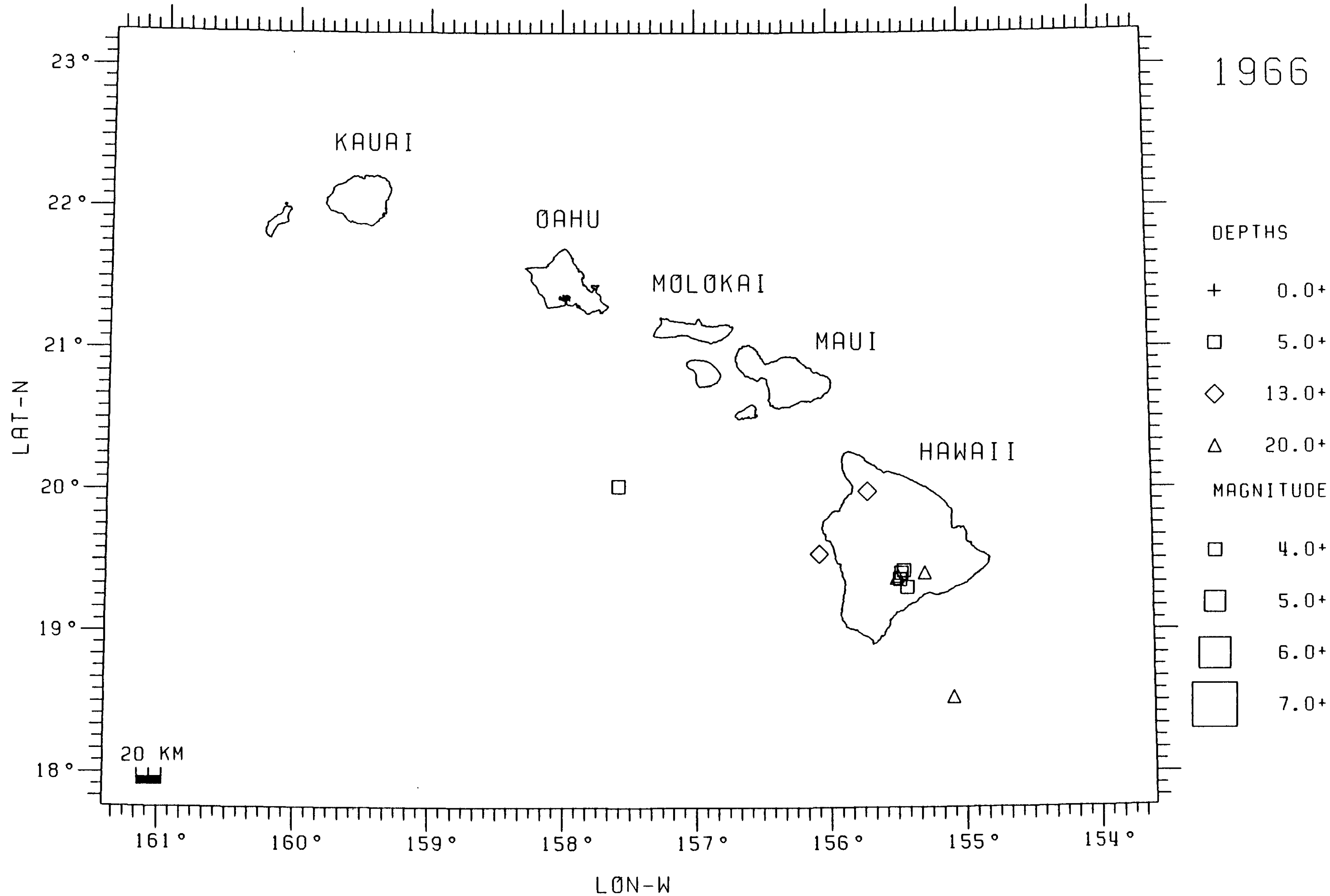
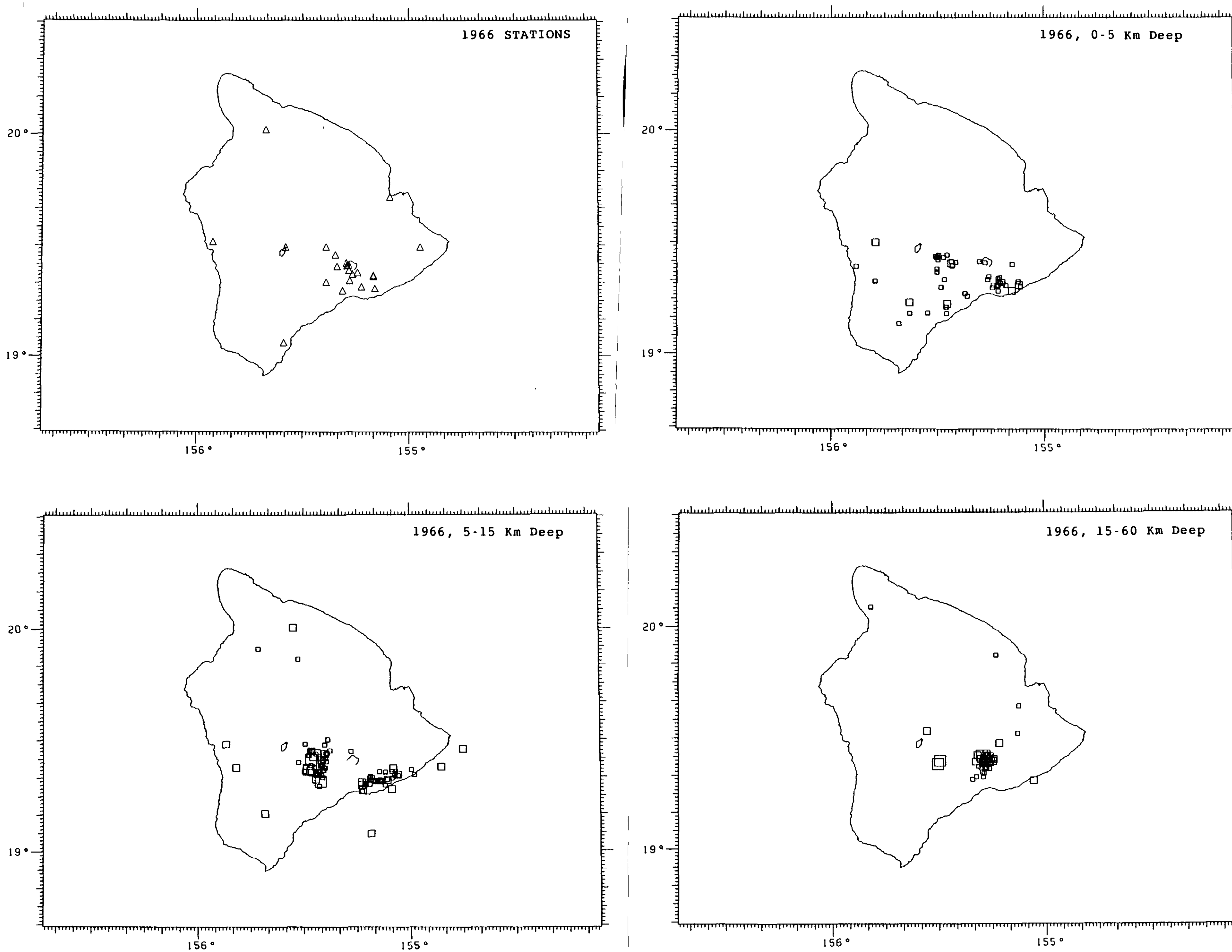
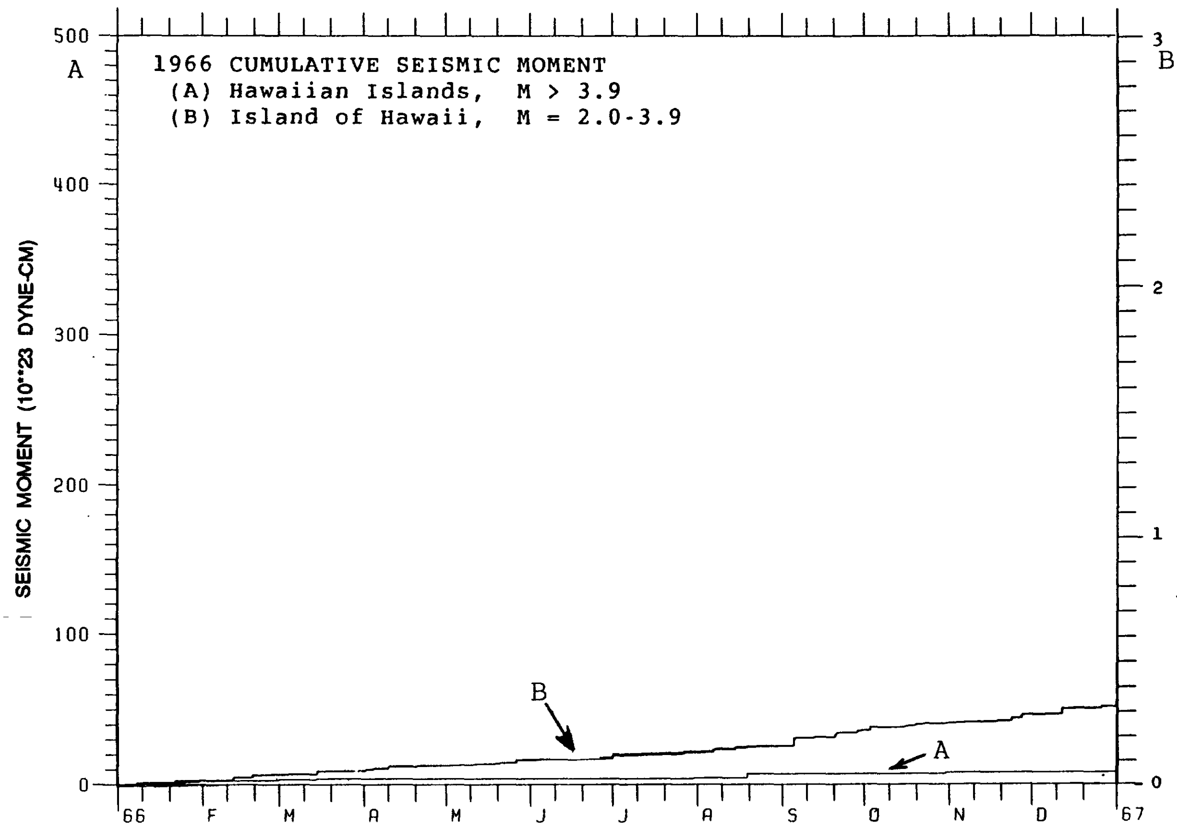
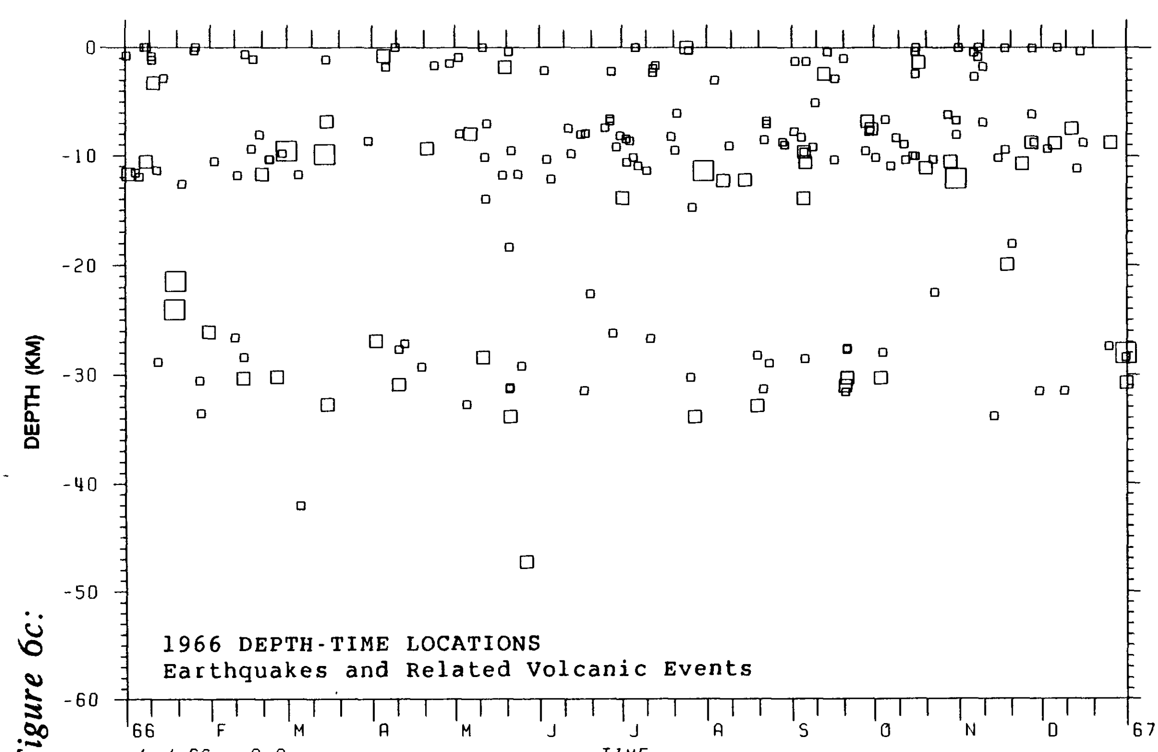

1966
KAUAI
OAHU
MOLOKAI
MAUI
HAWAII
DEPTHS
0.0+
5.0+
13.0+
20.0+
MAGNITUDES
4.0+
5.0+
6.0+
7.0+
20 KM
23°
22°
21°
20°
19°
18°
LAT-N
161°
160°
159°
158°
157°
156°
155°
154°
LON-W

Figure 6b:


1966 STATIONS
20°
19°
156°
155°
1966, 0-5 Km Deep
20°
19°
156°
155°
1966, 5-15 Km Deep
20°
19°
156°
155°
1966, 15-60 Km Deep
20°
19°
156°
155°



1966 CUMULATIVE SEISMIC MOMENT
(A) Hawaiian Islands, M > 3.9
(B) Island of Hawaii, M = 2.0-3.9
SEISMIC MOMENT (10**23 DYNE-CM)
A
B
500
400
300
200
100
0
3
2
1
0
66
F
M
A
M
J
J
A
S
O
N
D
67



1966 DEPTH-TIME LOCATIONS
Earthquakes and Related Volcanic Events
DEPTH (KM)
0
-10
-20
-30
-40
-50
-60
66
F
M
A
M
J
J
A
S
O
N
D
67
1 J 66, 0 0
TIME

Figure 6c:

Figure 7a:

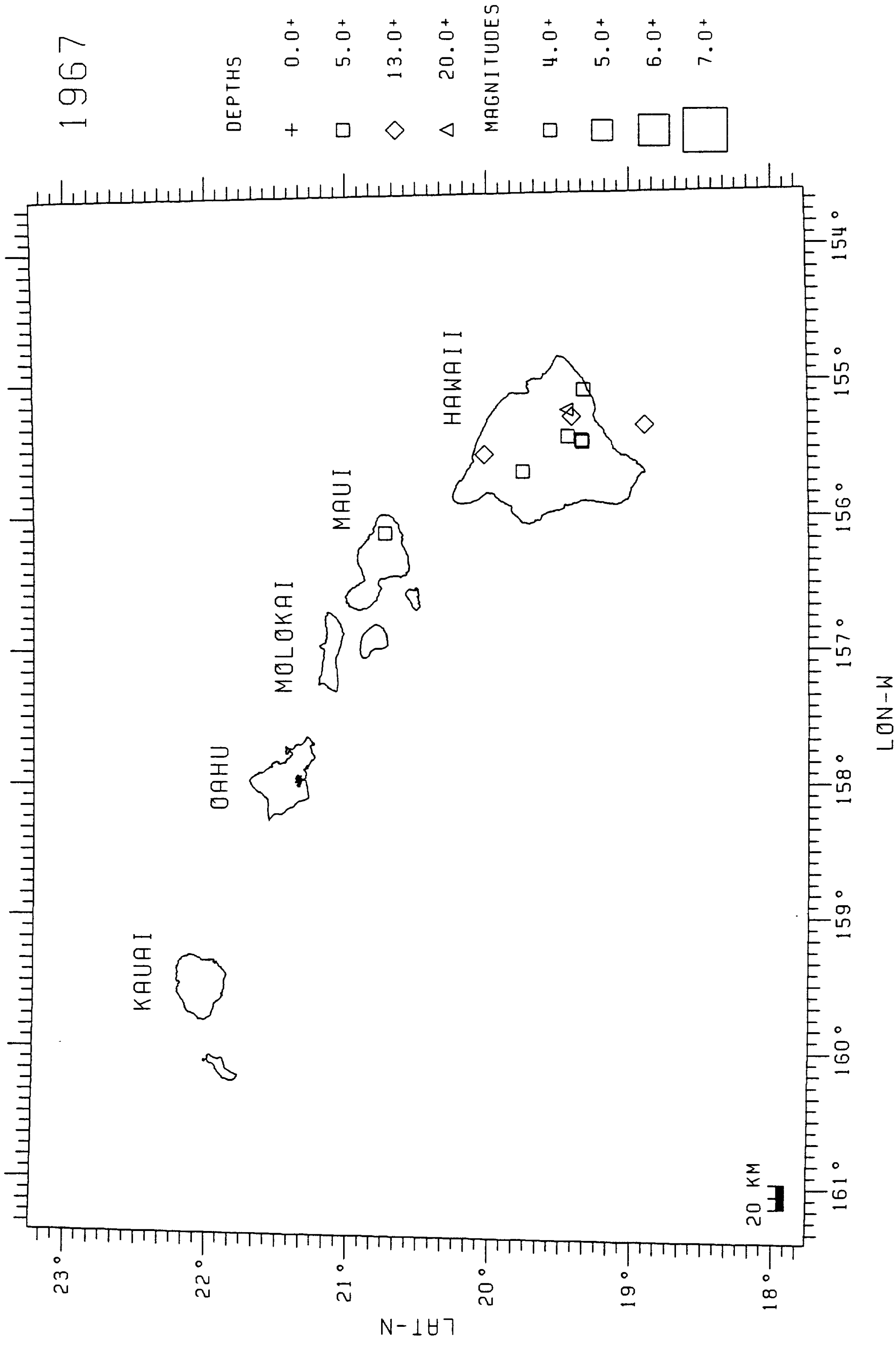
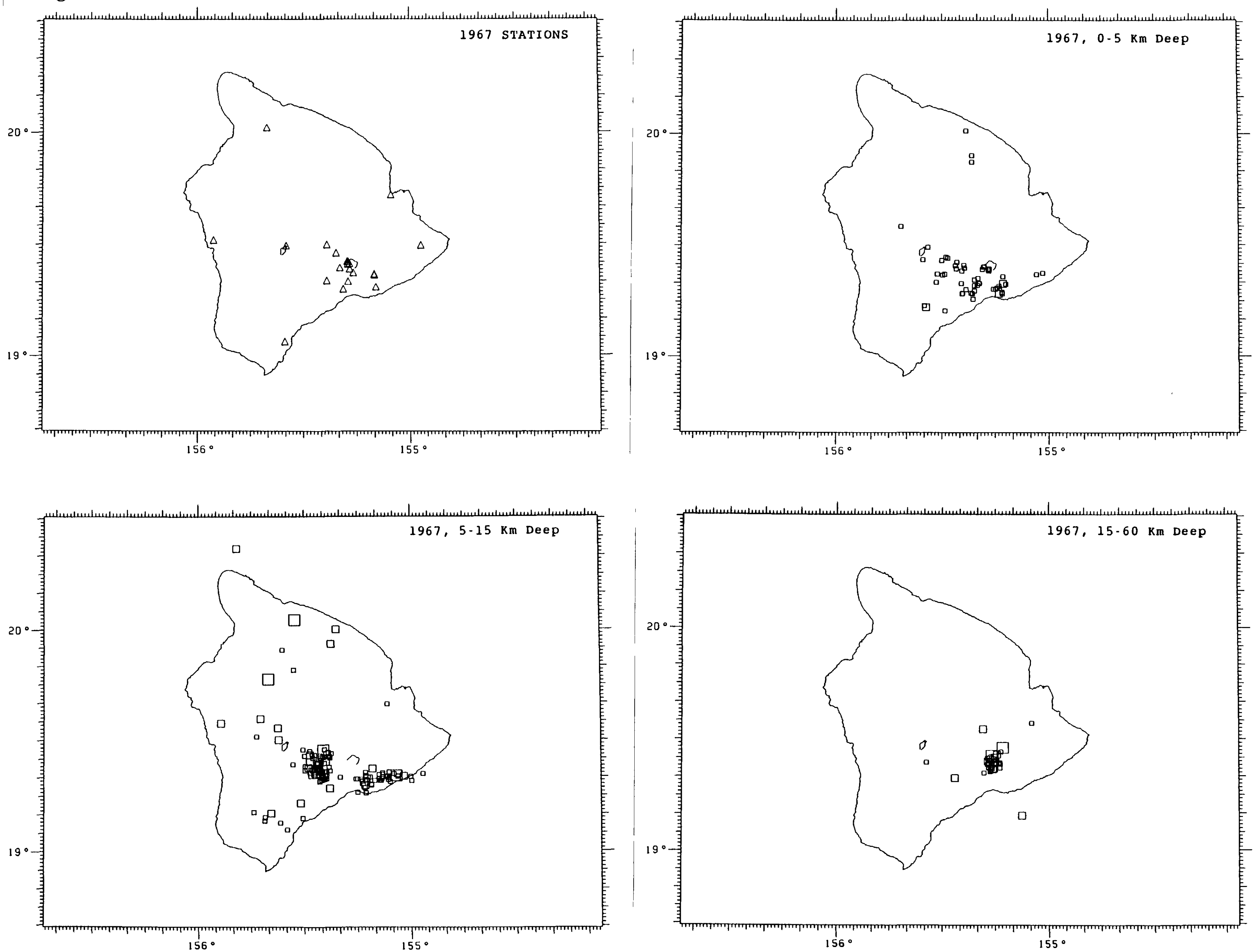
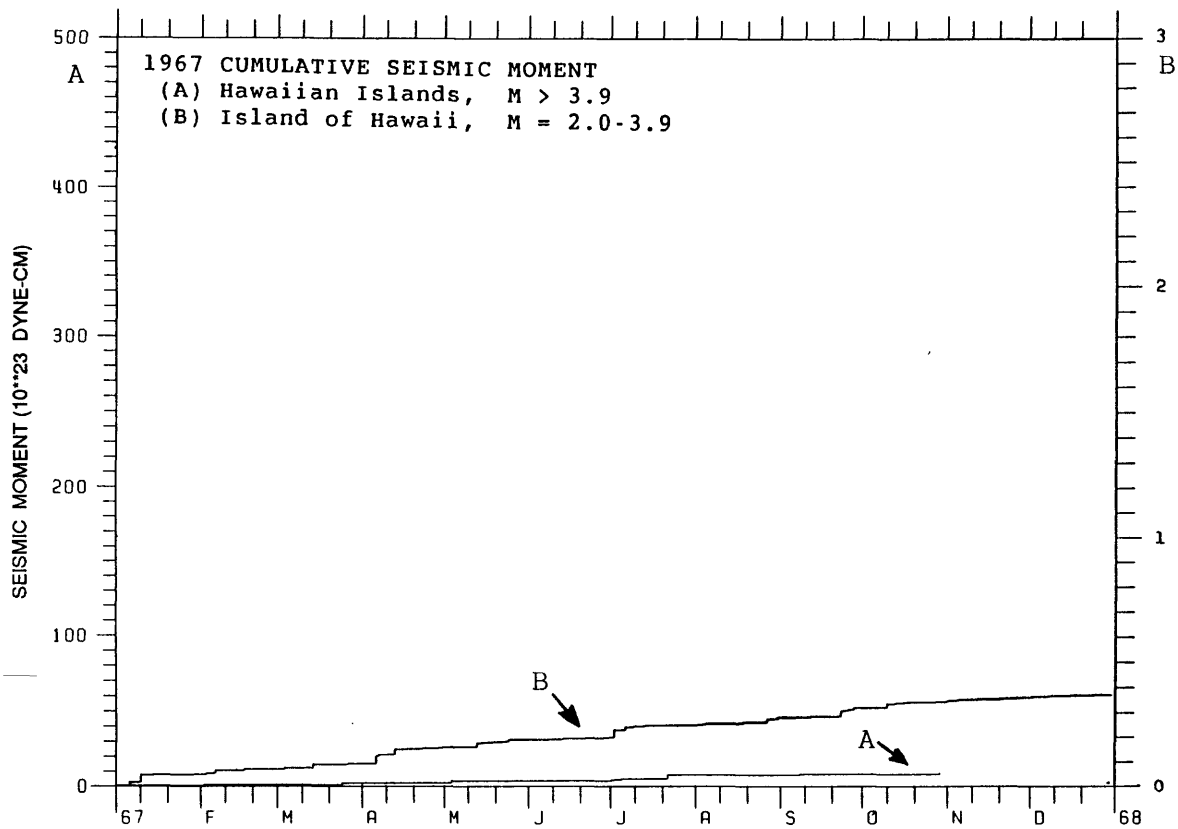

1967
DEPTHS
0.0+
5.0+
13.0+
20.0+
MAGNITUDES
4.0+
5.0+
6.0+
7.0+
KAUAI
OAHU
MOLOKAI
MAUI
HAWAII
20 KM
LAT-N
LON-W
23°
22°
21°
20°
19°
18°
154°
155°
156°
157°
158°
159°
160°
161°

Figure 7b:



1967 STATIONS
1967, 0-5 Km Deep
1967, 5-15 Km Deep
1967, 15-60 Km Deep
20°
19°
156°
155°


1967 CUMULATIVE SEISMIC MOMENT
(A) Hawaiian Islands, M > 3.9
(B) Island of Hawaii, M = 2.0-3.9
SEISMIC MOMENT (10**23 DYNE-CM)
A
B
500
400
300
200
100
0
3
2
1
0
67
F
M
A
M
J
J
A
S
O
N
D
68

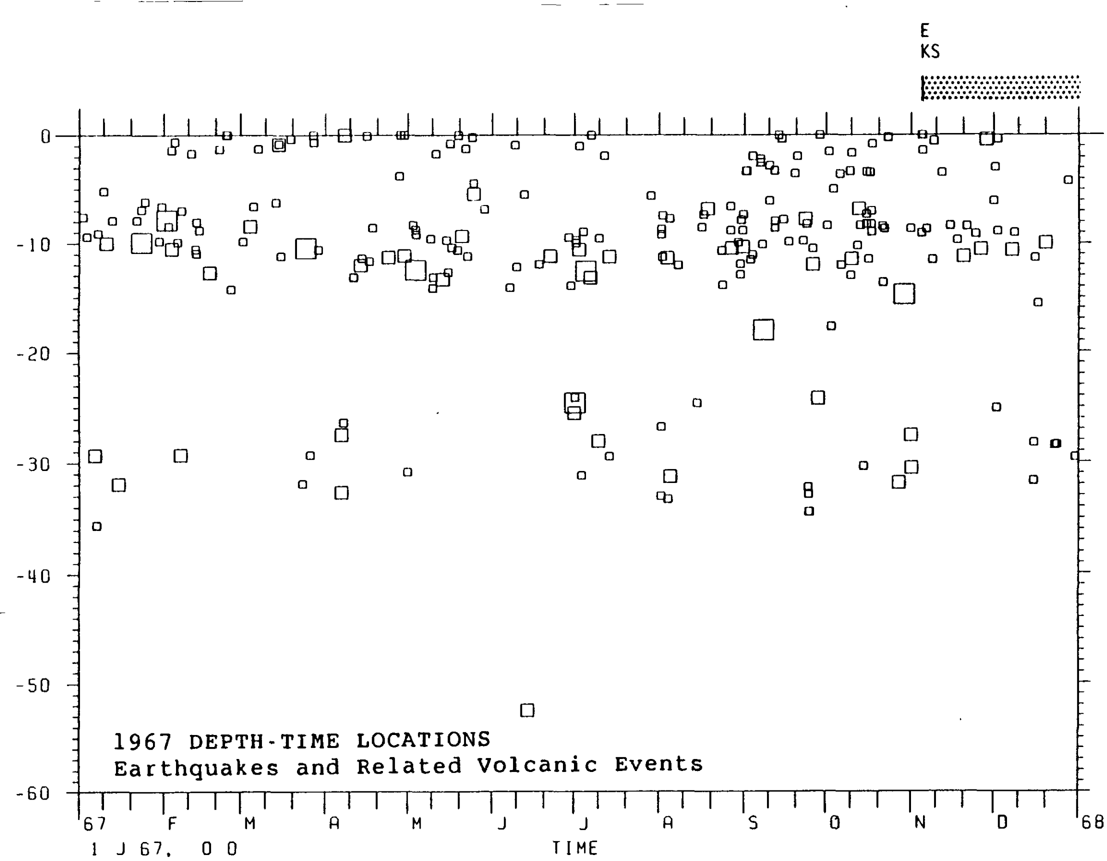
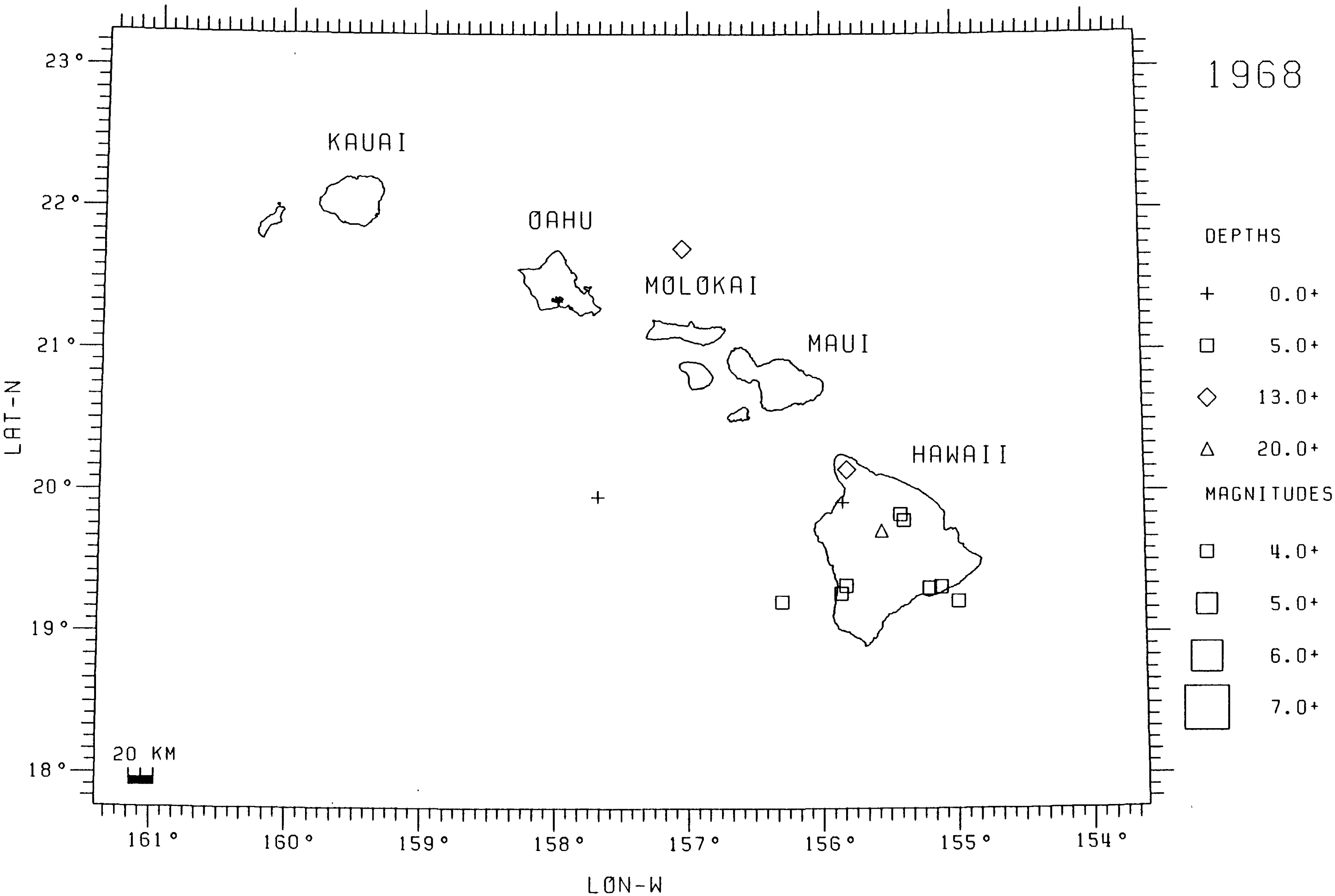

E
KS
1967 DEPTH-TIME LOCATIONS
Earthquakes and Related Volcanic Events
DEPTH (KM)
0
-10
-20
-30
-40
-50
-60
67
F
M
A
M
J
J
A
S
O
N
D
68
1 J 67, 0 0
TIME

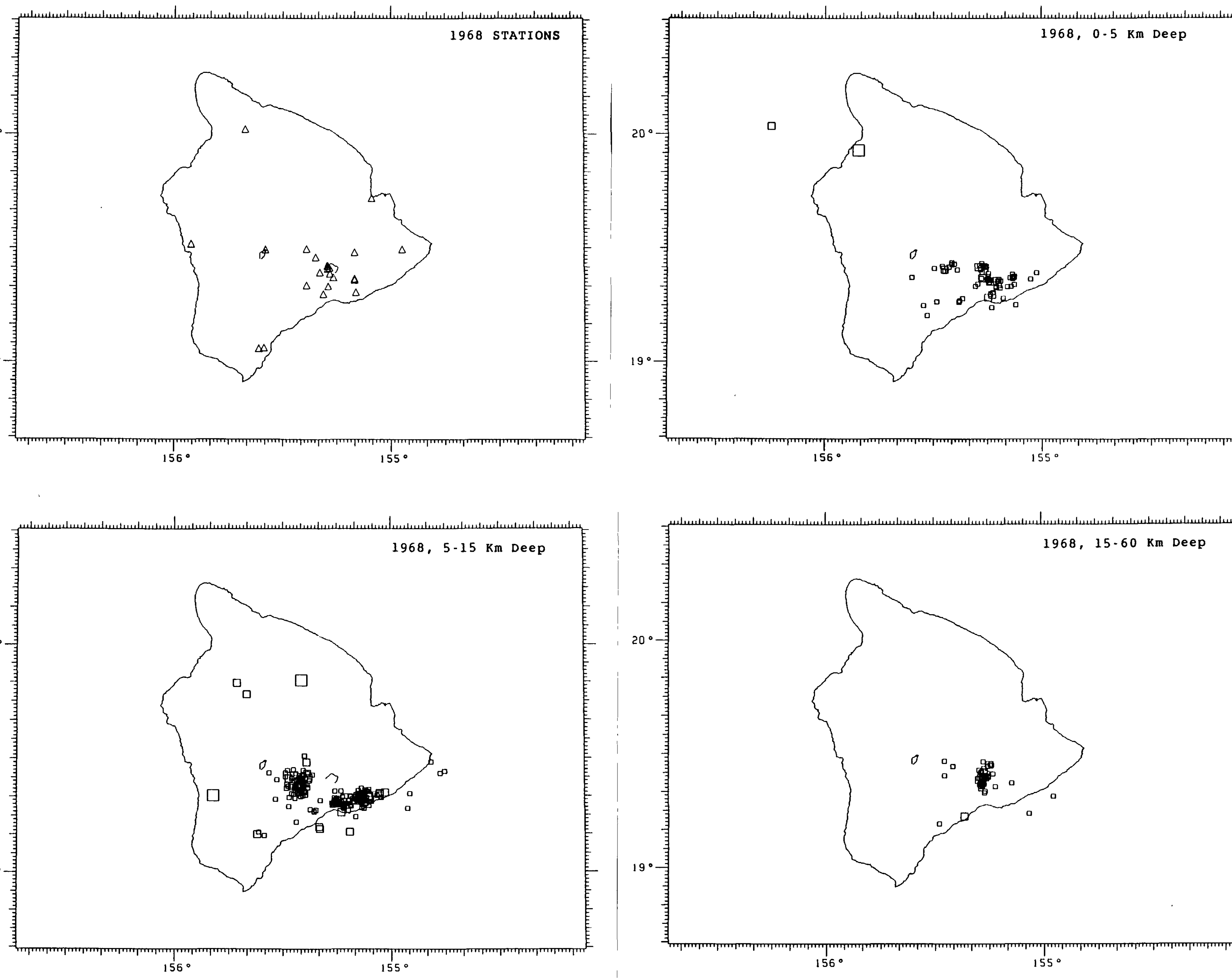
Figure 7c:

Figure 8a:

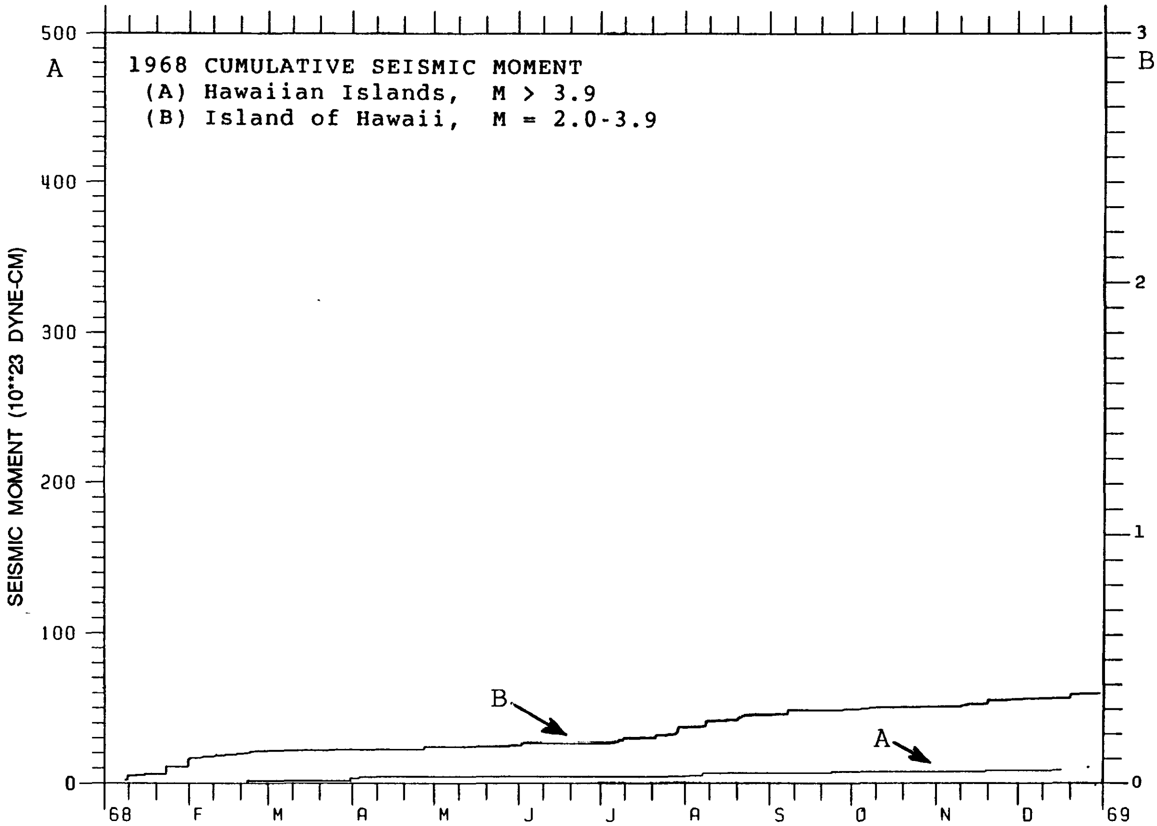


1968
KAUAI
OAHU
MOLOKAI
MAUI
HAWAII
DEPTHS
0.0+
5.0+
13.0+
20.0+
MAGNITUDES
4.0+
5.0+
6.0+
7.0+
20 KM
LAT-N
LON-W
23°
22°
21°
20°
19°
18°
161°
160°
159°
158°
157°
156°
155°
154°

Figure 8b:



1968 STATIONS
1968, 0-5 Km Deep
1968, 5-15 Km Deep
1968, 15-60 Km Deep
20°
19°
156°
155°


1968 CUMULATIVE SEISMIC MOMENT
(A) Hawaiian Islands, M > 3.9
(B) Island of Hawaii, M = 2.0-3.9
SEISMIC MOMENT (10**23 DYNE-CM)
A
B
500
400
300
200
100
0
3
2
1
0
68 F M A M J J A S O N D 69

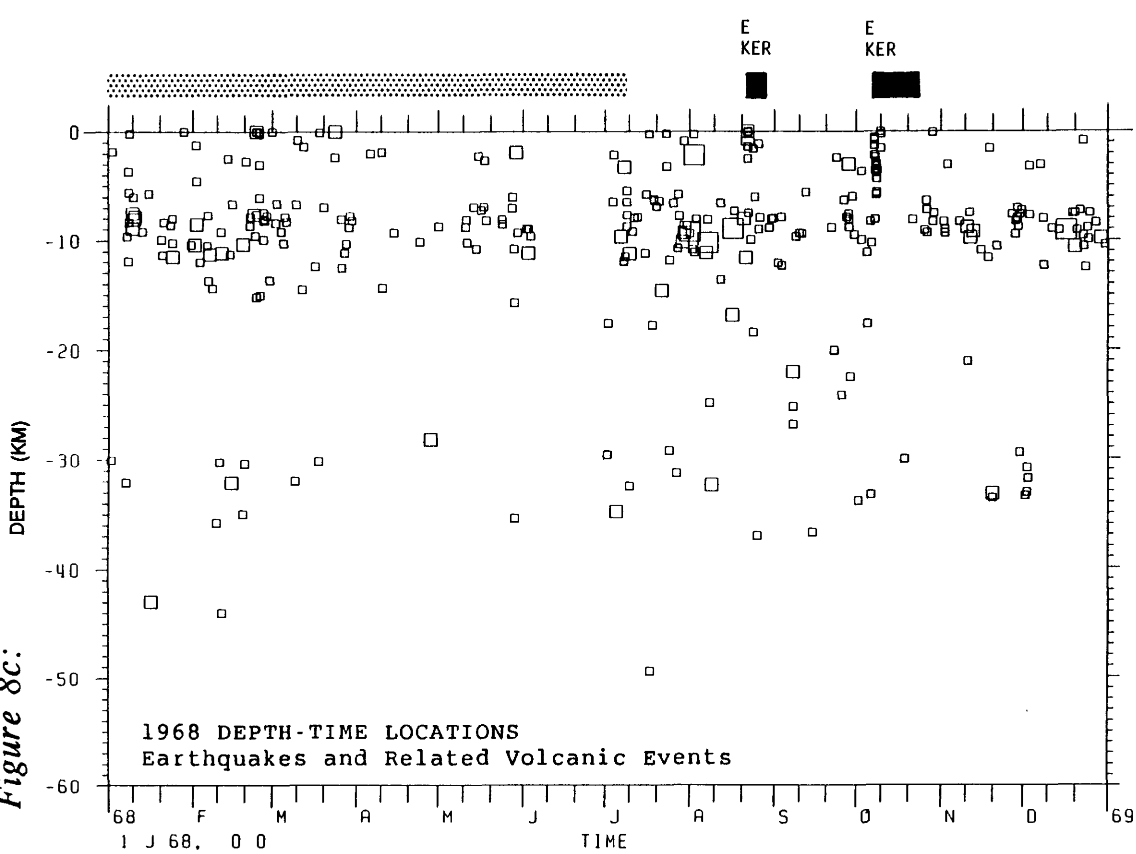

E
KER
E
KER
DEPTH (KM)
0
-10
-20
-30
-40
-50
-60
1968 DEPTH-TIME LOCATIONS
Earthquakes and Related Volcanic Events
68 F M A M J J A S O N D 69
1 J 68. 0 0
TIME

Figure 8c:

Figure 9a:

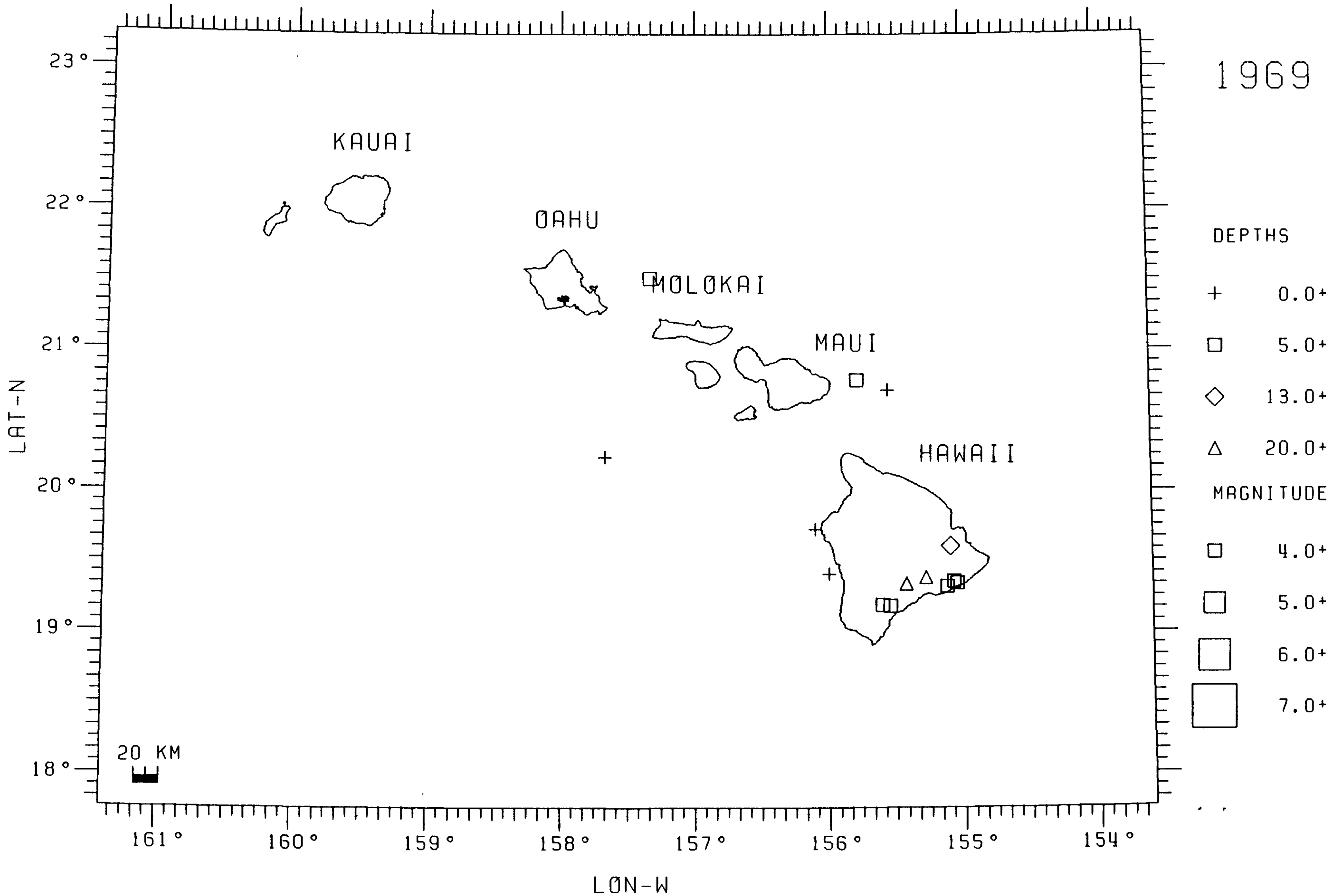
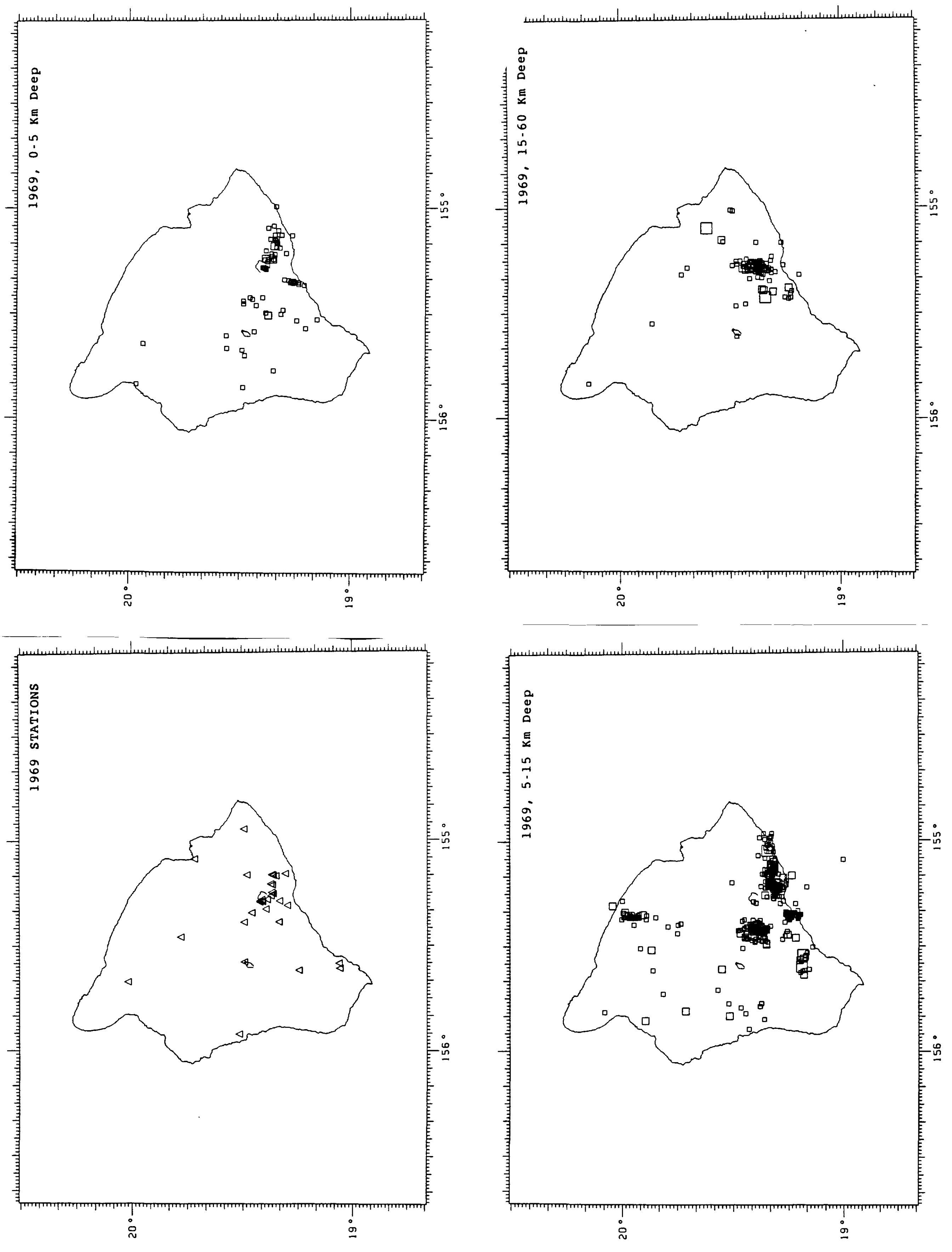
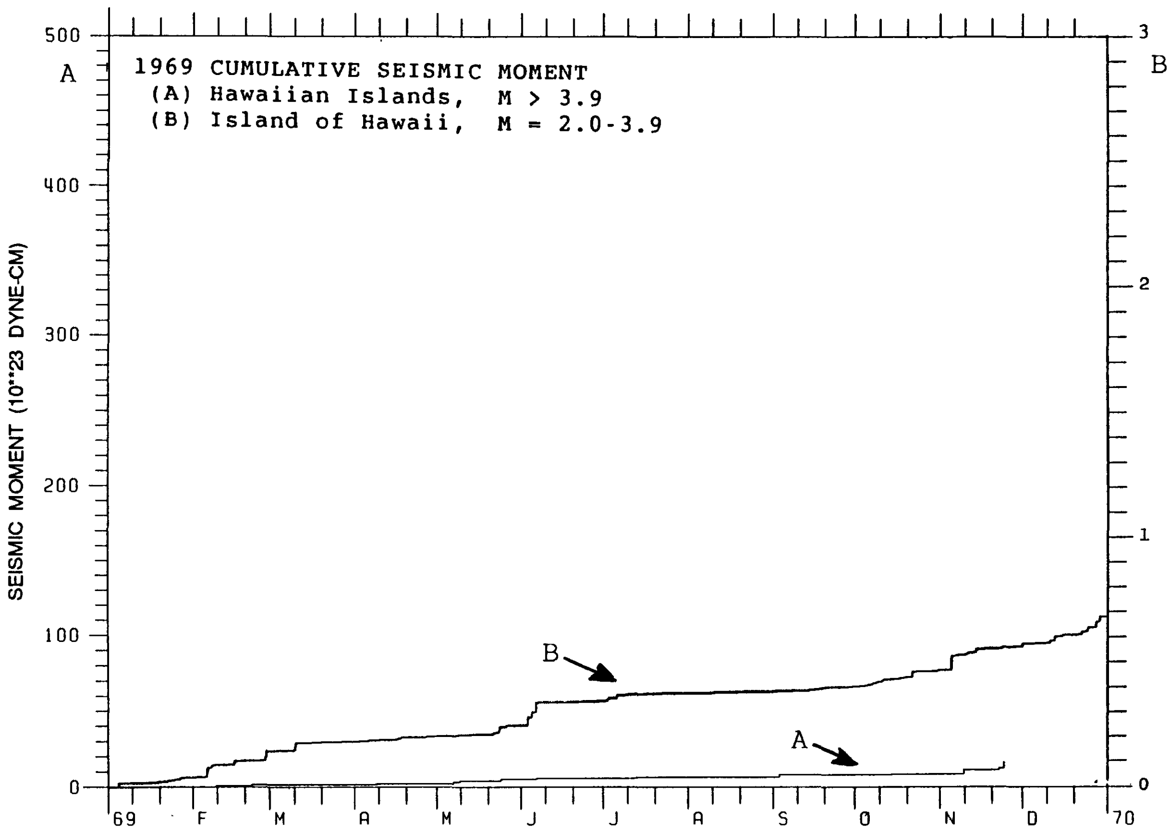

1969
KAUAI
OAHU
MOLOKAI
MAUI
HAWAII
DEPTHS
0.0+
5.0+
13.0+
20.0+
MAGNITUDES
4.0+
5.0+
6.0+
7.0+
20 KM
23°
22°
21°
20°
19°
18°
LAT-N
161°
160°
159°
158°
157°
156°
155°
154°
LON-W

Figure 9b:


1969 STATIONS
1969, 0-5 Km Deep
1969, 5-15 Km Deep
1969, 15-60 Km Deep
20°
19°
155°
156°


1969 CUMULATIVE SEISMIC MOMENT
(A) Hawaiian Islands, M > 3.9
(B) Island of Hawaii, M = 2.0-3.9
SEISMIC MOMENT (10**23 DYNE-CM)
A
B
500
400
300
200
100
0
3
2
1
0
69
F
M
A
M
J
J
A
S
O
N
D
70

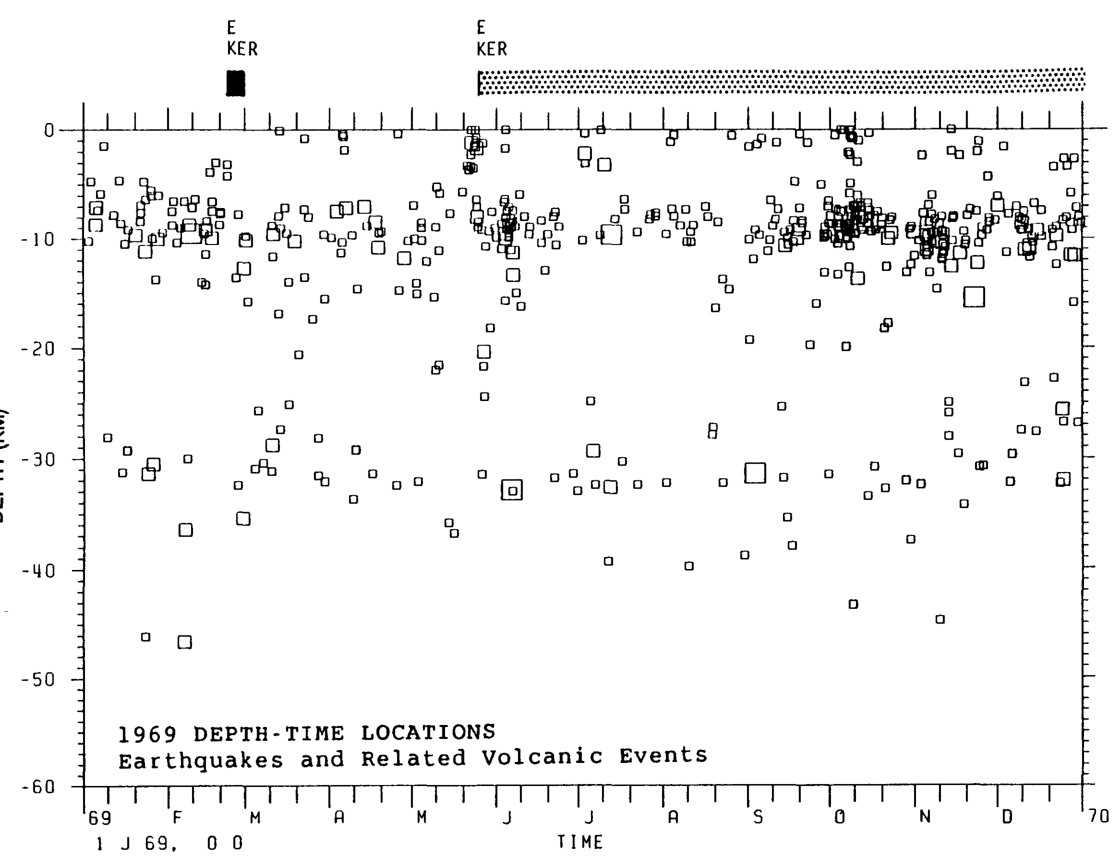
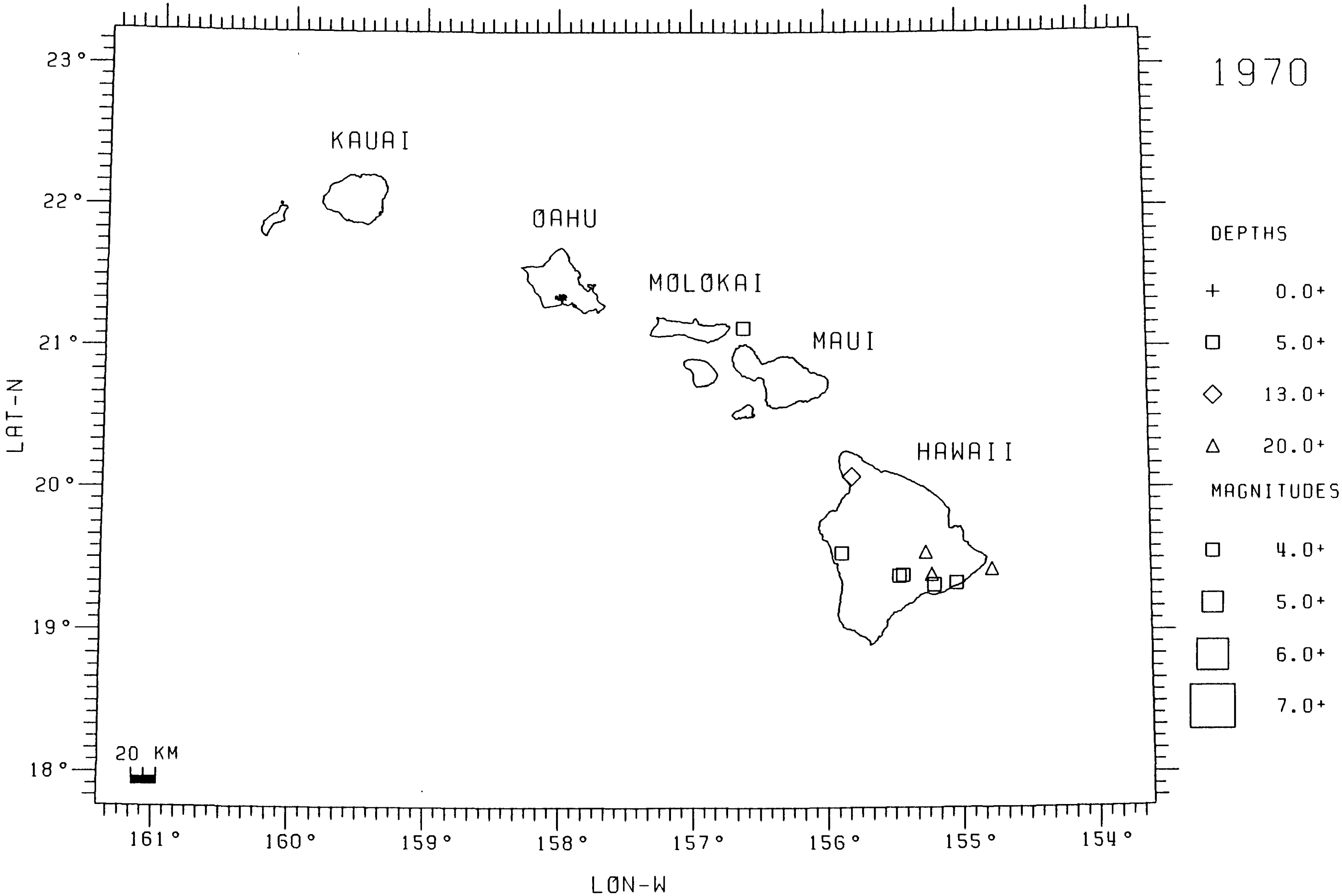

E
KER
E
KER
DEPTH (KM)
0
-10
-20
-30
-40
-50
-60
1969 DEPTH-TIME LOCATIONS
Earthquakes and Related Volcanic Events
69
F
M
A
M
J
J
A
S
O
N
D
70
1 J 69, 0 0
TIME

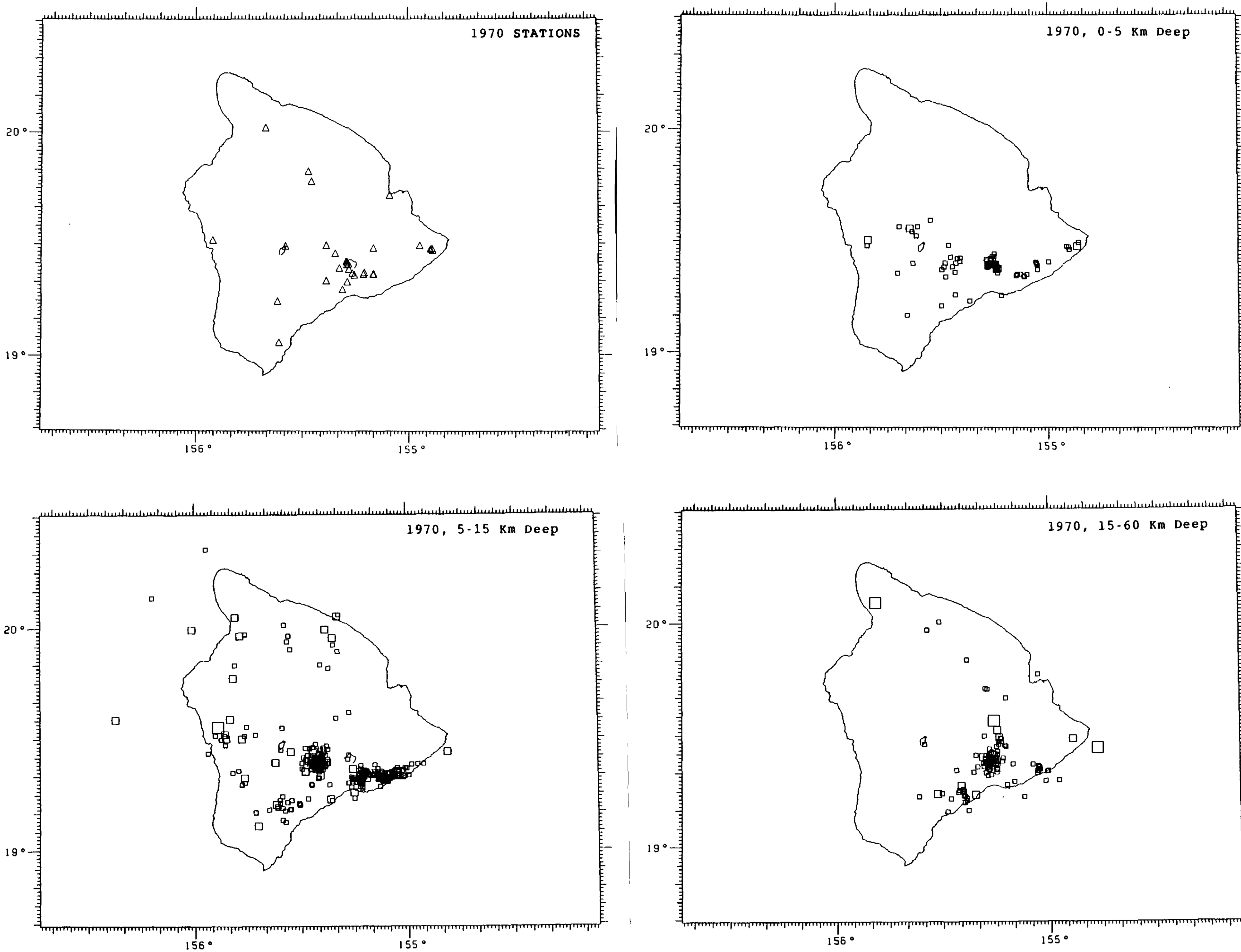
Figure 9c:

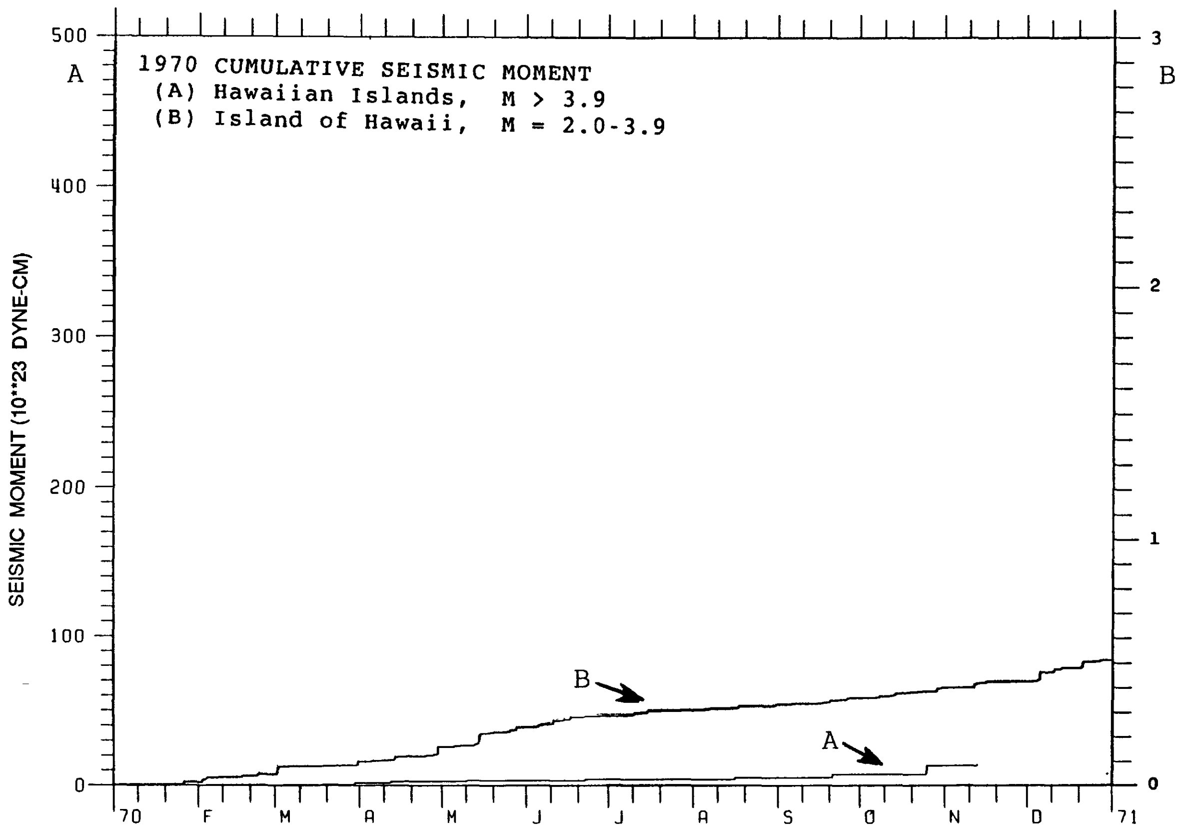
Figure 10a:



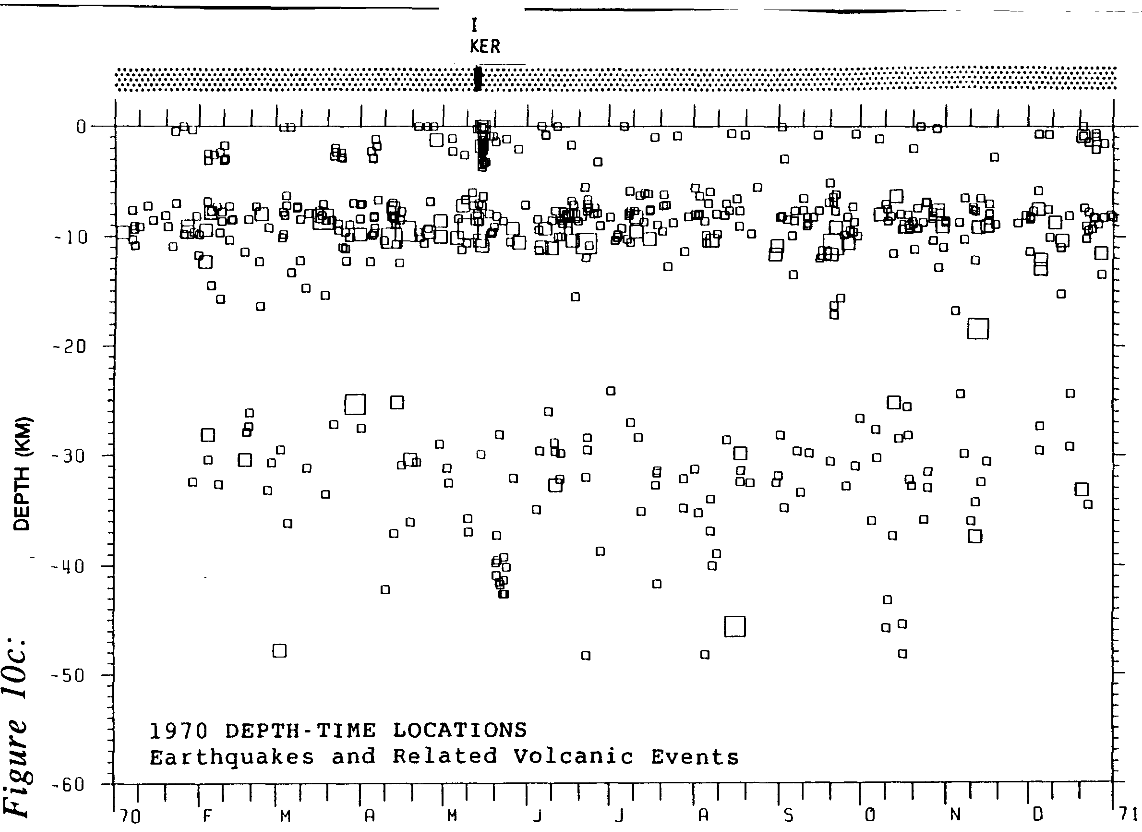
1970
KAUAI
OAHU
MOLOKAI
MAUI
HAWAII
23°
22°
21°
20°
19°
18°
LAT-N
161°
160°
159°
158°
157°
156°
155°
154°
LON-W
20 KM
DEPTHS
0.0+
5.0+
13.0+
20.0+
MAGNITUDES
4.0+
5.0+
6.0+
7.0+

Figure 10b:


1970 STATIONS
1970, 0-5 Km Deep
1970, 5-15 Km Deep
1970, 15-60 Km Deep
20°
19°
156°
155°



1970 CUMULATIVE SEISMIC MOMENT
(A) Hawaiian Islands, M > 3.9
(B) Island of Hawaii, M = 2.0-3.9
SEISMIC MOMENT (10**23 DYNE-CM)
A
B
500
400
300
200
100
0
3
2
1
0
70 F M A M J J A S O N D 71



I
KER
DEPTH (KM)
0
-10
-20
-30
-40
-50
-60
1970 DEPTH-TIME LOCATIONS
Earthquakes and Related Volcanic Events
70 F M A M J J A S O N D 71
1 J 70, 0 0
TIME

Figure 10c:

Figure 11a:

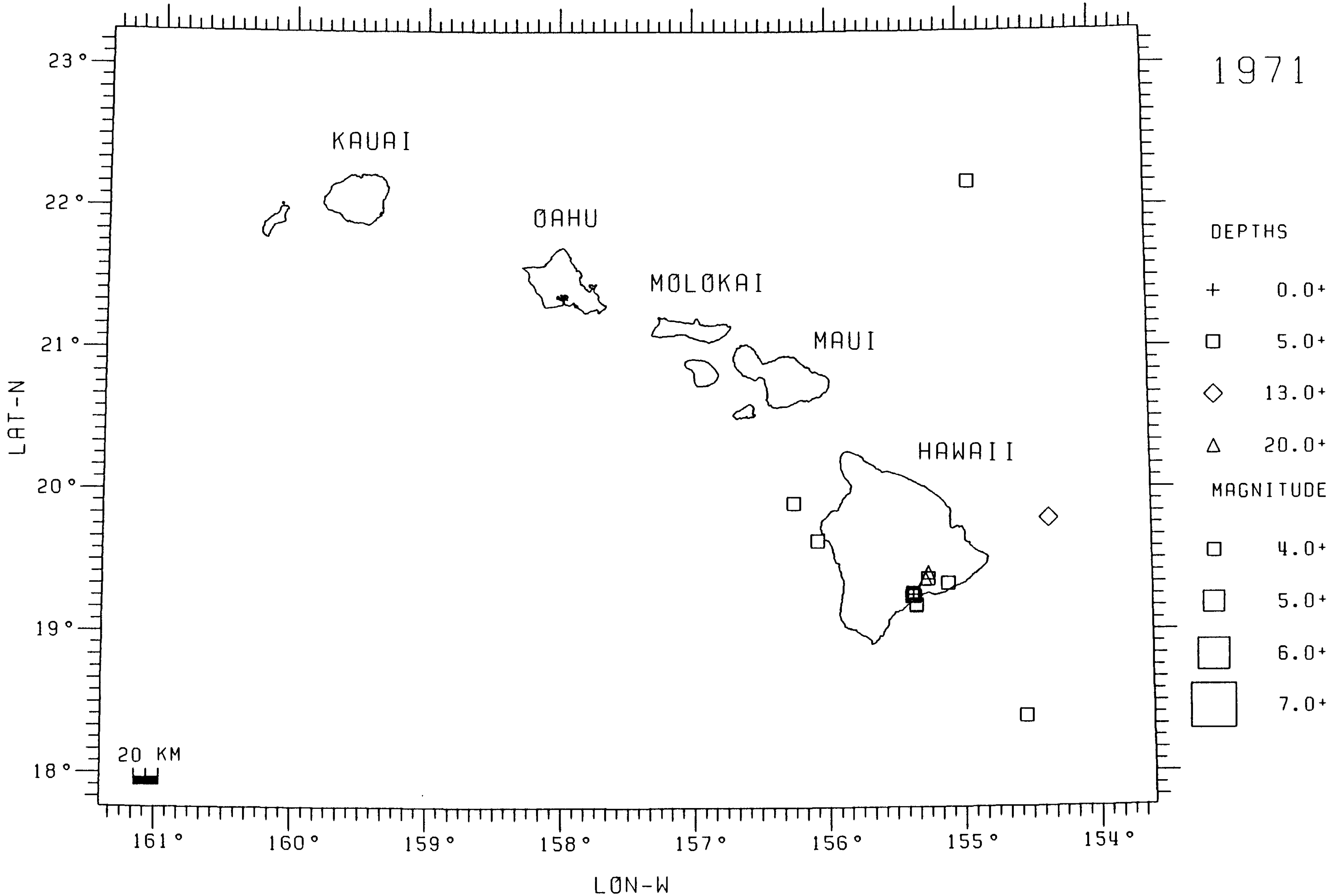
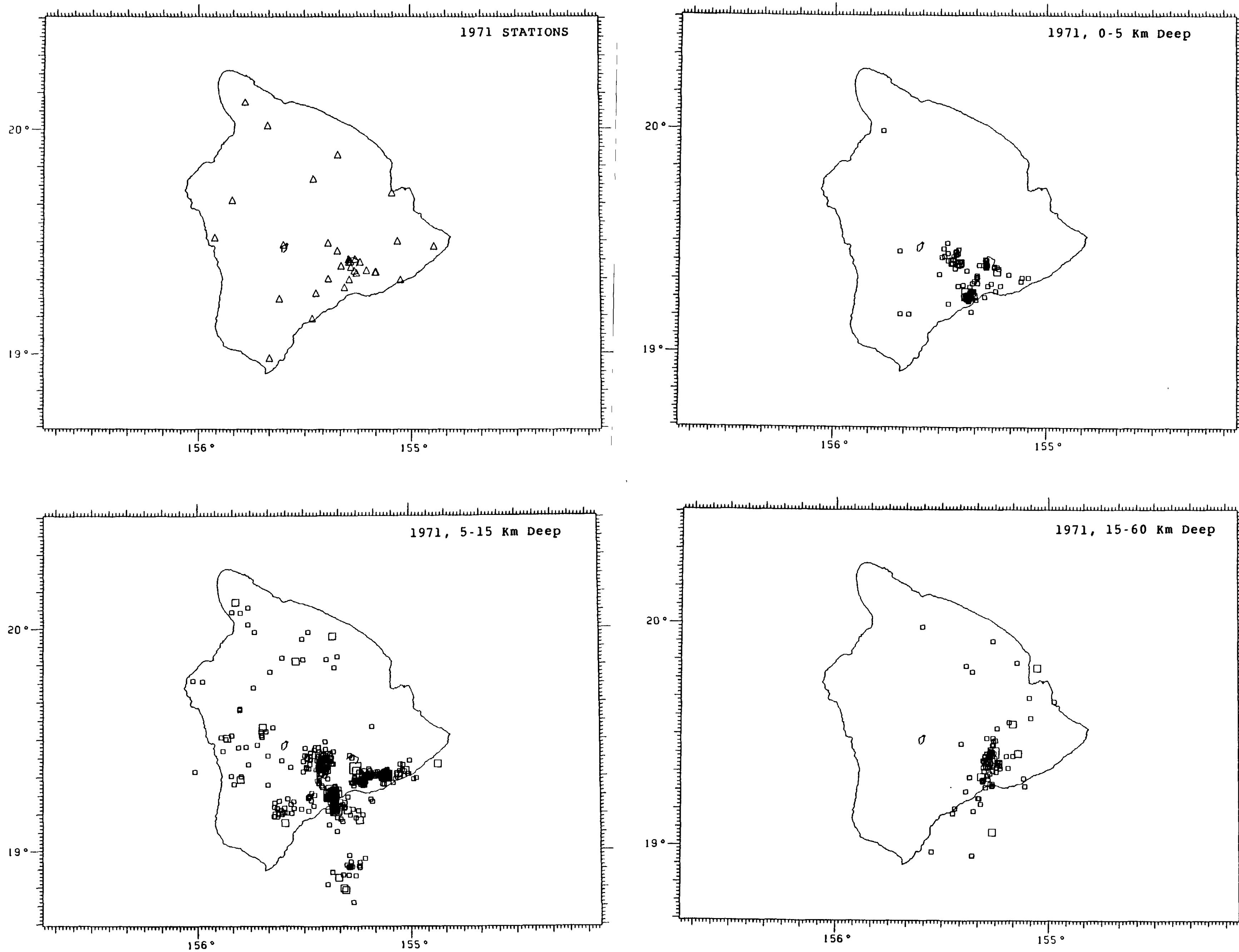

1971
KAUAI
OAHU
MOLOKAI
MAUI
HAWAII
DEPTHS
0.0+
5.0+
13.0+
20.0+
MAGNITUDES
4.0+
5.0+
6.0+
7.0+
20 KM
23°
22°
21°
20°
19°
18°
LAT-N
161°
160°
159°
158°
157°
156°
155°
154°
LON-W

Figure 11b:



1971 STATIONS
1971, 0-5 Km Deep
1971, 5-15 Km Deep
1971, 15-60 Km Deep
20°
19°
156°
155°

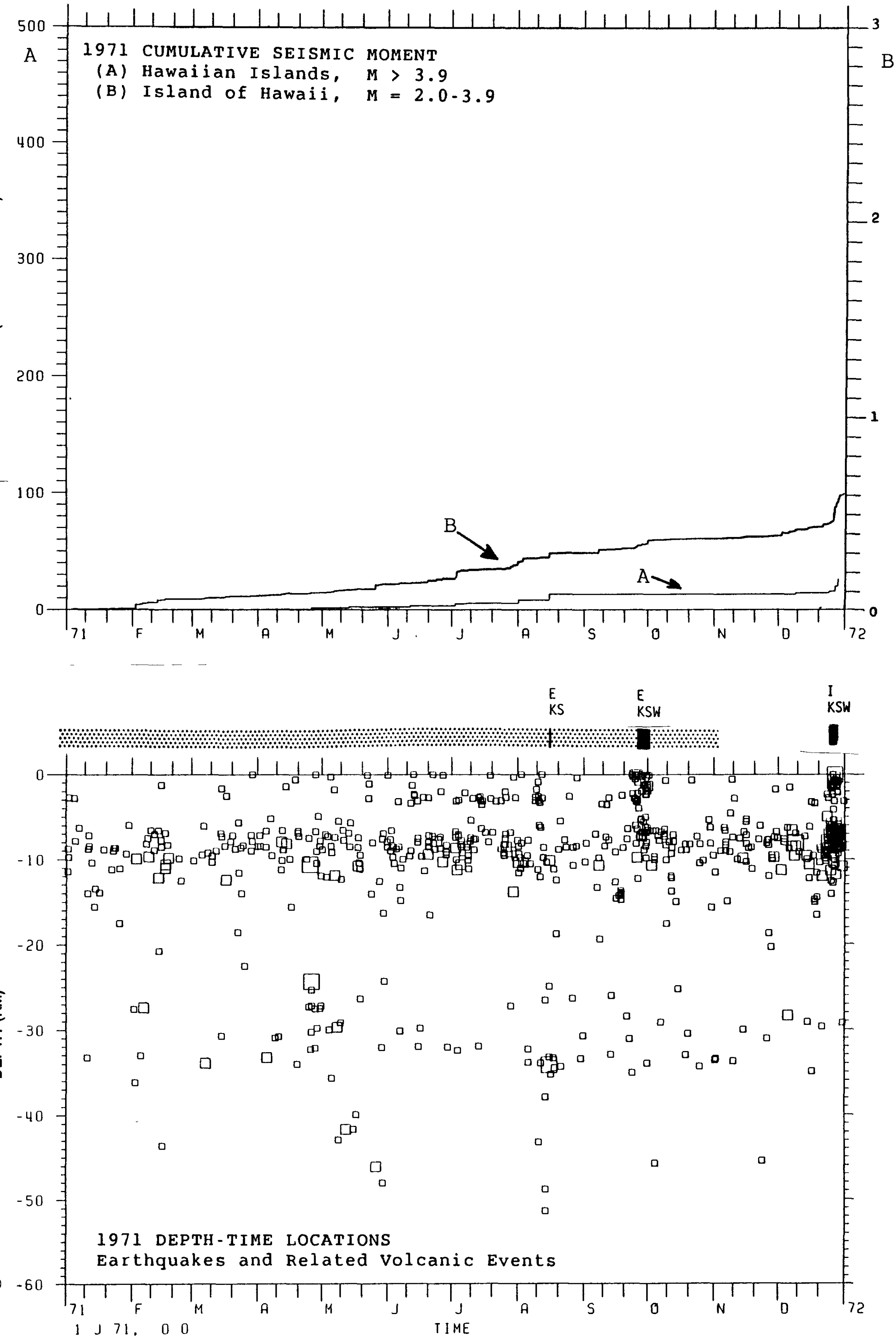

1971 CUMULATIVE SEISMIC MOMENT
(A) Hawaiian Islands, M > 3.9
(B) Island of Hawaii, M = 2.0-3.9
SEISMIC MOMENT (10**23 DYNE-CM)
A
B
500
400
300
200
100
0
3
2
1
0
71 F M A M J J A S O N D 72
E
KS
E
KSW
I
KSW
DEPTH (KM)
0
-10
-20
-30
-40
-50
-60
1971 DEPTH-TIME LOCATIONS
Earthquakes and Related Volcanic Events
71 F M A M J J A S O N D 72
1 J 71, 0 0
TIME

Figure 11c:

Figure 12a:

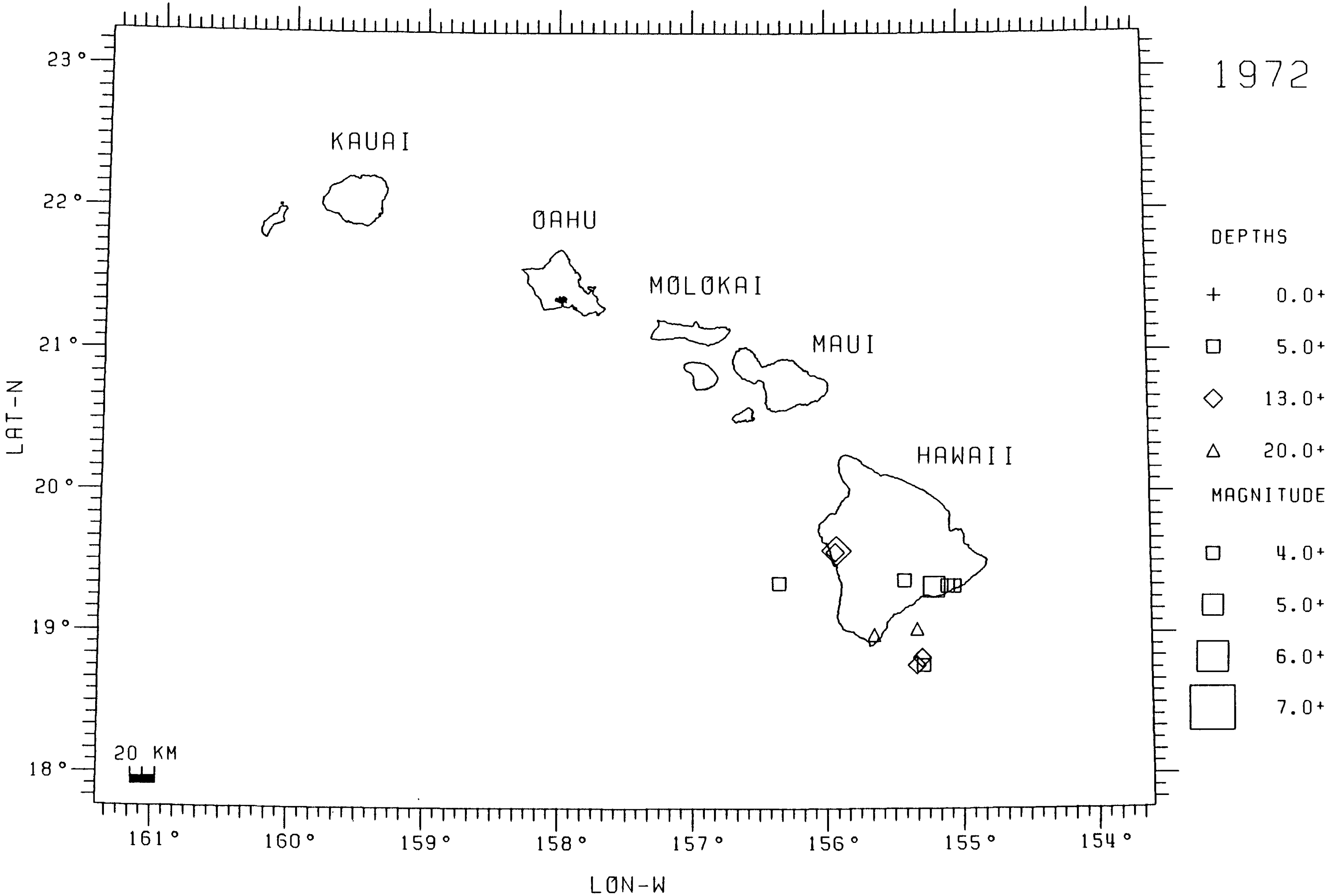
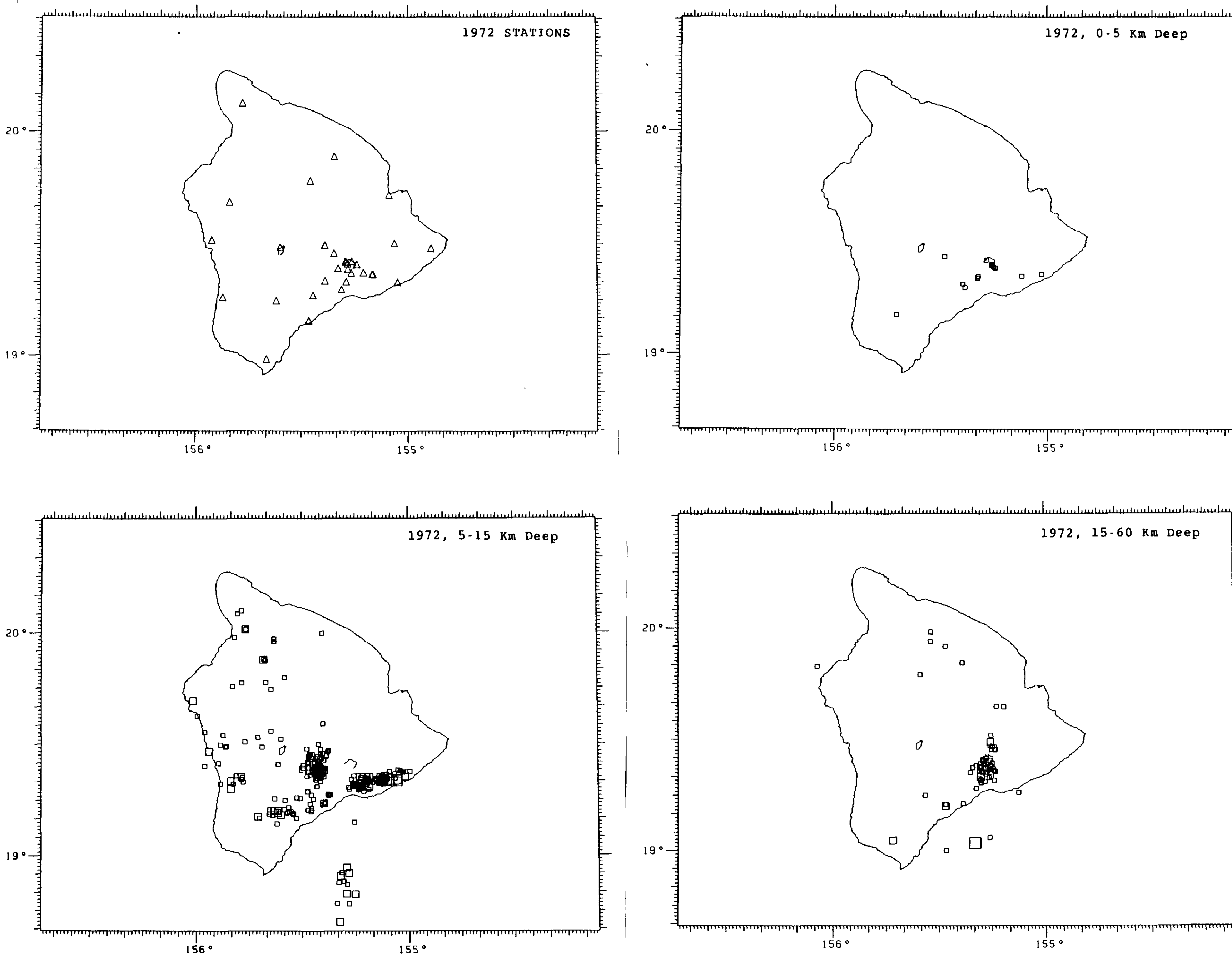
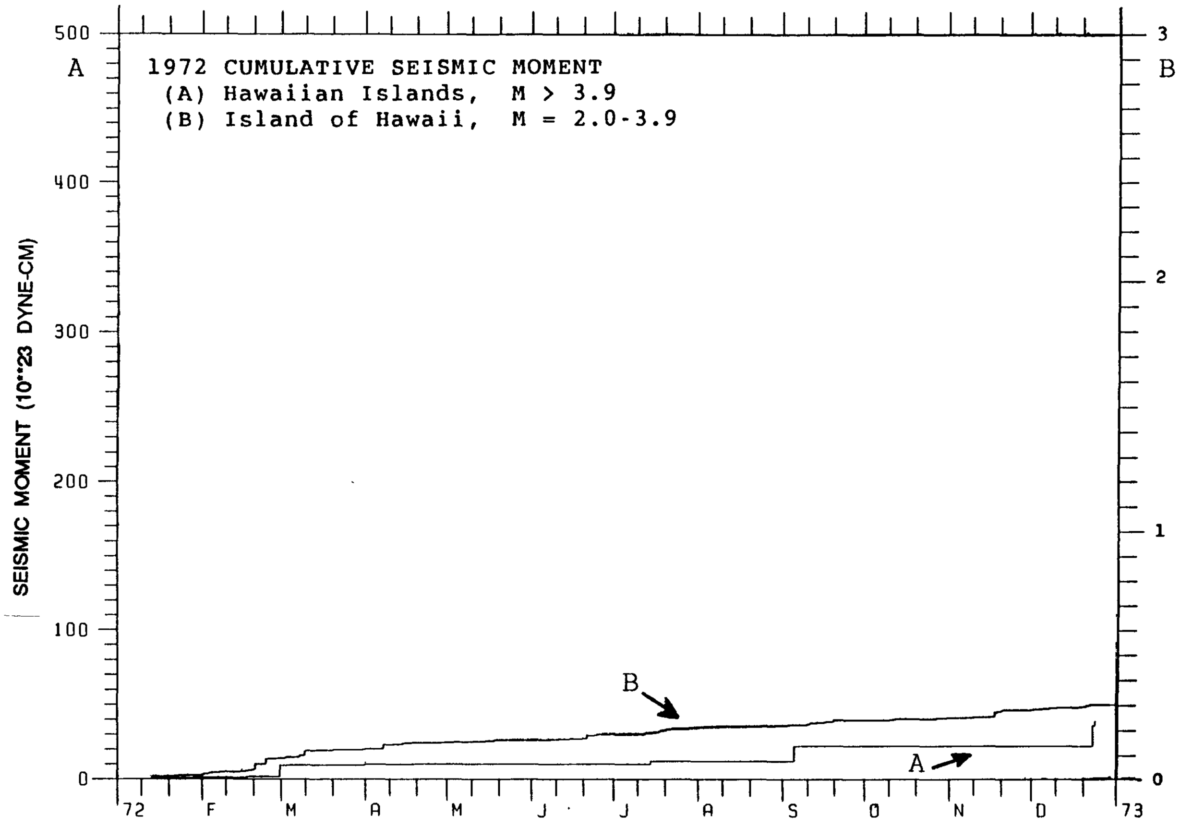

1972
KAUAI
OAHU
MOLOKAI
MAUI
HAWAII
DEPTHS
0.0+
5.0+
13.0+
20.0+
MAGNITUDES
4.0+
5.0+
6.0+
7.0+
20 KM
23°
22°
21°
20°
19°
18°
LAT-N
161°
160°
159°
158°
157°
156°
155°
154°
LON-W

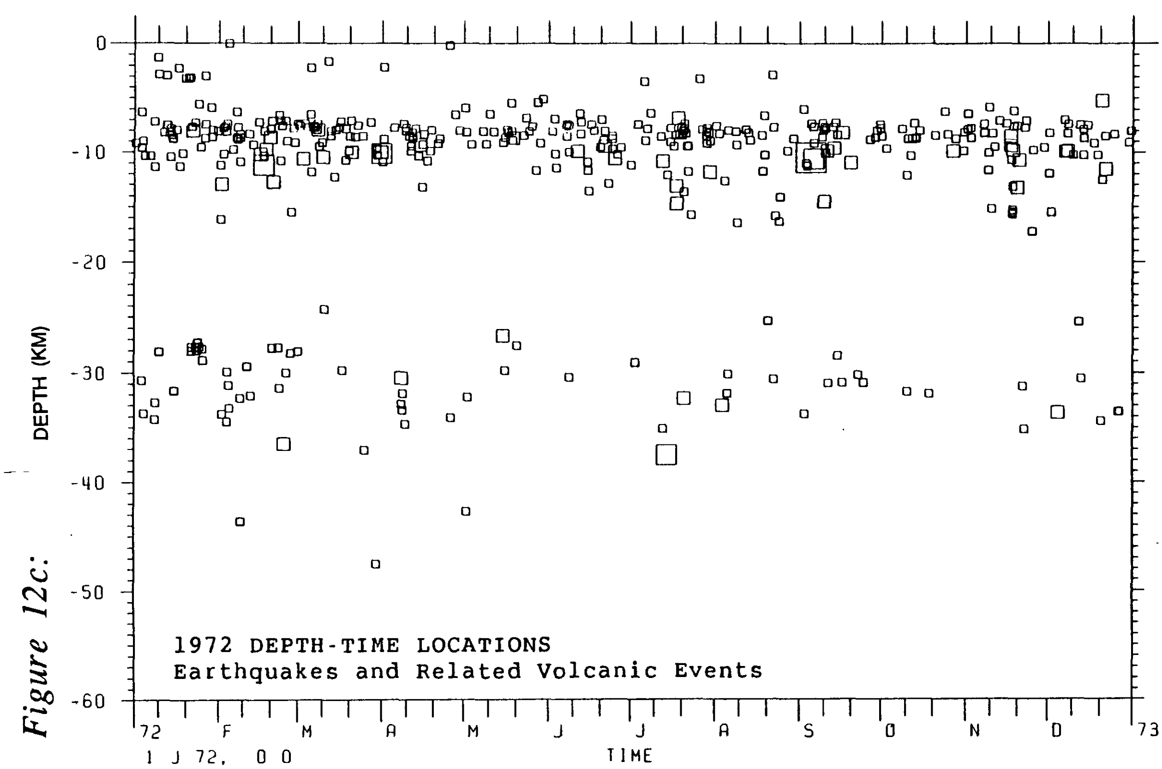
Figure 12b:



1972 STATIONS
1972, 0-5 Km Deep
1972, 5-15 Km Deep
1972, 15-60 Km Deep
20°
19°
156°
155°



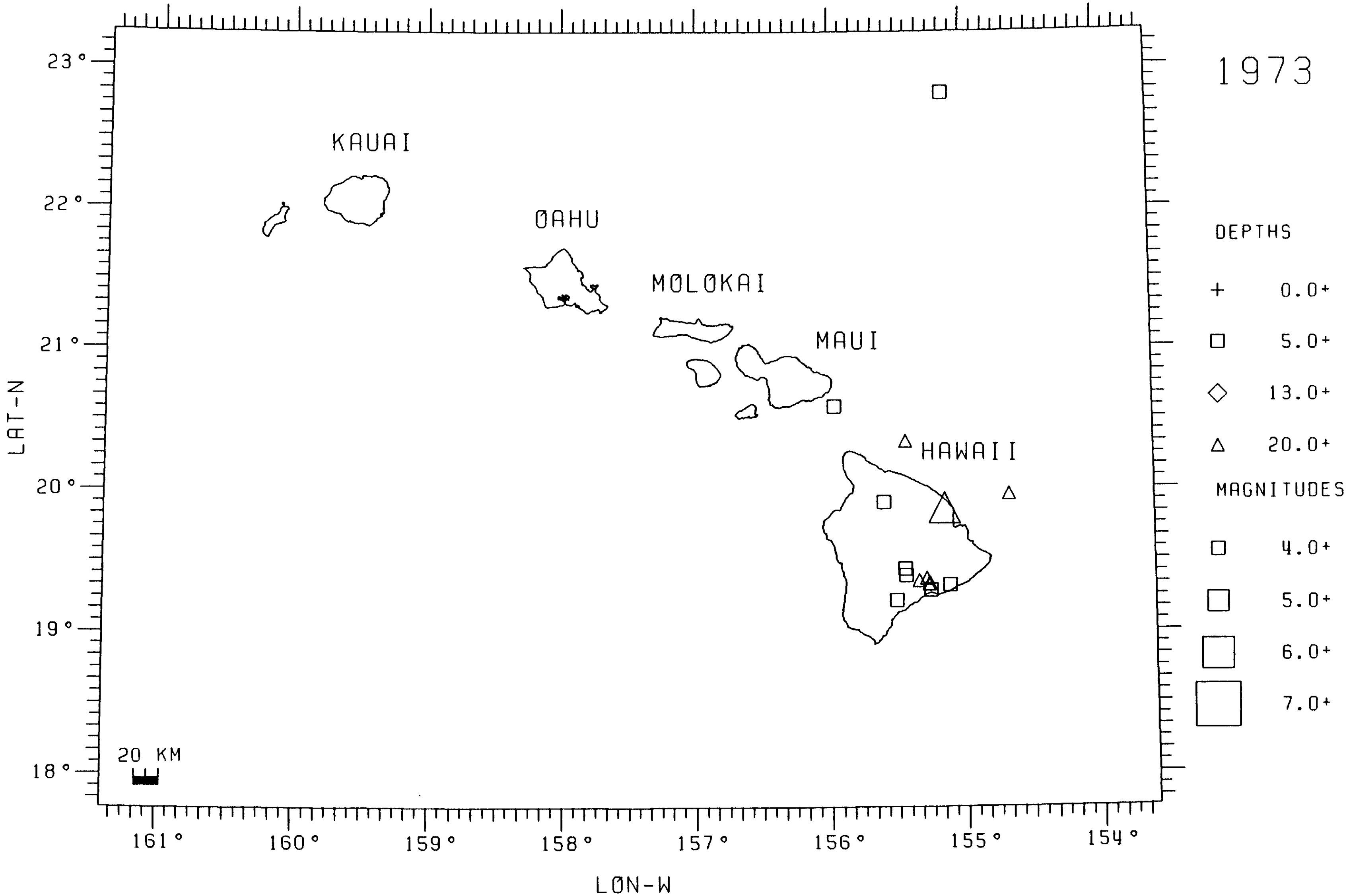
1972 CUMULATIVE SEISMIC MOMENT
(A) Hawaiian Islands, M > 3.9
(B) Island of Hawaii, M = 2.0-3.9
SEISMIC MOMENT (10**23 DYNE-CM)
A
B
500
400
300
200
100
0
3
2
1
0
72 F M A M J J A S O N D 73



1972 DEPTH-TIME LOCATIONS
Earthquakes and Related Volcanic Events
DEPTH (KM)
0
-10
-20
-30
-40
-50
-60
72 F M A M J J A S O N D 73
1 J 72, 0 0
TIME

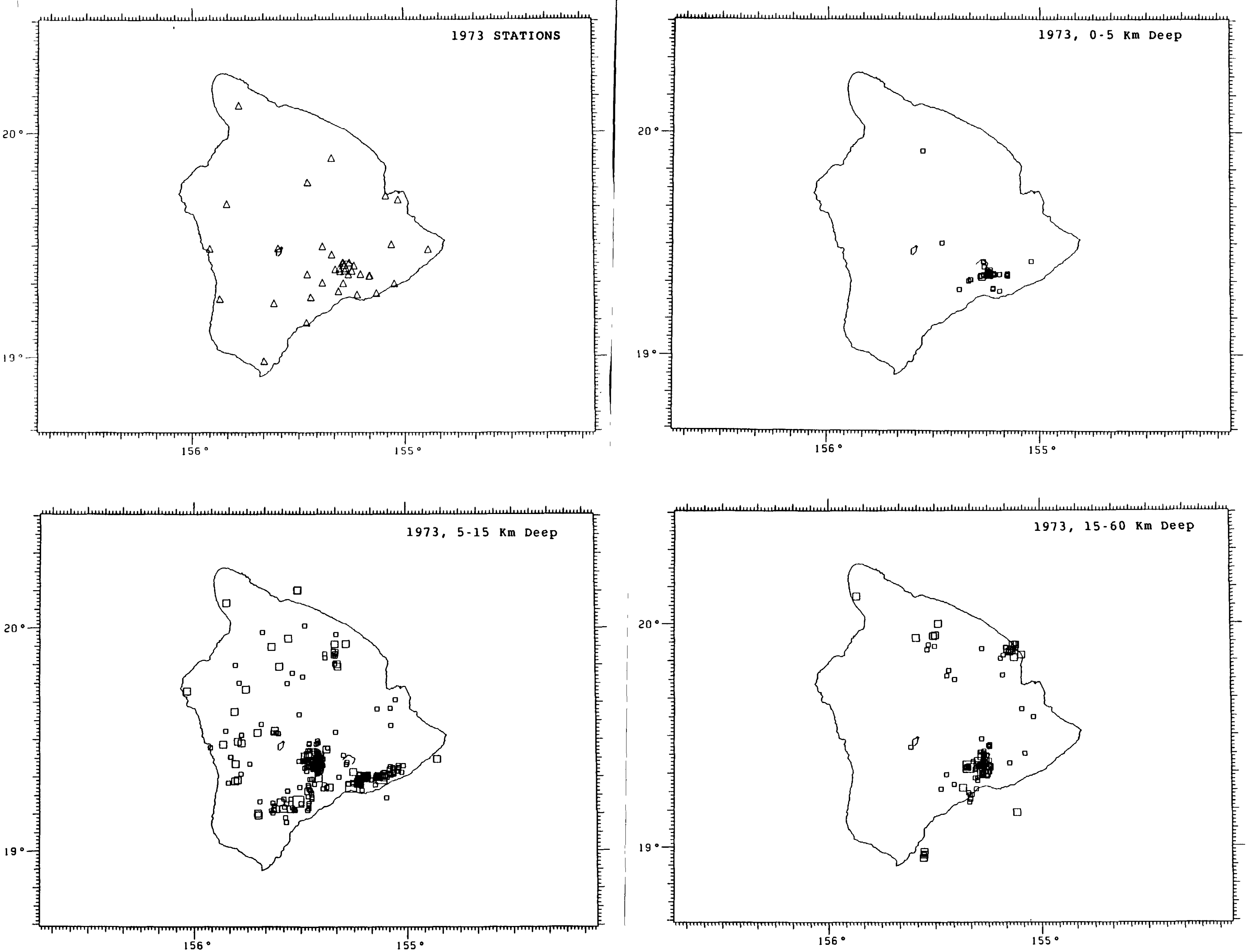
Figure 12c:

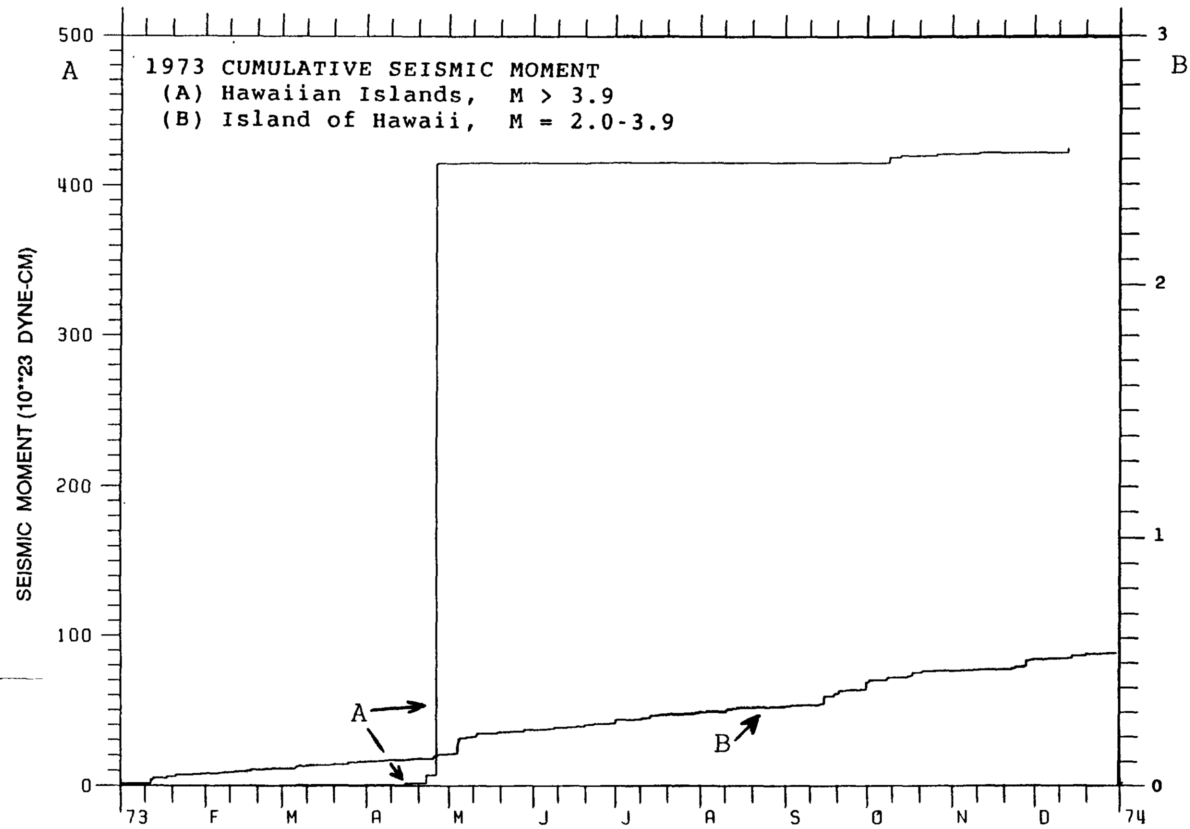
Figure 13a:



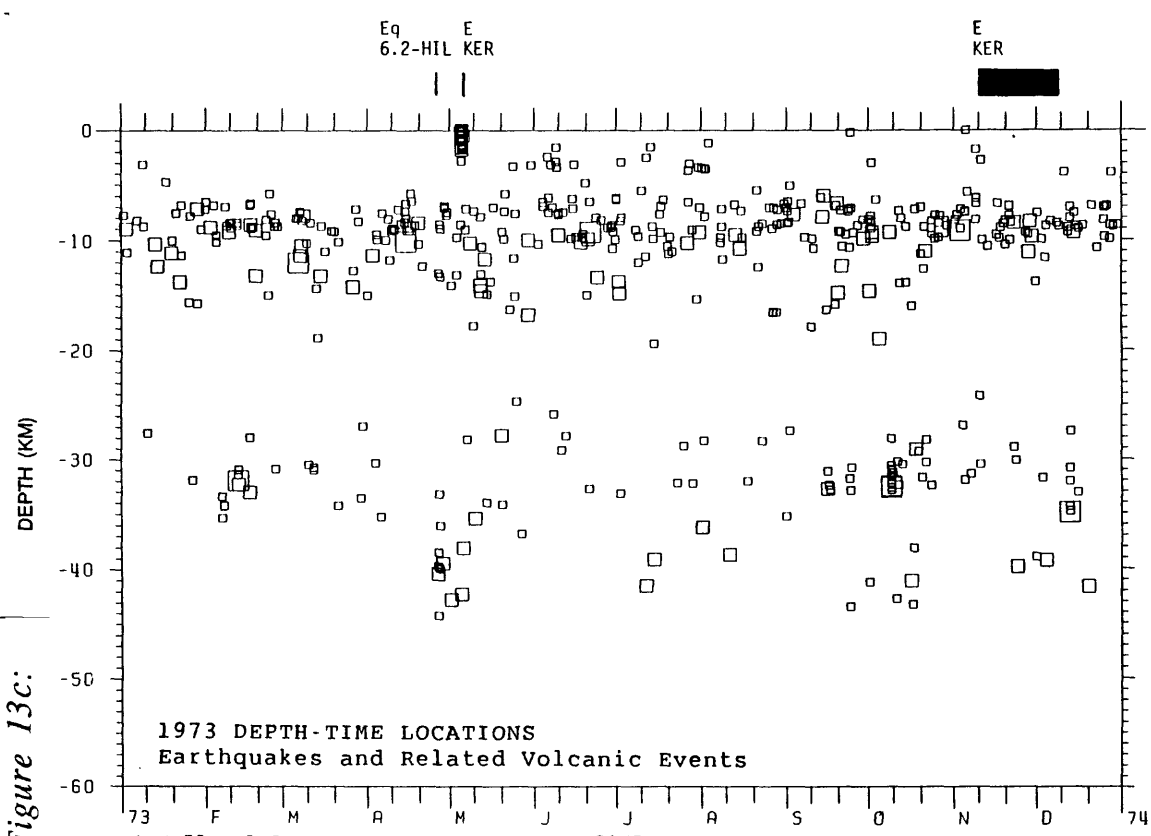
1973
KAUAI
OAHU
MOLOKAI
MAUI
HAWAII
DEPTHS
0.0+
5.0+
13.0+
20.0+
MAGNITUDES
4.0+
5.0+
6.0+
7.0+
20 KM
23°
22°
21°
20°
19°
18°
LAT-N
161°
160°
159°
158°
157°
156°
155°
154°
LON-W

Figure 13b:


1973 STATIONS
1973, 0-5 Km Deep
1973, 5-15 Km Deep
1973, 15-60 Km Deep
20°
19°
156°
155°



1973 CUMULATIVE SEISMIC MOMENT
(A) Hawaiian Islands, M > 3.9
(B) Island of Hawaii, M = 2.0-3.9
SEISMIC MOMENT (10**23 DYNE-CM)
A
B
500
400
300
200
100
0
3
2
1
0
73
F
M
A
M
J
J
A
S
O
N
D
74



Eq
6.2-HIL
E
KER
E
KER
1973 DEPTH-TIME LOCATIONS
Earthquakes and Related Volcanic Events
DEPTH (KM)
0
-10
-20
-30
-40
-50
-60
73
F
M
A
M
J
J
A
S
O
N
D
74
1 J 73, 0 0
TIME

Figure 13c:

Figure 14a:

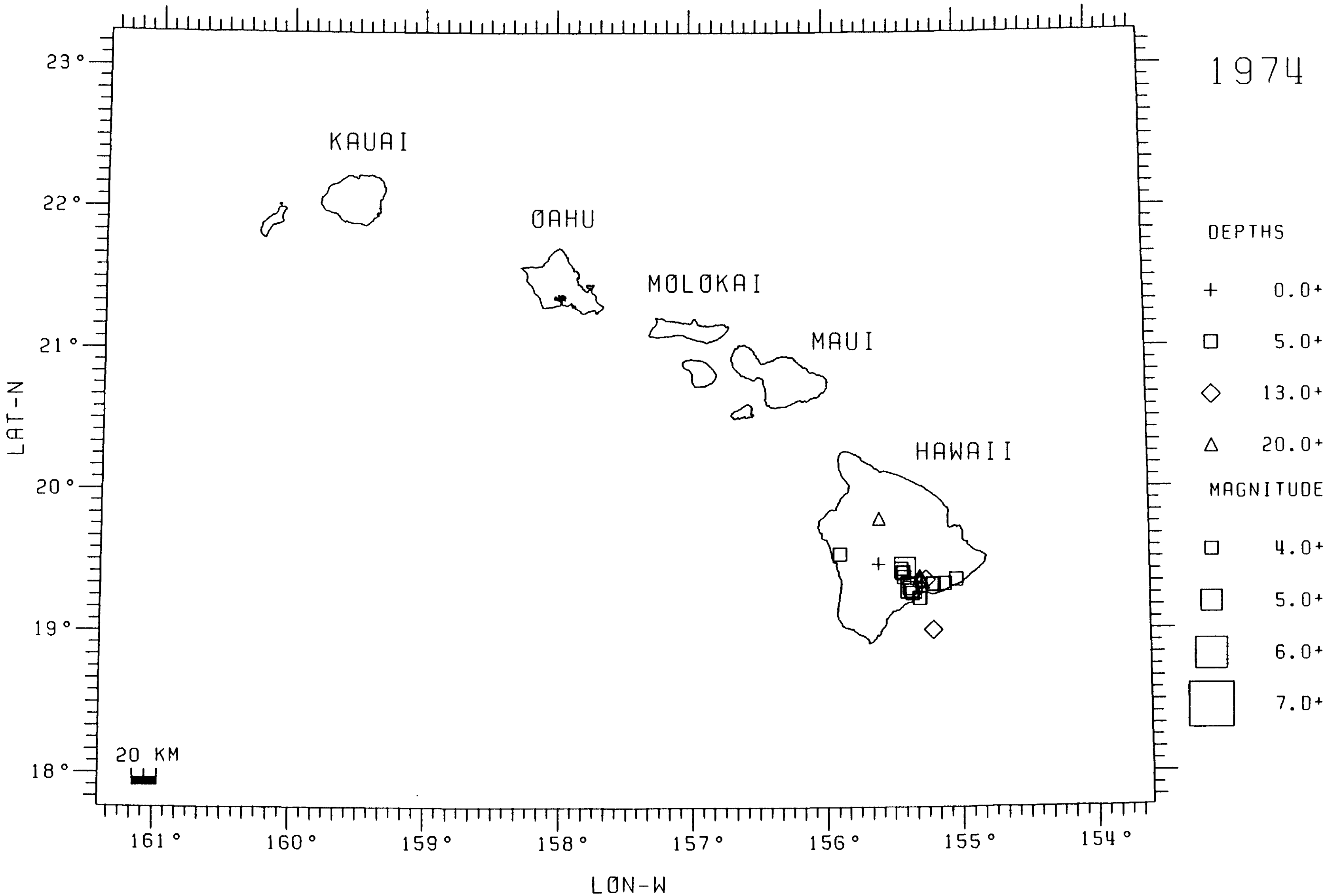
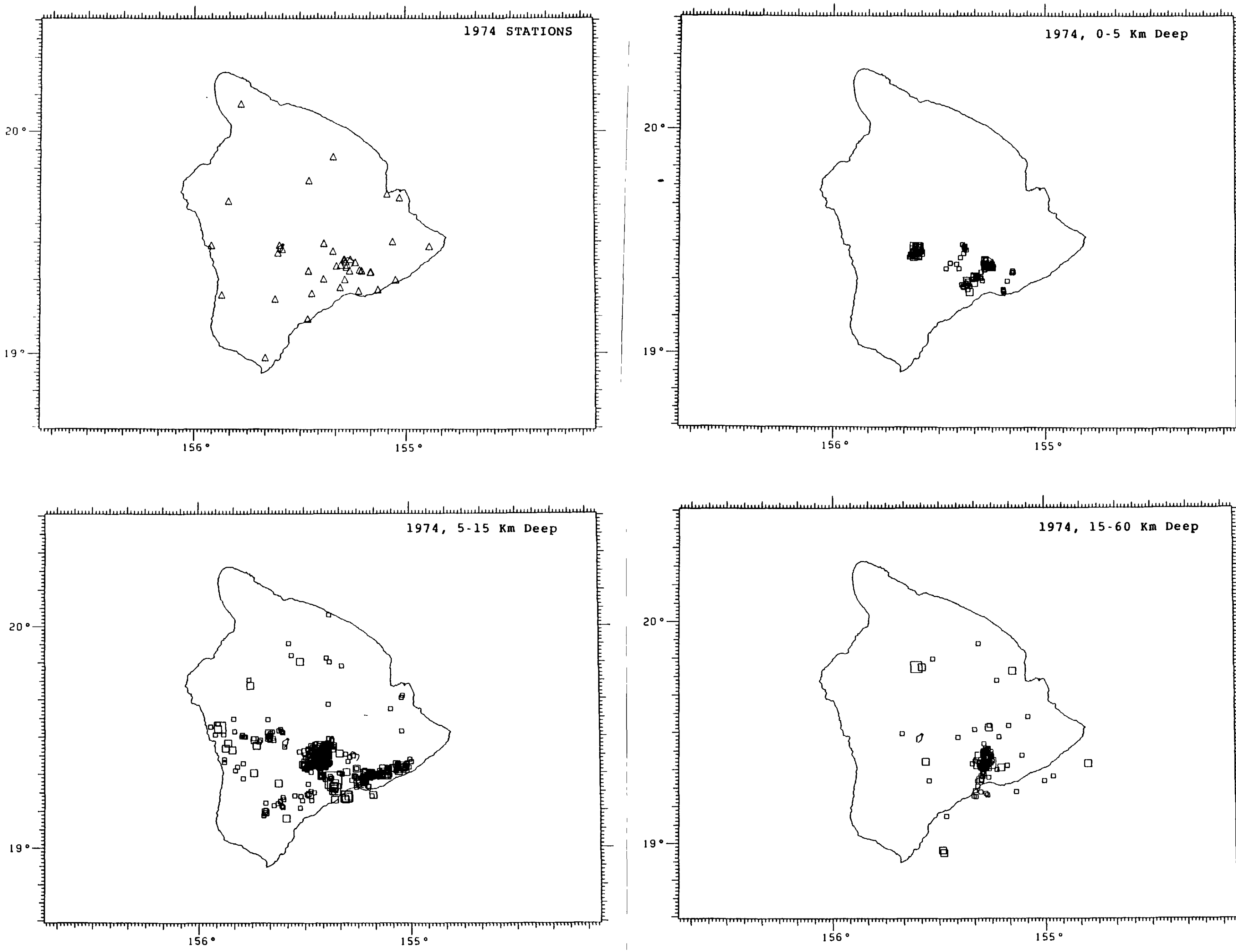

1974
KAUAI
OAHU
MOLOKAI
MAUI
HAWAII
DEPTHS
0.0+
5.0+
13.0+
20.0+
MAGNITUDES
4.0+
5.0+
6.0+
7.0+
20 KM
23°
22°
21°
20°
19°
18°
LAT-N
161°
160°
159°
158°
157°
156°
155°
154°
LON-W

Figure 14b:



1974 STATIONS
1974, 0-5 Km Deep
1974, 5-15 Km Deep
1974, 15-60 Km Deep
20°
19°
156°
155°

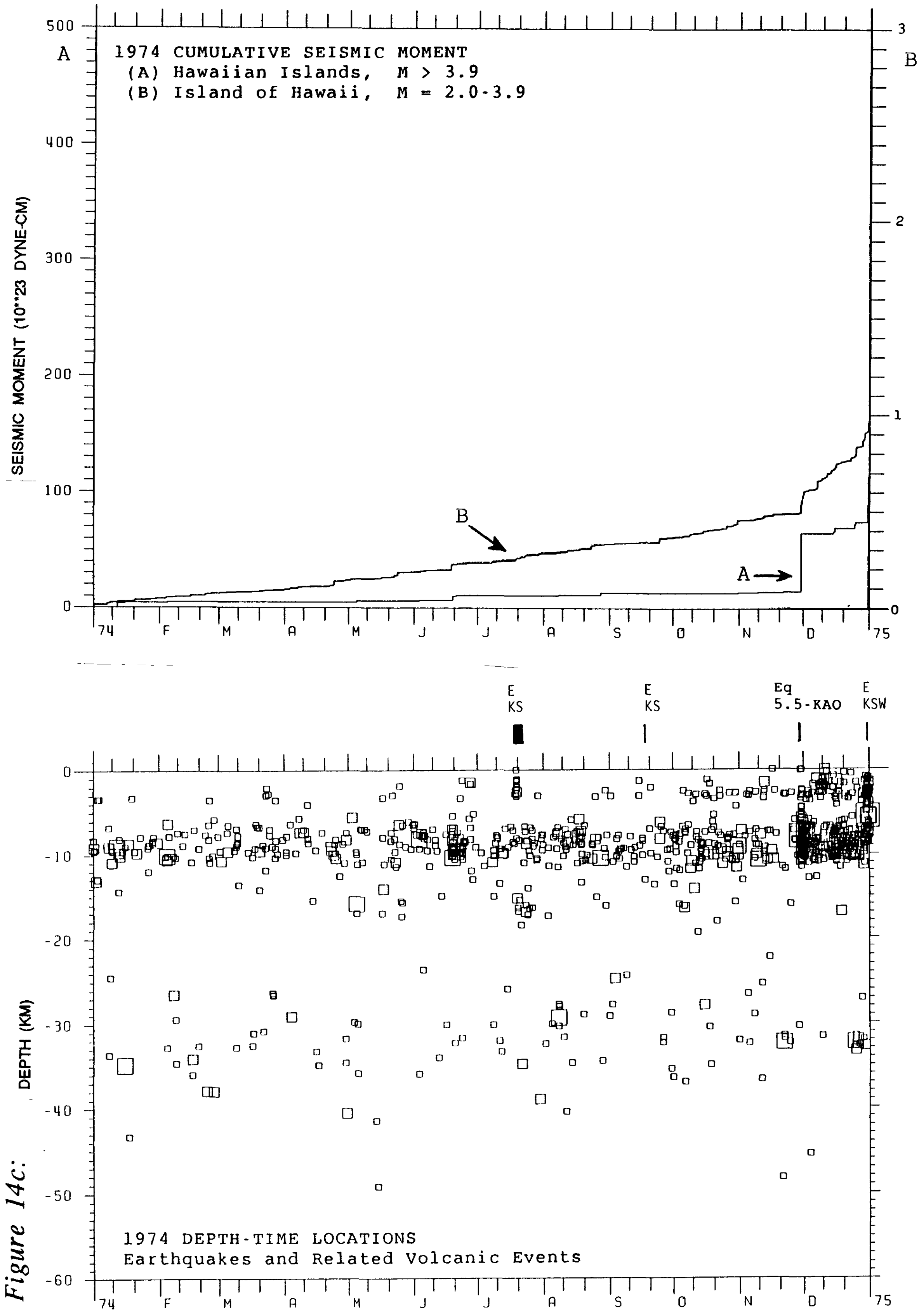

1974 CUMULATIVE SEISMIC MOMENT
(A) Hawaiian Islands, M > 3.9
(B) Island of Hawaii, M = 2.0-3.9
SEISMIC MOMENT (10**23 DYNE-CM)
A
B
500
400
300
200
100
0
3
2
1
0
74
F
M
A
M
J
J
A
S
O
N
D
75
E
KS
E
KS
Eq
5.5-KAO
E
KSW
0
-10
-20
-30
-40
-50
-60
DEPTH (KM)
1974 DEPTH-TIME LOCATIONS
Earthquakes and Related Volcanic Events
TIME
1 J 74. 0 0

Figure 14c:

Figure 15a:

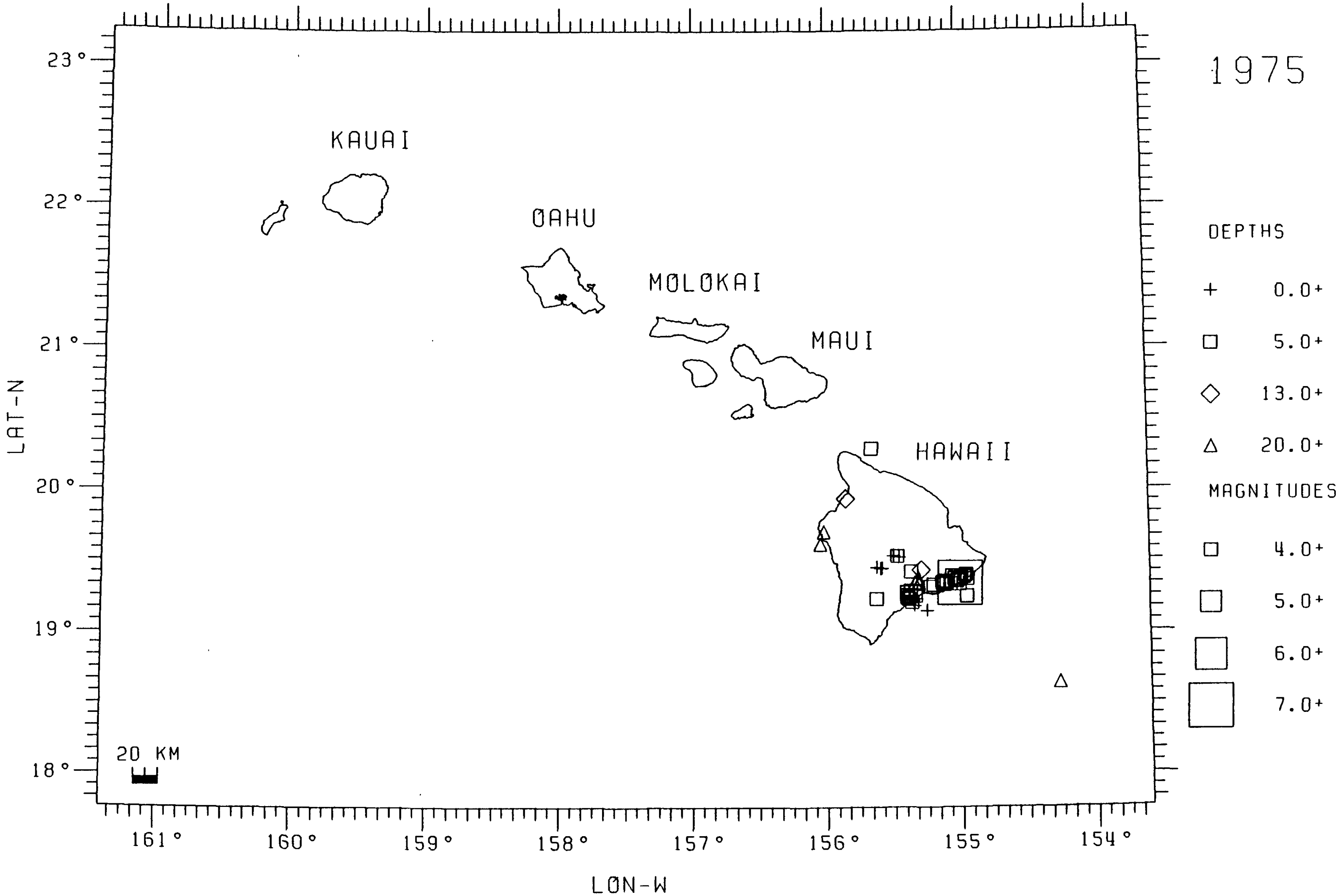
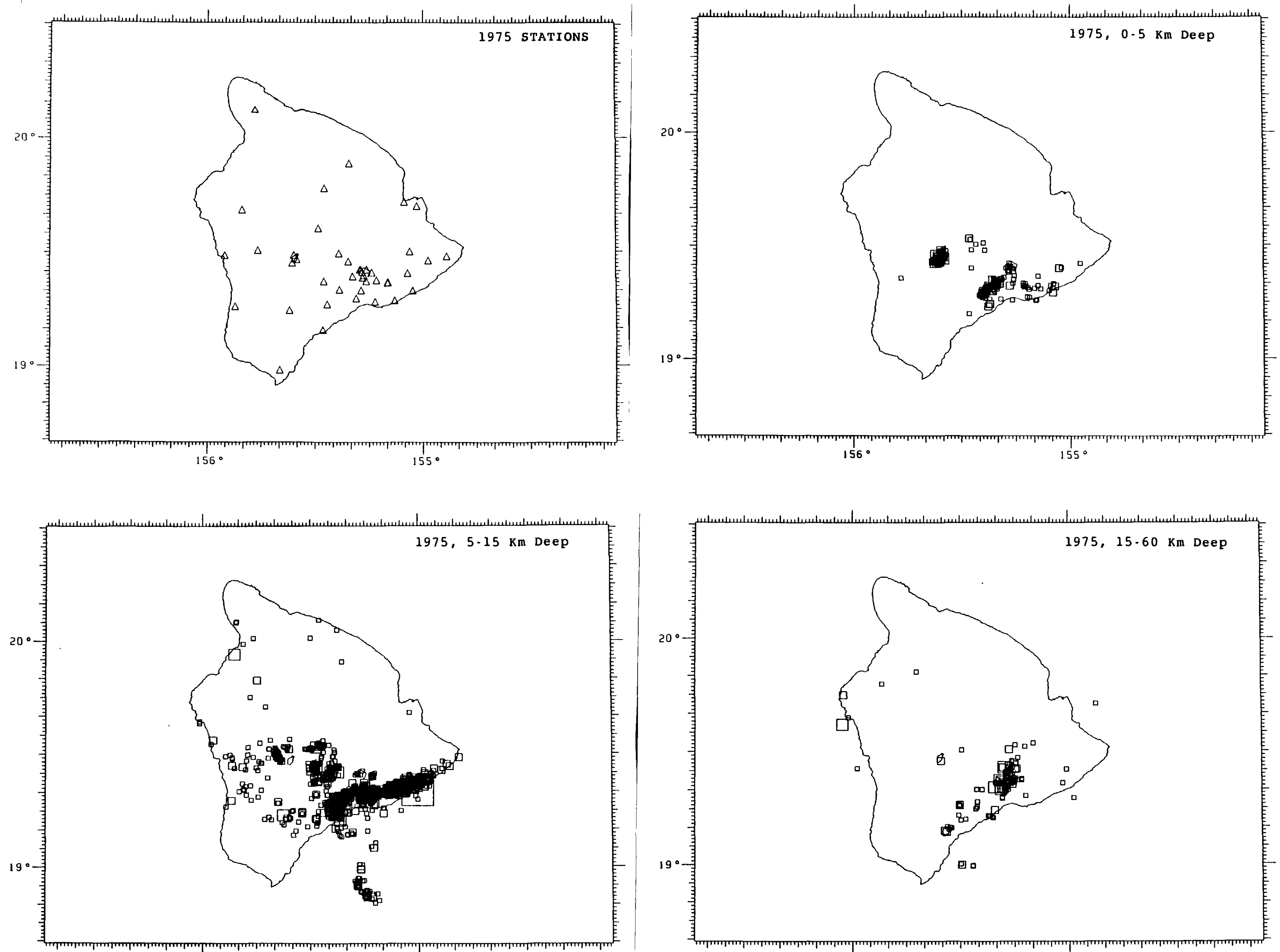
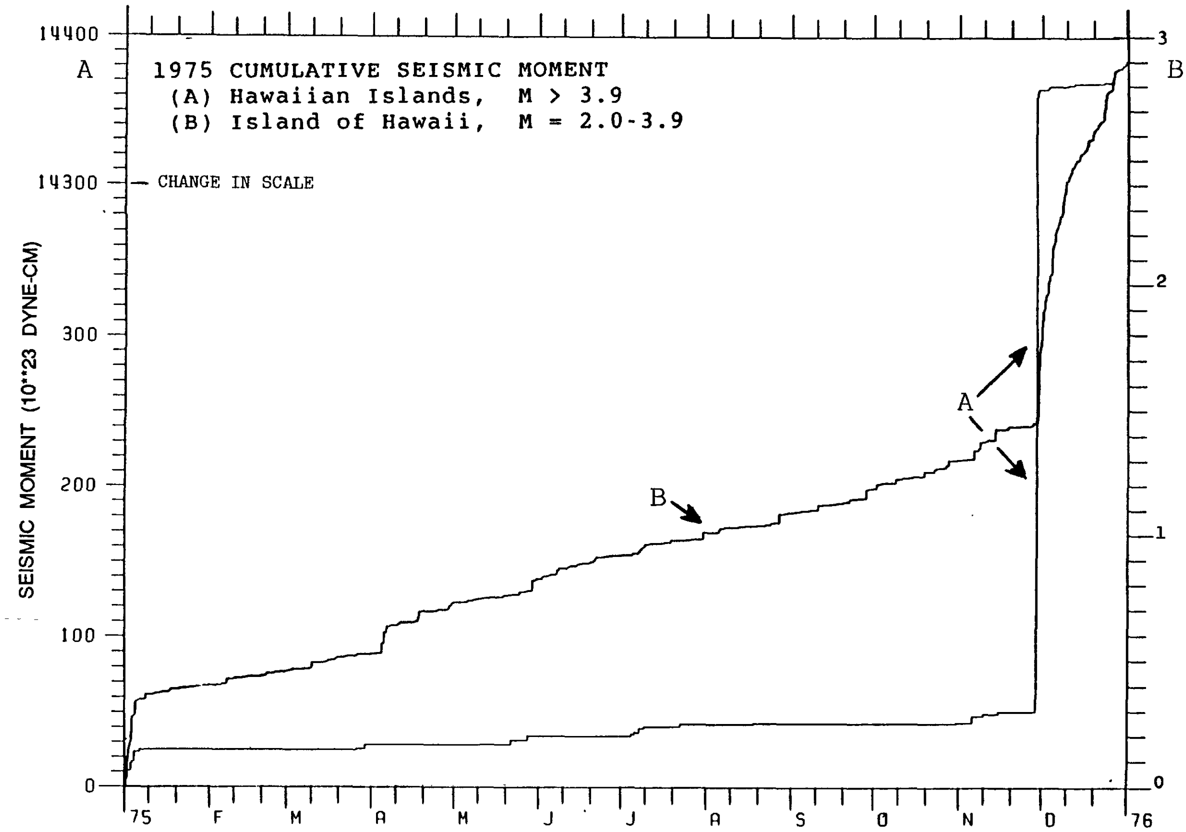

1975
KAUAI
OAHU
MOLOKAI
MAUI
HAWAII
DEPTHS
0.0+
5.0+
13.0+
20.0+
MAGNITUDES
4.0+
5.0+
6.0+
7.0+
20 KM
23°
22°
21°
20°
19°
18°
LAT-N
161°
160°
159°
158°
157°
156°
155°
154°
LON-W

Figure 15b:


1975 STATIONS
1975, 0-5 Km Deep
1975, 5-15 Km Deep
1975, 15-60 Km Deep
20°
19°
156°
155°


1975 CUMULATIVE SEISMIC MOMENT
(A) Hawaiian Islands, M > 3.9
(B) Island of Hawaii, M = 2.0-3.9
CHANGE IN SCALE
SEISMIC MOMENT (10**23 DYNE-CM)
14400
14300
300
200
100
0
A
B
3
2
1
0
75
F
M
A
M
J
J
A
S
O
N
D
76

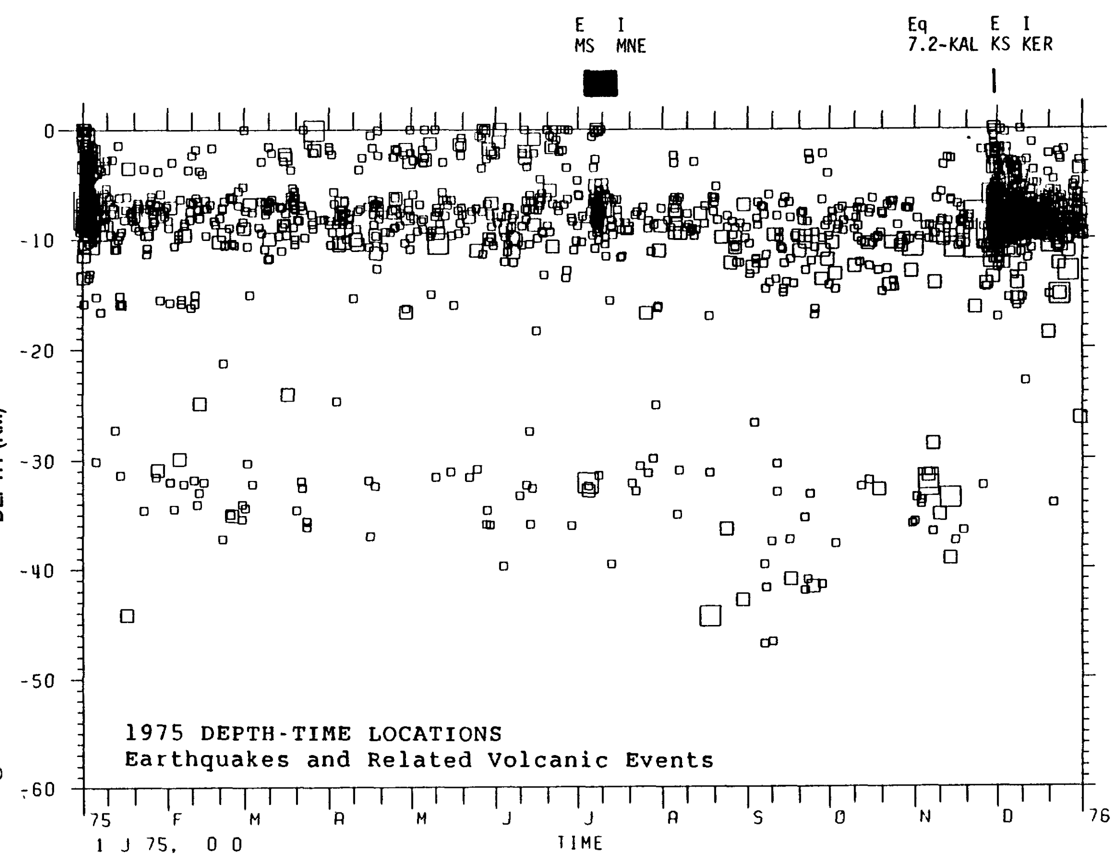

E I
MS MNE
Eq
7.2-KAL
E I
KS KER
0
-10
-20
-30
-40
-50
-60
DEPTH (KM)
1975 DEPTH-TIME LOCATIONS
Earthquakes and Related Volcanic Events
75
F
M
A
M
J
J
A
S
O
N
D
76
1 J 75, 0 0
TIME

Figure 15c:

Figure 16a:

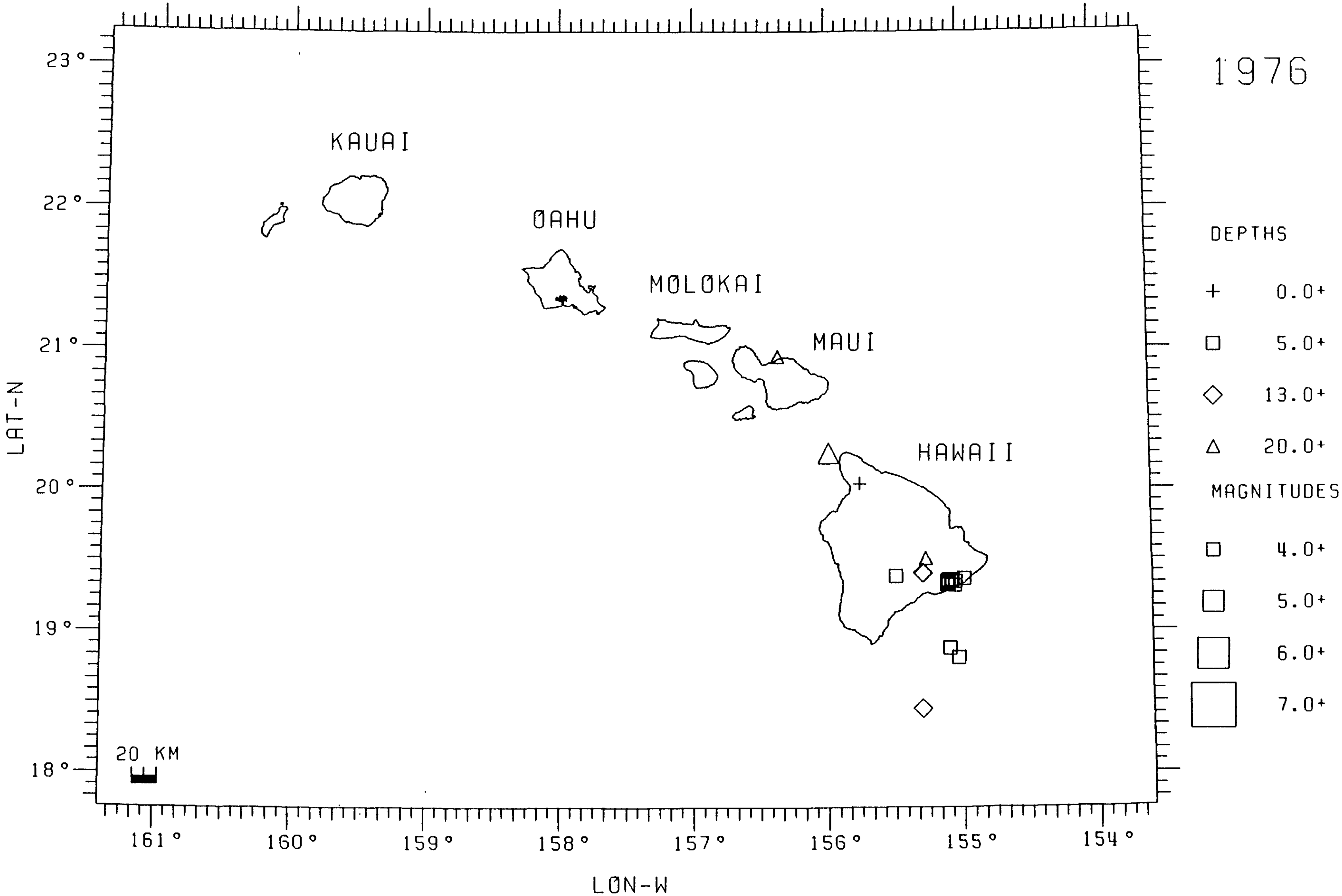
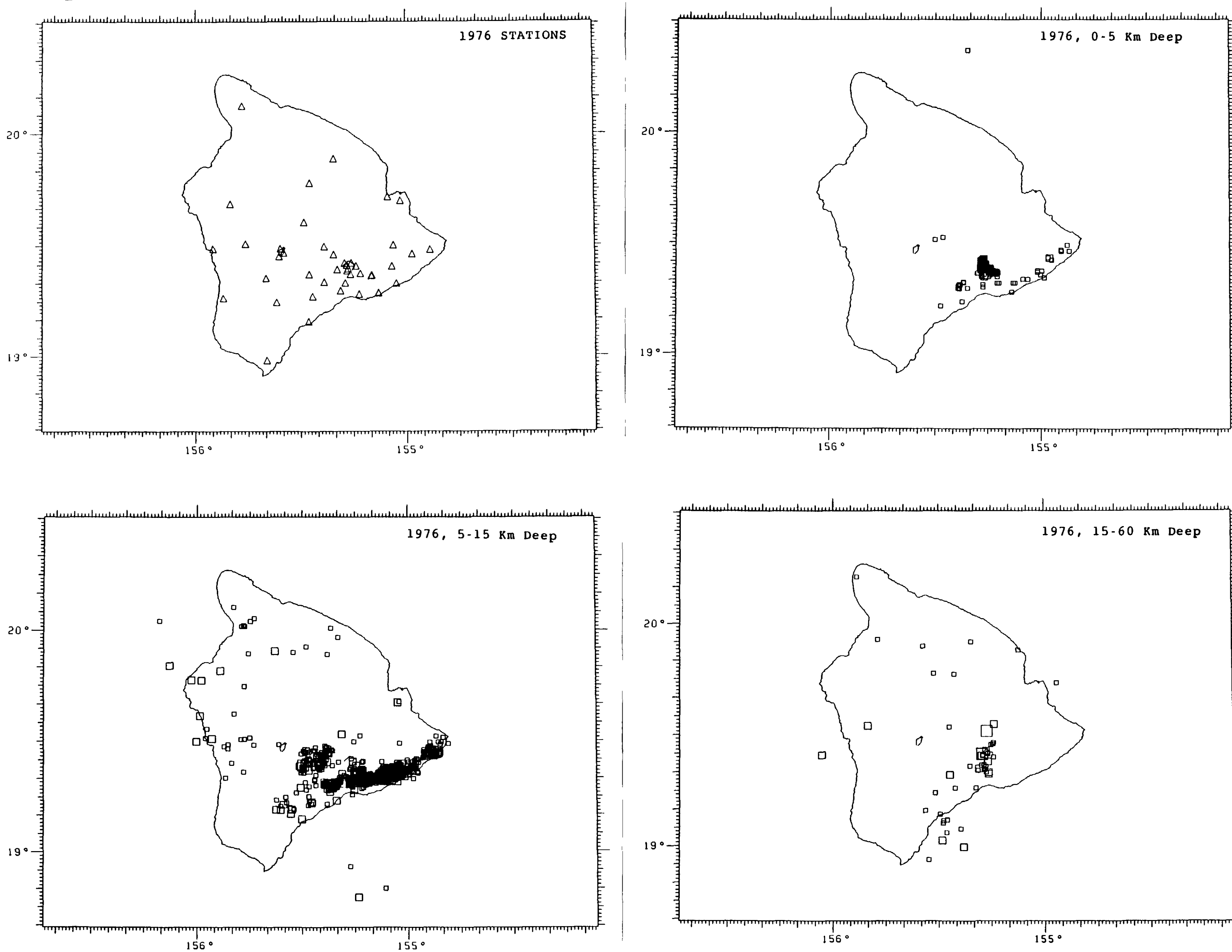
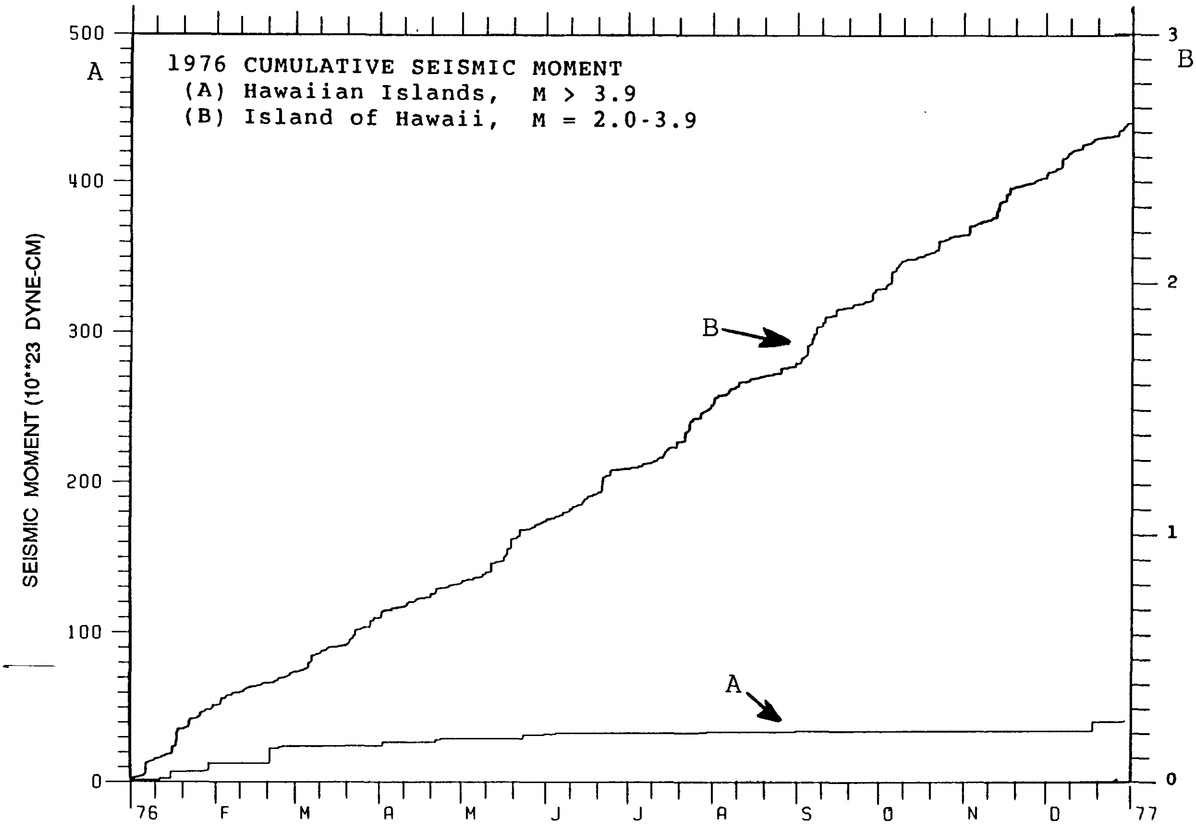

1976
KAUAI
OAHU
MOLOKAI
MAUI
HAWAII
DEPTHS
0.0+
5.0+
13.0+
20.0+
MAGNITUDES
4.0+
5.0+
6.0+
7.0+
20 KM
23°
22°
21°
20°
19°
18°
LAT-N
161°
160°
159°
158°
157°
156°
155°
154°
LON-W

Figure 16b:


1976 STATIONS
1976, 0-5 Km Deep
1976, 5-15 Km Deep
1976, 15-60 Km Deep
20°
19°
156°
155°


1976 CUMULATIVE SEISMIC MOMENT
(A) Hawaiian Islands, M > 3.9
(B) Island of Hawaii, M = 2.0-3.9
SEISMIC MOMENT (10**23 DYNE-CM)
A
B
500
400
300
200
100
0
3
2
1
0
76
F
M
A
M
J
J
A
S
O
N
D
77

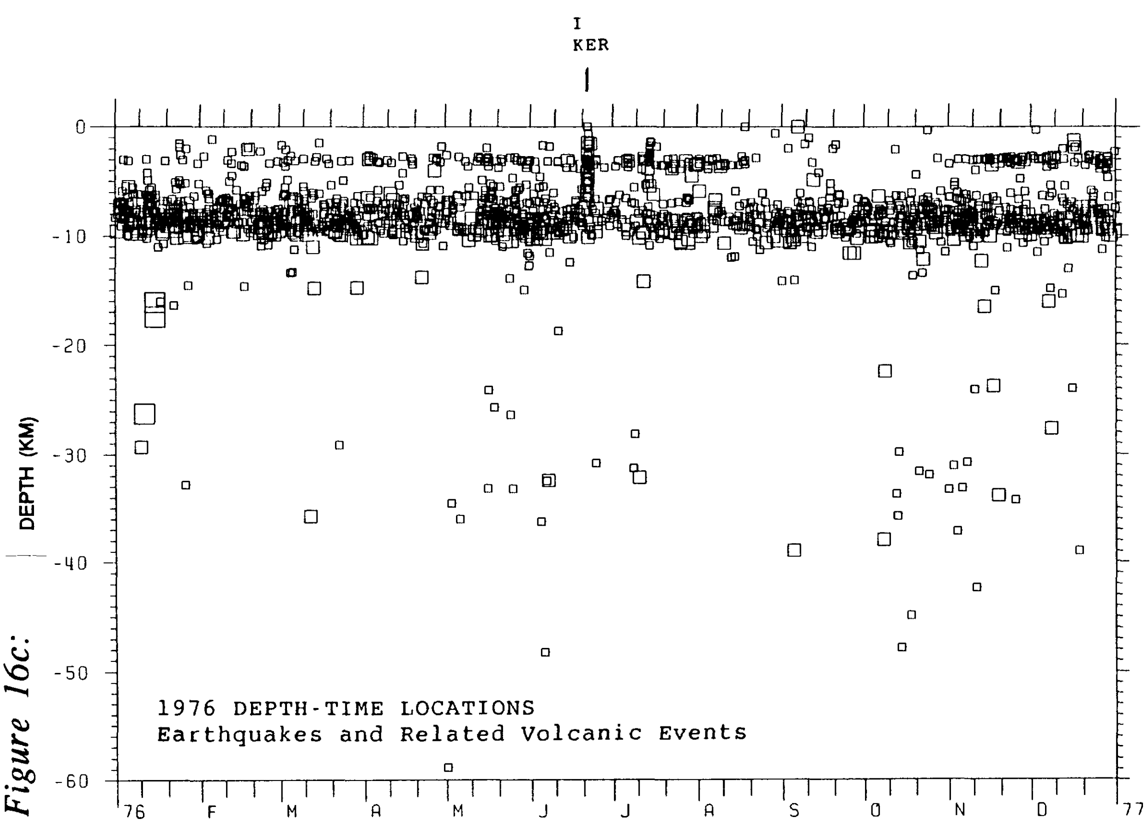

KER
1976 DEPTH-TIME LOCATIONS
Earthquakes and Related Volcanic Events
DEPTH (KM)
0
-10
-20
-30
-40
-50
-60
76
F
M
A
M
J
J
A
S
O
N
D
77
1 J 76, 0 0
TIME

Figure 16c:

Figure 17a:

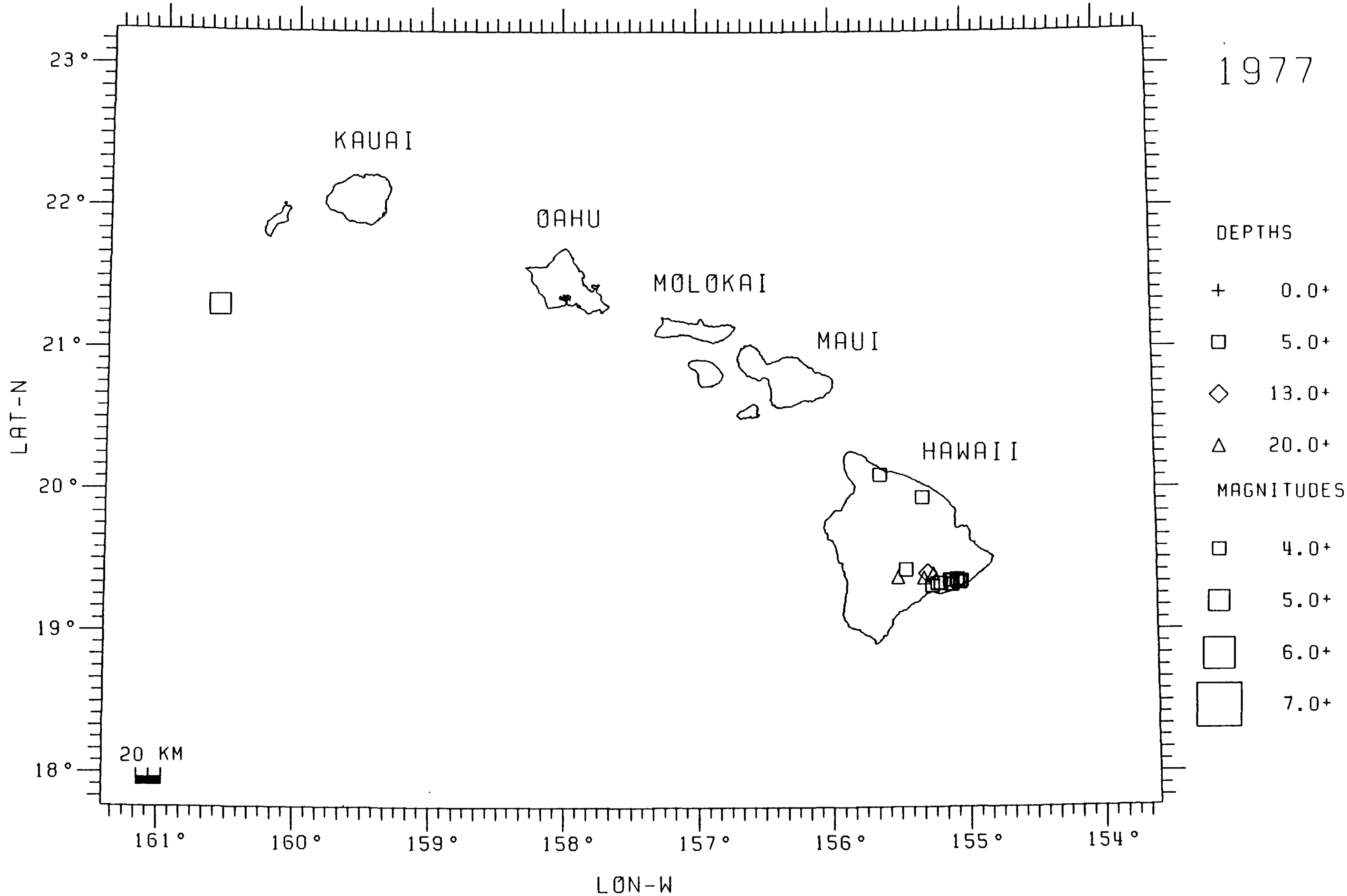
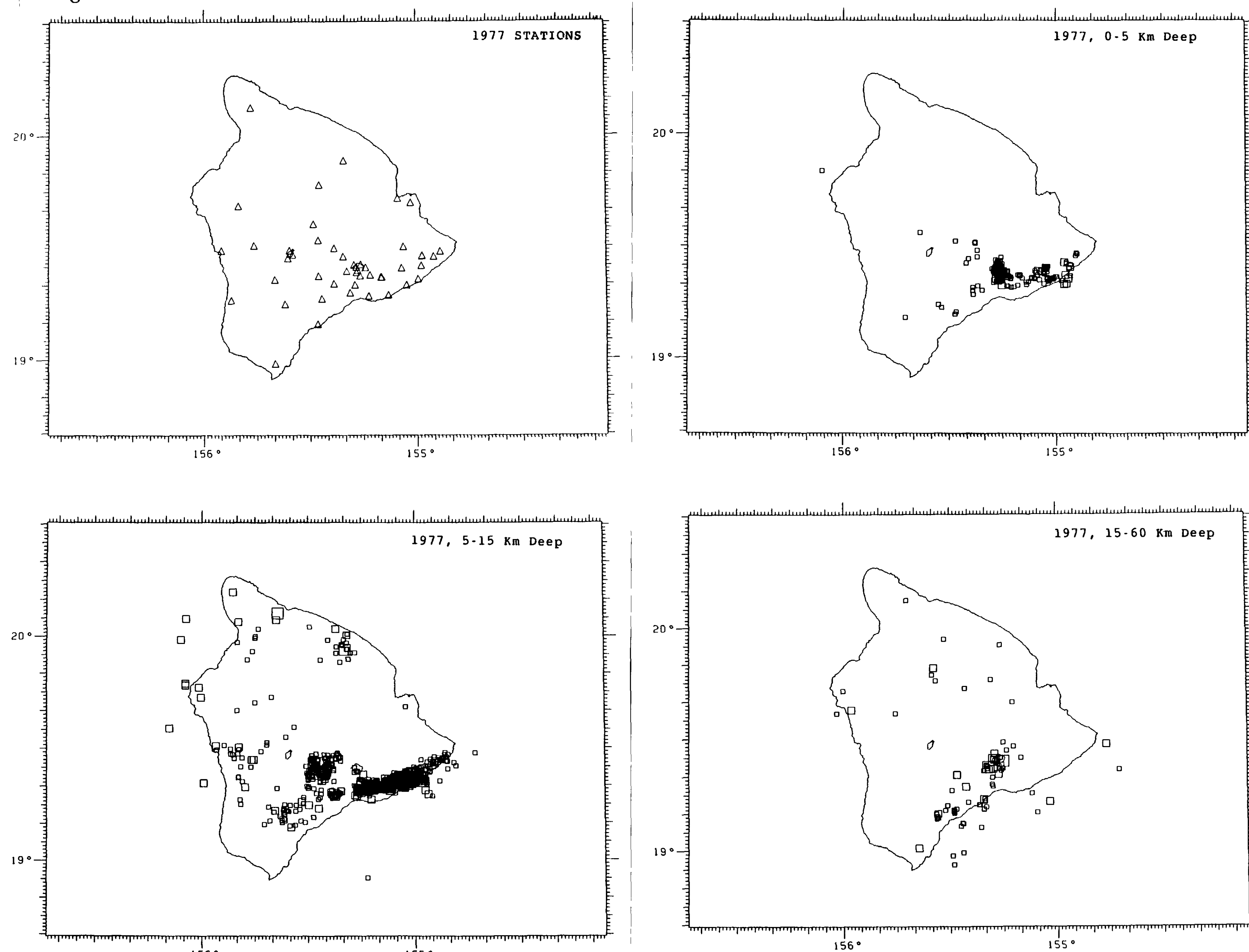

1977
KAUAI
ØAHU
MØLØKAI
MAUI
HAWAII
23°
22°
21°
20°
19°
18°
LAT-N
161°
160°
159°
158°
157°
156°
155°
154°
LØN-W
20 KM
DEPTHS
0.0+
5.0+
13.0+
20.0+
MAGNITUDES
4.0+
5.0+
6.0+
7.0+

Figure 17b:


1977 STATIONS
1977, 0-5 Km Deep
1977, 5-15 Km Deep
1977, 15-60 Km Deep
20°
19°
156°
155°

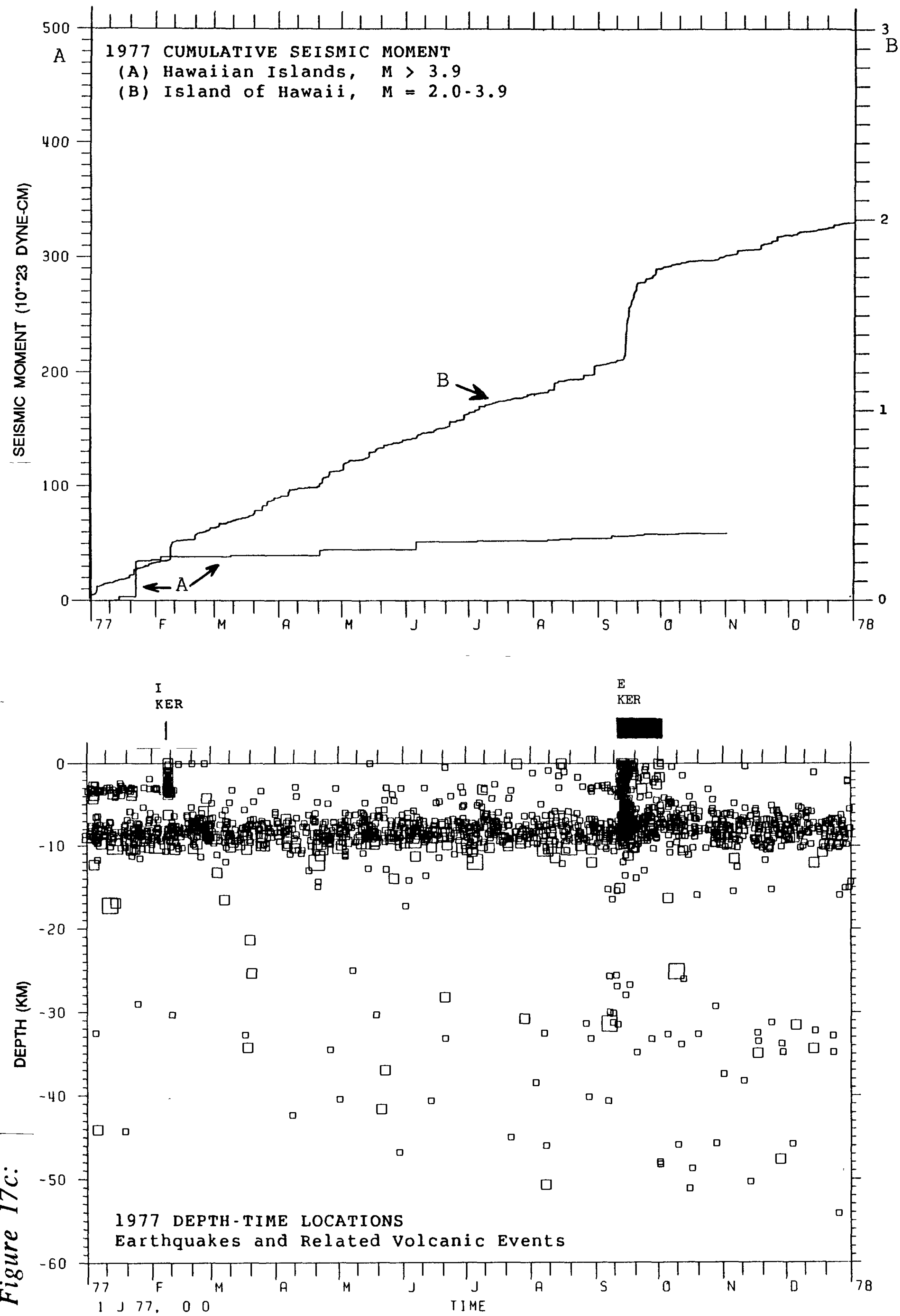
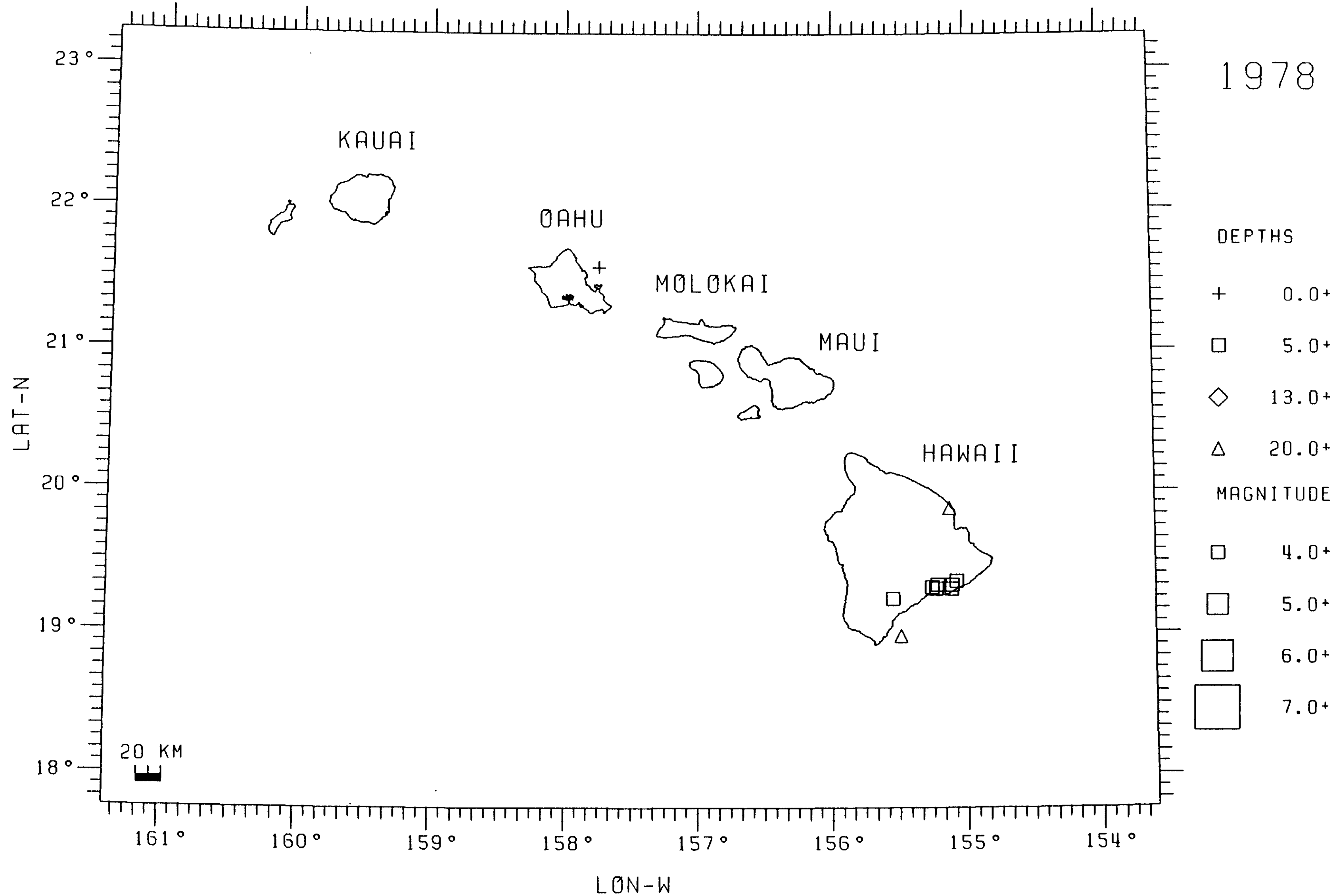

1977 CUMULATIVE SEISMIC MOMENT
(A) Hawaiian Islands, M > 3.9
(B) Island of Hawaii, M = 2.0-3.9
SEISMIC MOMENT (10**23 DYNE-CM)
500
400
300
200
100
0
A
B
3
2
1
0
77
F
M
A
M
J
J
A
S
O
N
D
78
I
KER
E
KER
DEPTH (KM)
0
-10
-20
-30
-40
-50
-60
1977 DEPTH-TIME LOCATIONS
Earthquakes and Related Volcanic Events
1 J 77, 0 0
TIME

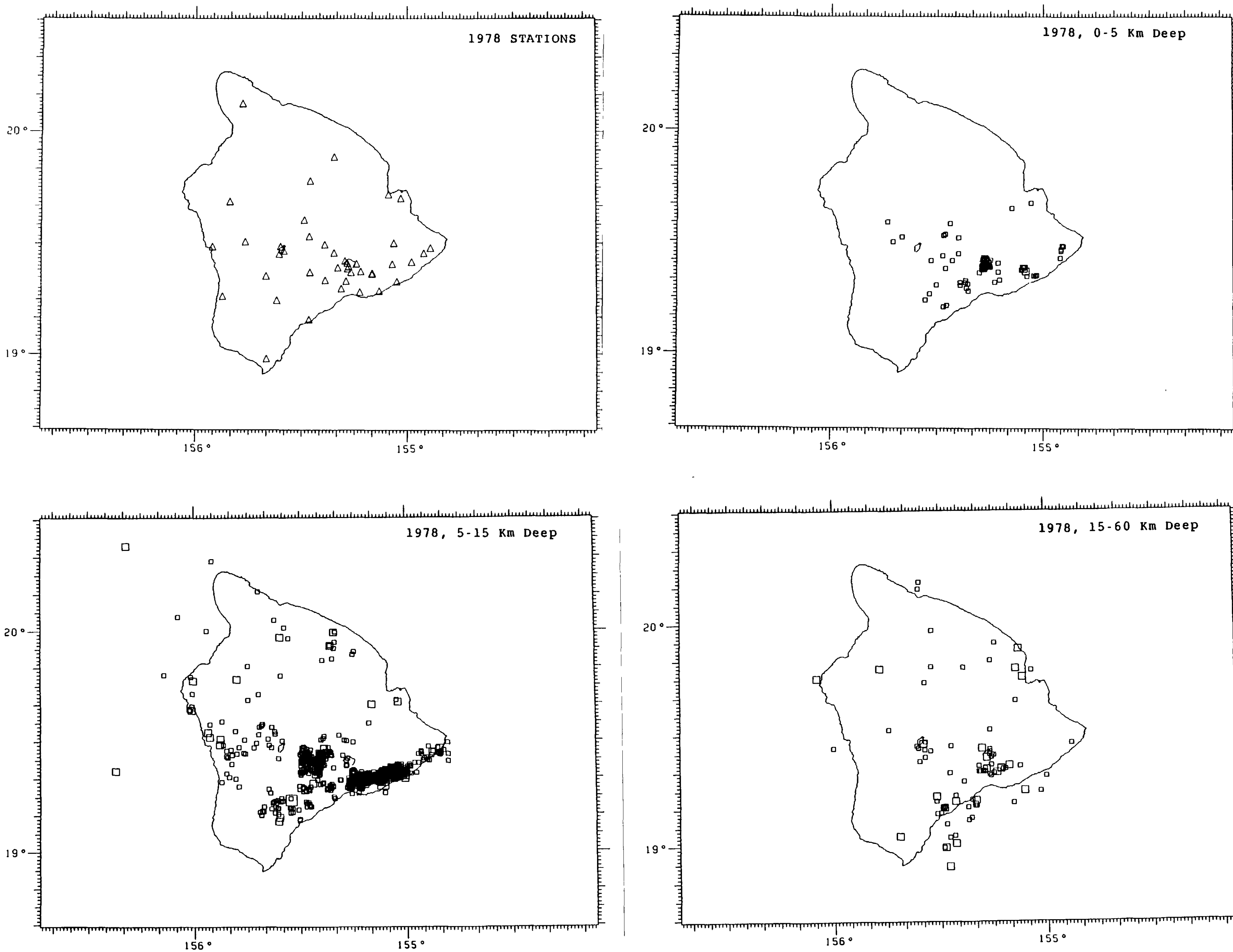
Figure 17c:

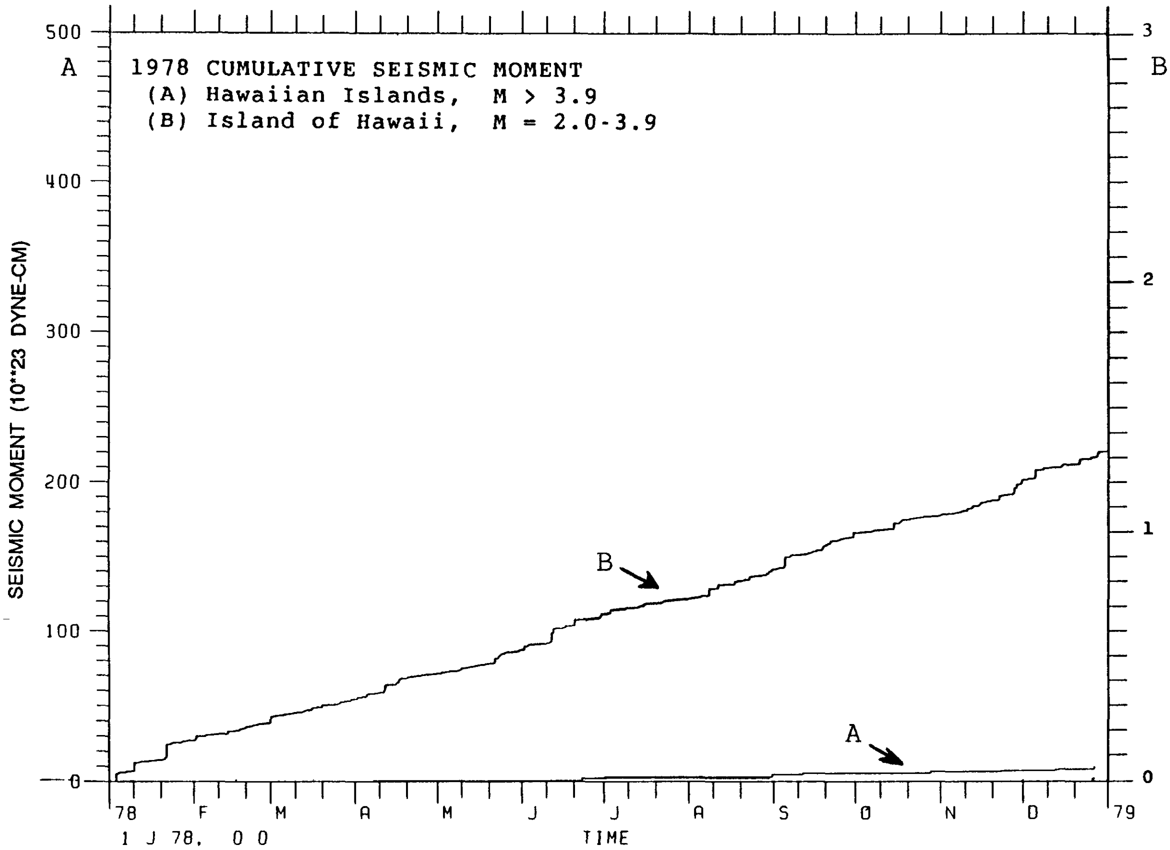
Figure 18a:



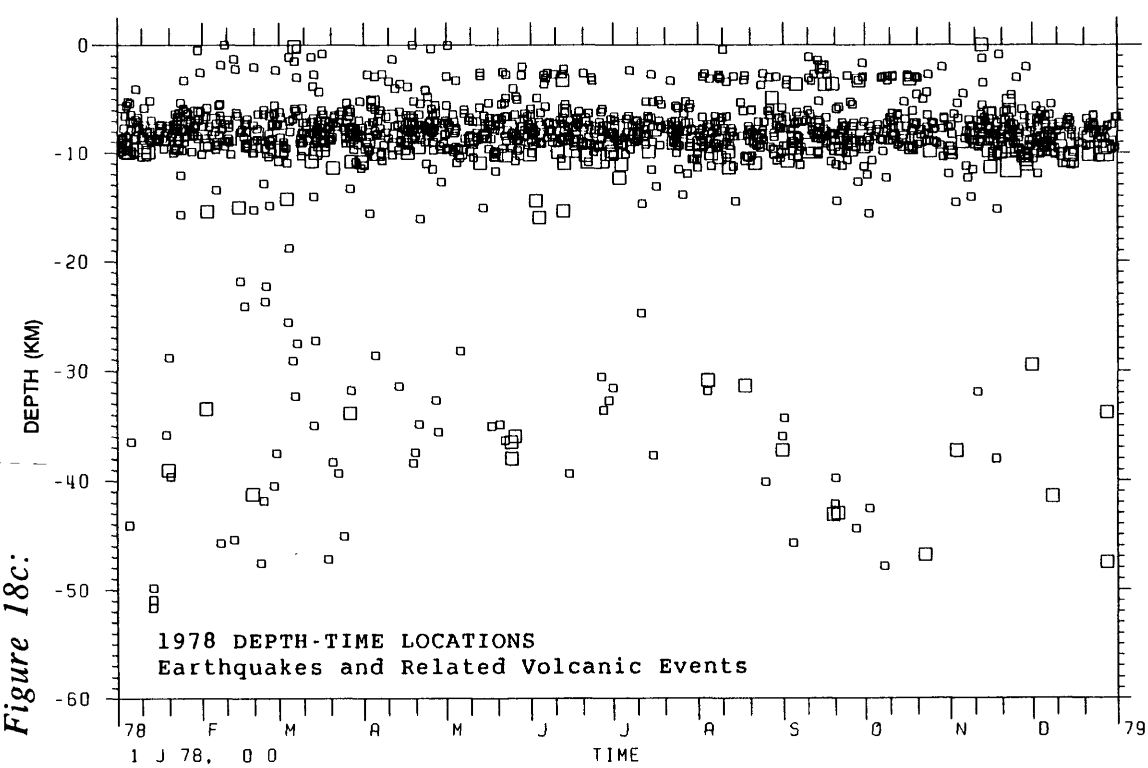
1978
KAUAI
OAHU
MOLOKAI
MAUI
HAWAII
DEPTHS
0.0+
5.0+
13.0+
20.0+
MAGNITUDES
4.0+
5.0+
6.0+
7.0+
LAT-N
23°
22°
21°
20°
19°
18°
20 KM
161°
160°
159°
158°
157°
156°
155°
154°
LON-W

Figure 18b:


1978 STATIONS
1978, 0-5 Km Deep
1978, 5-15 Km Deep
1978, 15-60 Km Deep
20°
19°
156°
155°



500
400
300
200
100
0
A
SEISMIC MOMENT (10**23 DYNE-CM)
1978 CUMULATIVE SEISMIC MOMENT
(A) Hawaiian Islands, M > 3.9
(B) Island of Hawaii, M = 2.0-3.9
B
A
3
2
1
0
78 F M A M J J A S O N D 79
1 J 78, 0 0
TIME



0
-10
-20
-30
-40
-50
-60
DEPTH (KM)
1978 DEPTH-TIME LOCATIONS
Earthquakes and Related Volcanic Events
78 F M A M J J A S O N D 79
1 J 78, 0 0
TIME

Figure 18c:

Figure 19a:

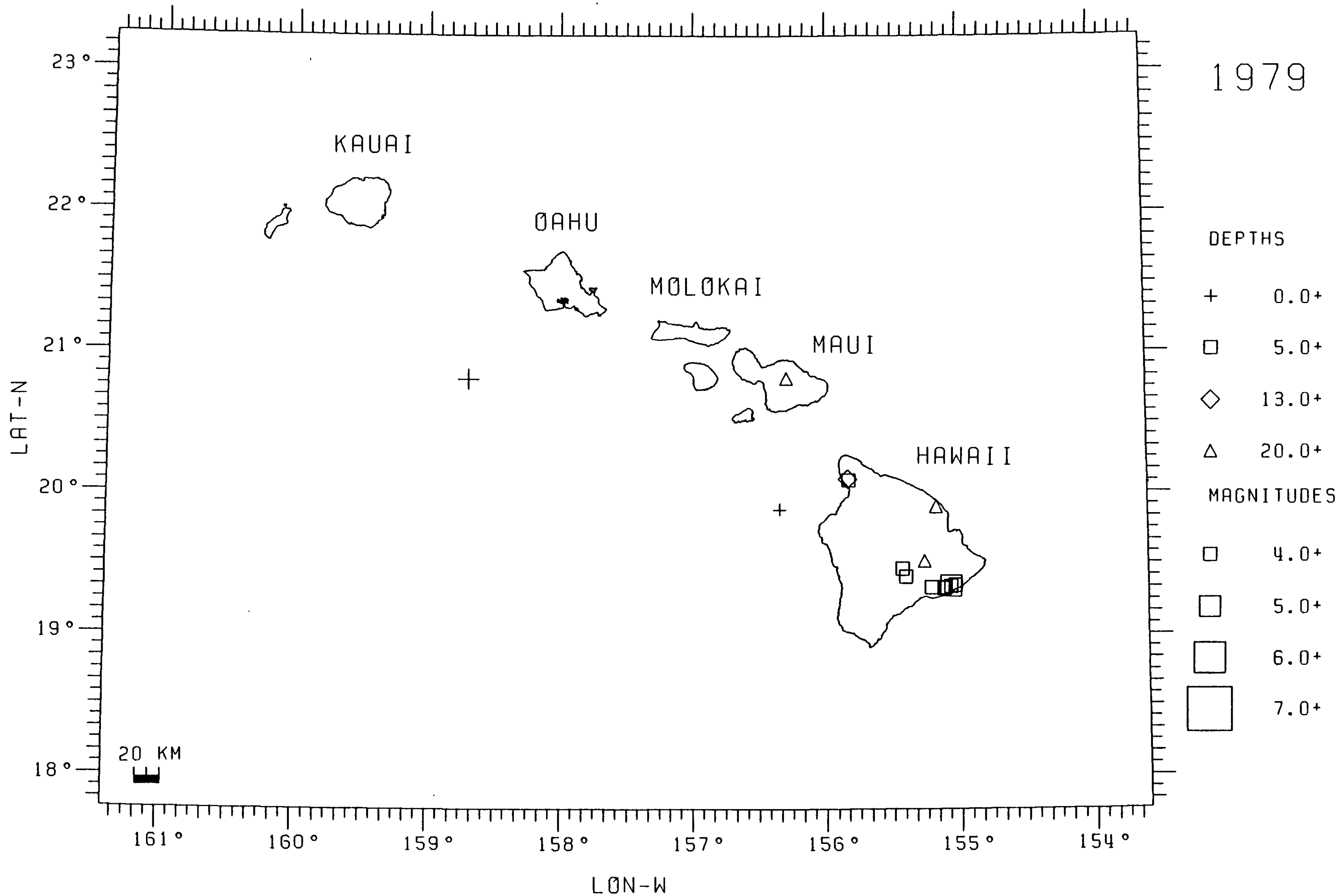
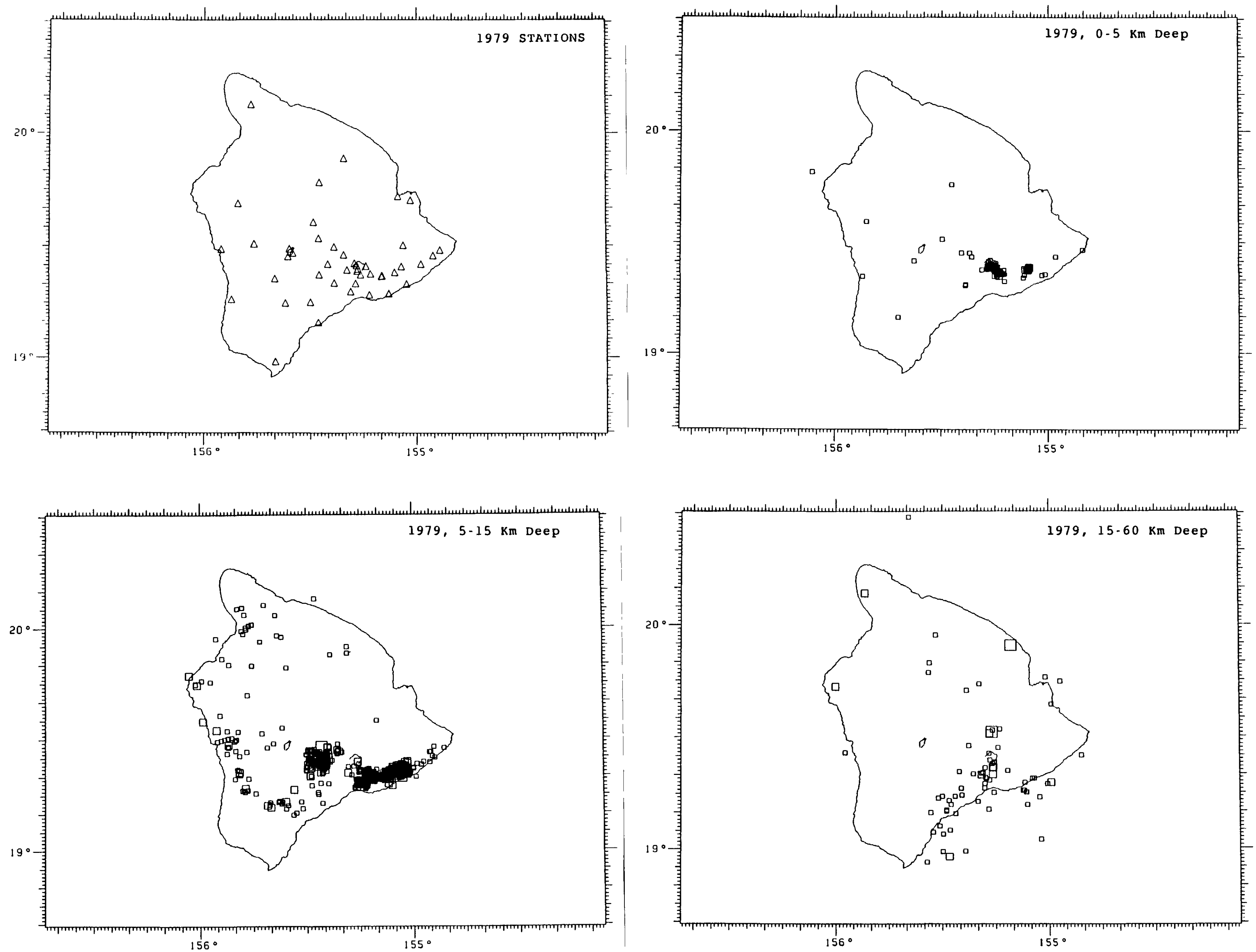
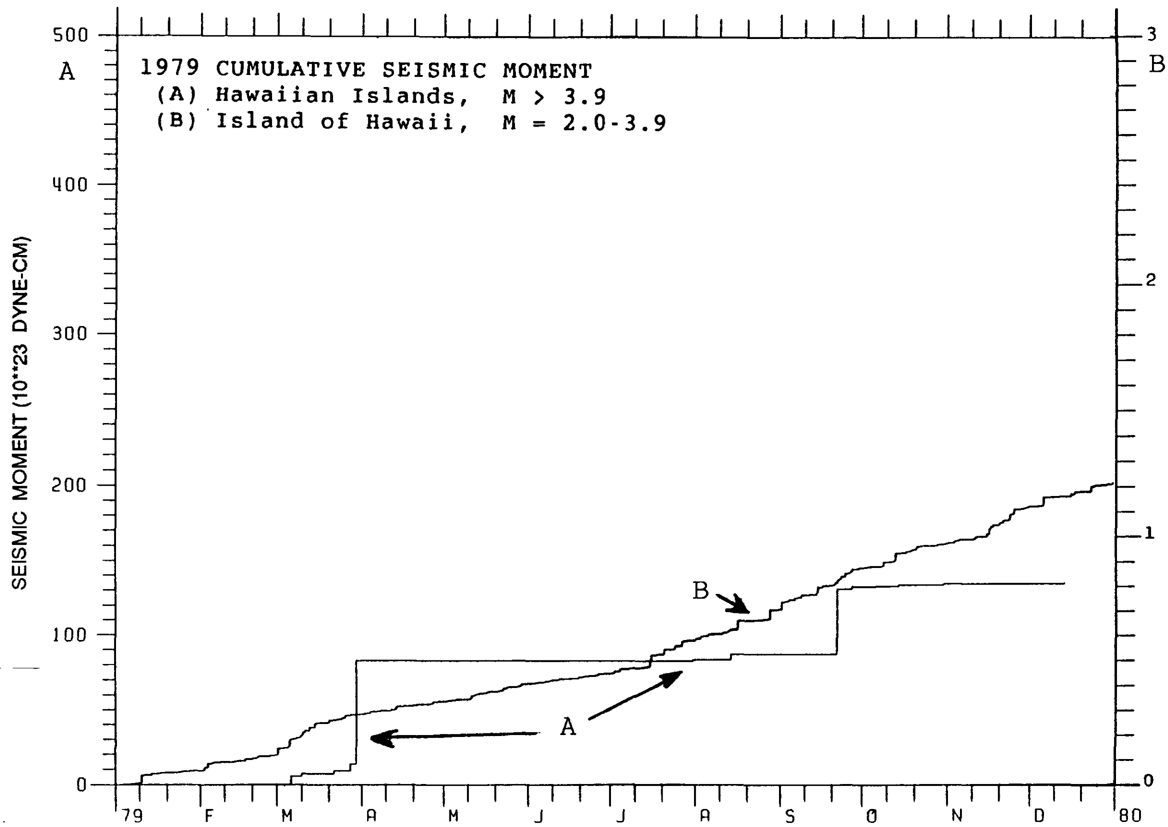

1979
KAUAI
OAHU
MOLOKAI
MAUI
HAWAII
DEPTHS
0.0+
5.0+
13.0+
20.0+
MAGNITUDES
4.0+
5.0+
6.0+
7.0+
20 KM
23°
22°
21°
20°
19°
18°
LAT-N
161°
160°
159°
158°
157°
156°
155°
154°
LON-W

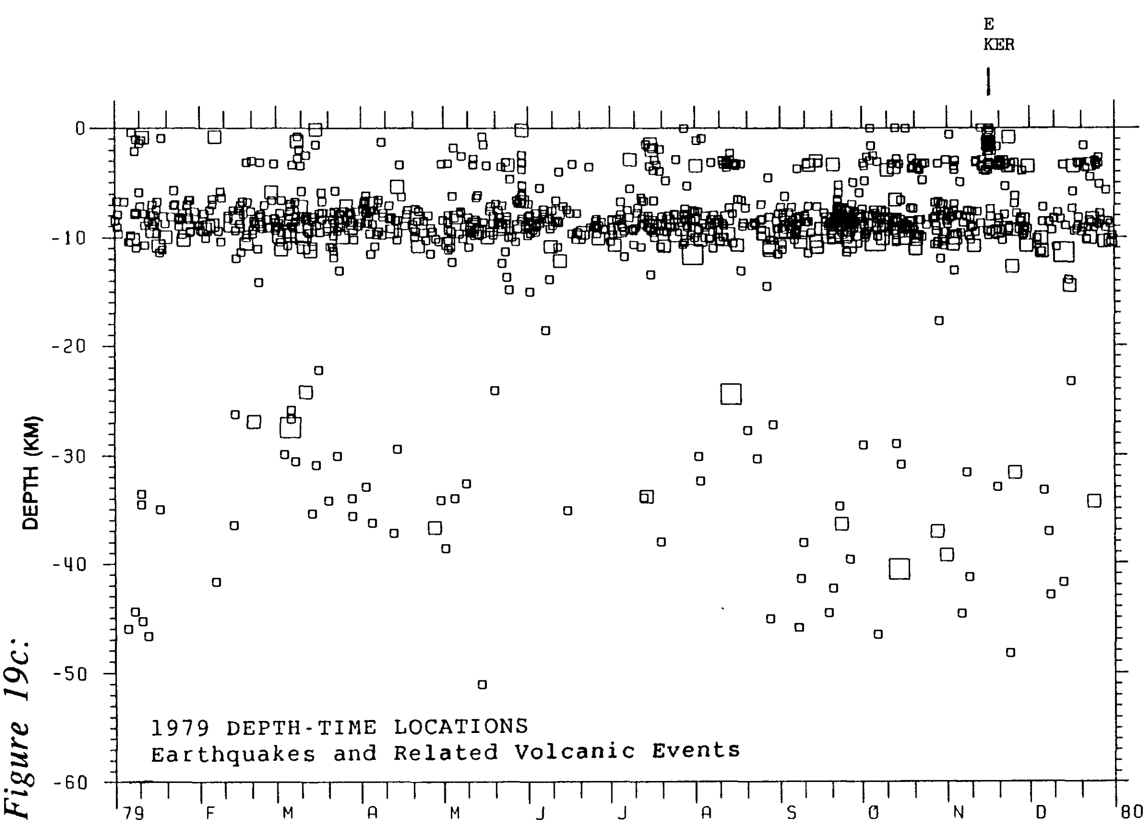
Figure 19b:



1979 STATIONS
1979, 0-5 Km Deep
1979, 5-15 Km Deep
1979, 15-60 Km Deep
20°
19°
156°
155°



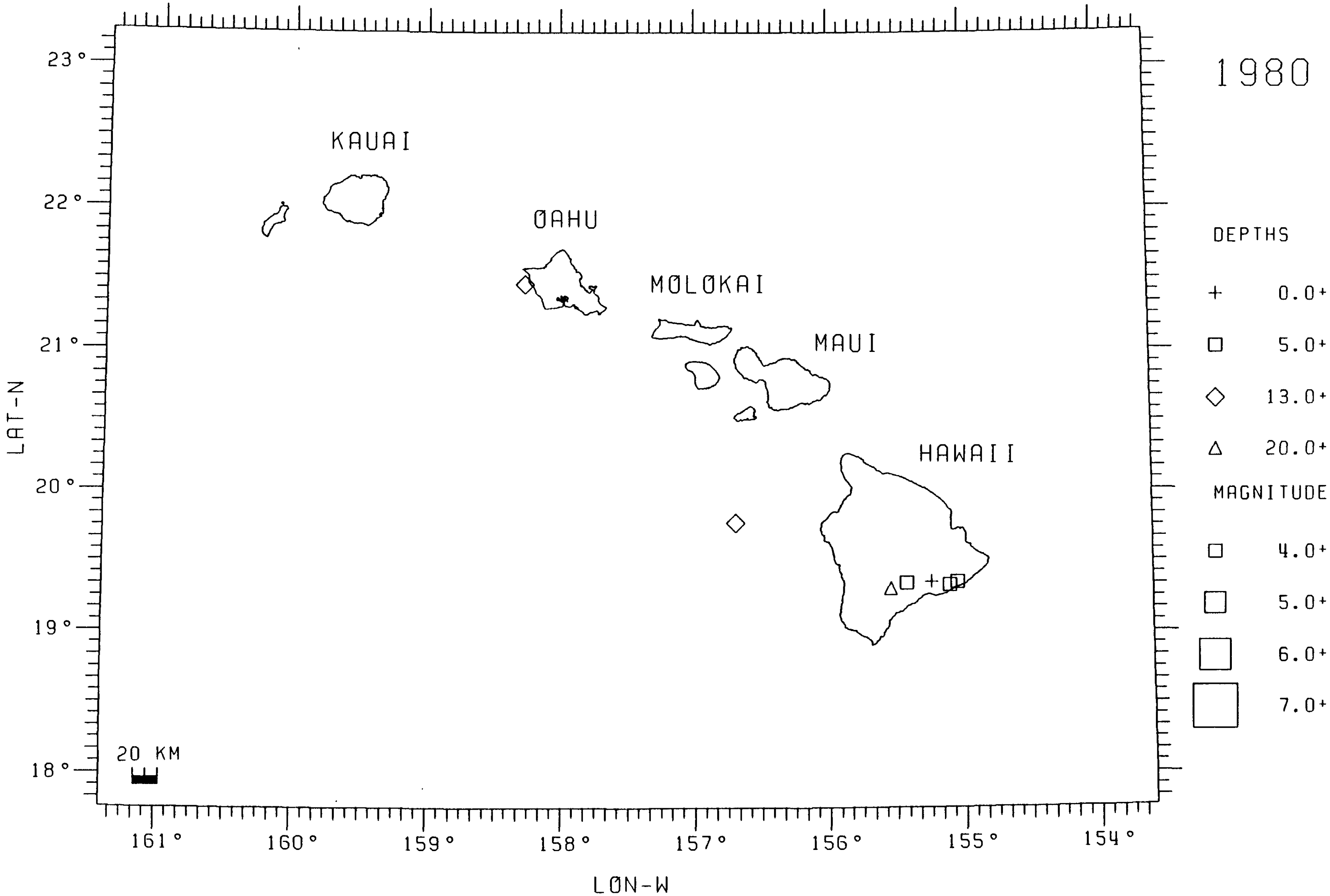
A
B
1979 CUMULATIVE SEISMIC MOMENT
(A) Hawaiian Islands, M > 3.9
(B) Island of Hawaii, M = 2.0-3.9
SEISMIC MOMENT (10**23 DYNE-CM)
500
400
300
200
100
0
3
2
1
0
B
A
79
F
M
A
M
J
J
A
S
O
N
D
80



E
KER
DEPTH (KM)
0
-10
-20
-30
-40
-50
-60
1979 DEPTH-TIME LOCATIONS
Earthquakes and Related Volcanic Events
79
F
M
A
M
J
J
A
S
O
N
D
80
1 J 79, 0 0
TIME

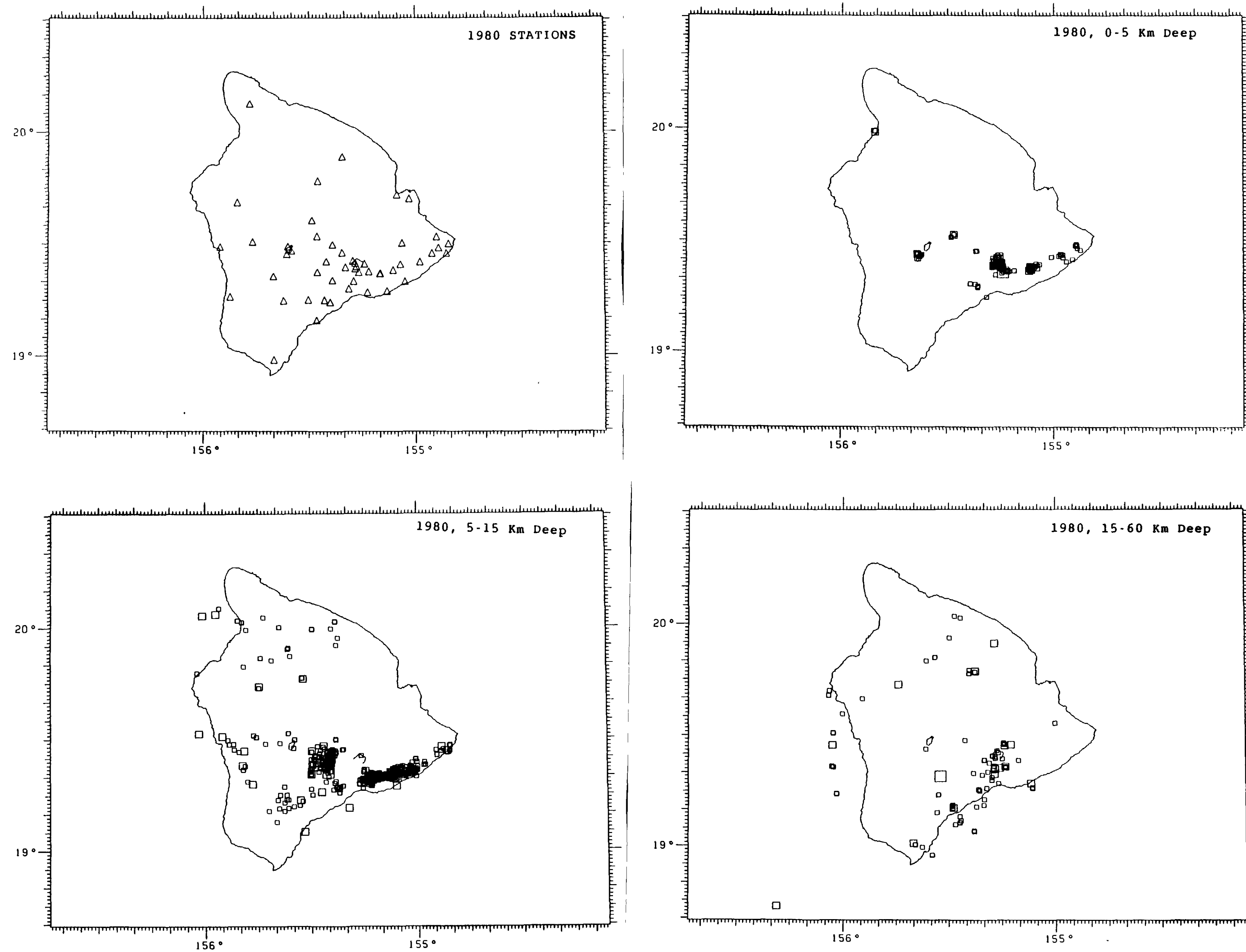
Figure 19c:

Figure 20a:



1980
KAUAI
OAHU
MOLOKAI
MAUI
HAWAII
23°
22°
21°
20°
19°
18°
LAT-N
161°
160°
159°
158°
157°
156°
155°
154°
LON-W
20 KM
DEPTHS
0.0+
5.0+
13.0+
20.0+
MAGNITUDES
4.0+
5.0+
6.0+
7.0+

Figure 20b:



1980 STATIONS
1980, 0-5 Km Deep
1980, 5-15 Km Deep
1980, 15-60 Km Deep
20°
19°
156°
155°

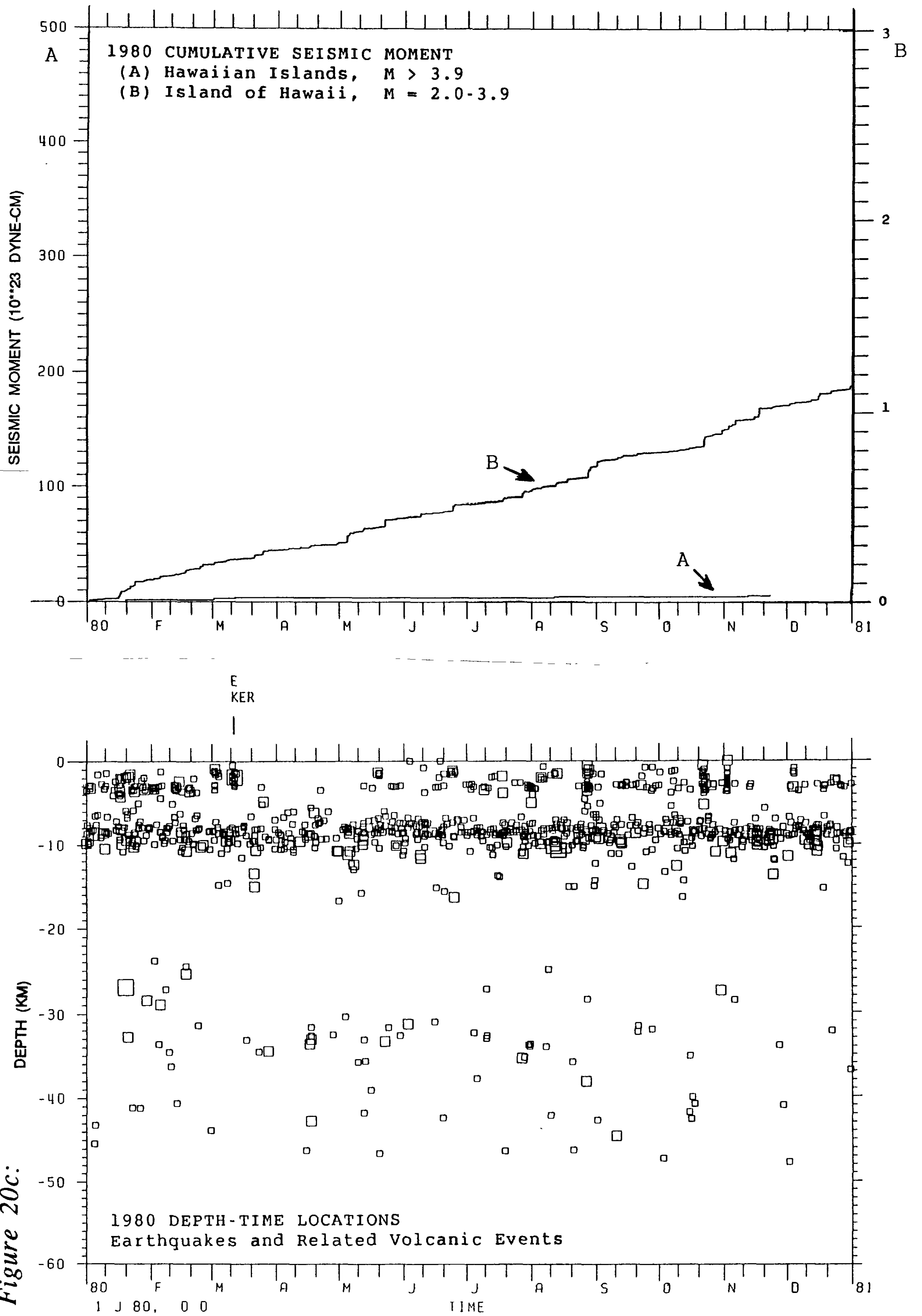
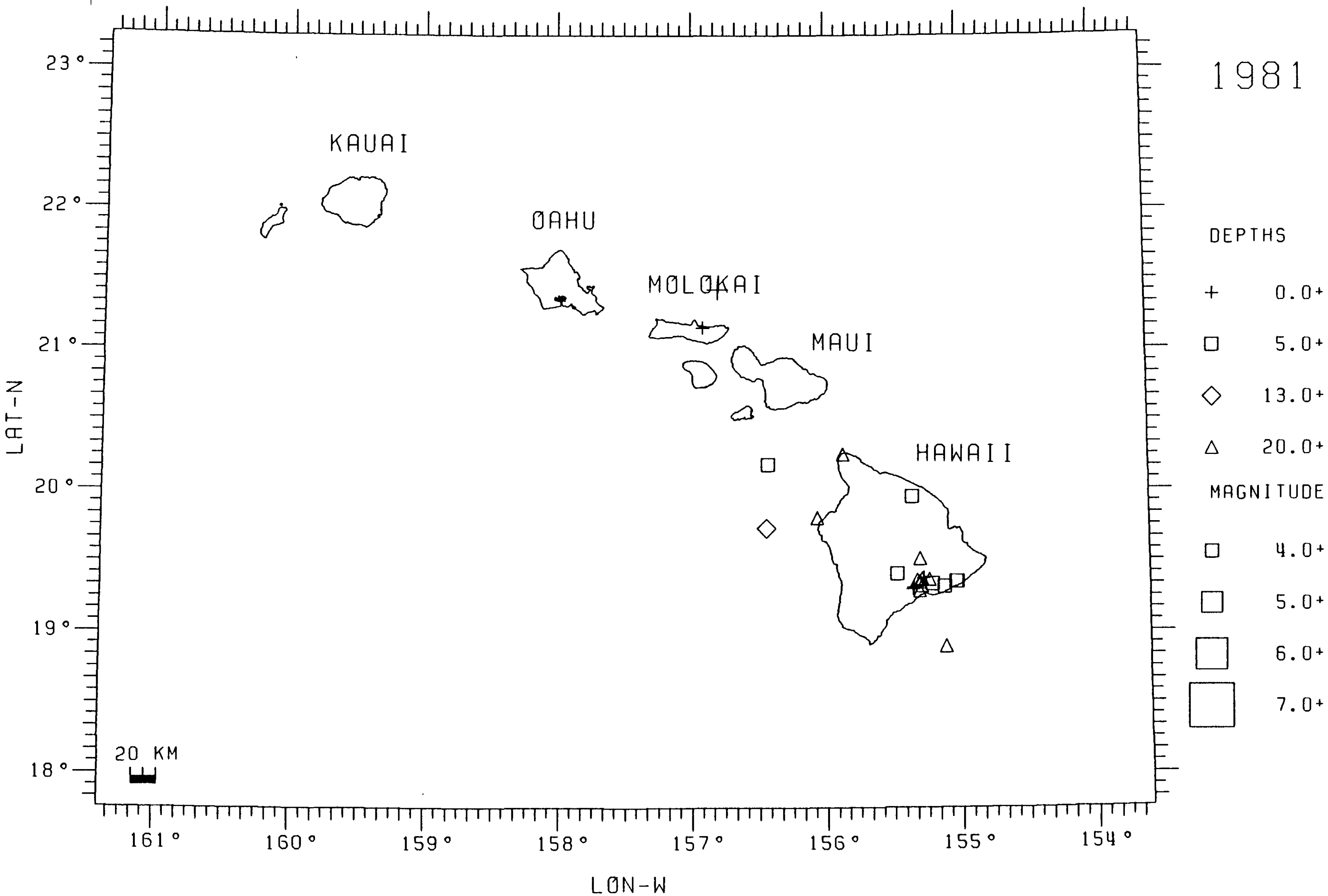

1980 CUMULATIVE SEISMIC MOMENT
(A) Hawaiian Islands, M > 3.9
(B) Island of Hawaii, M = 2.0-3.9
SEISMIC MOMENT (10**23 DYNE-CM)
500
400
300
200
100
0
A
B
3
2
1
0
B
A
80 F M A M J J A S O N D 81
E
KER
1980 DEPTH-TIME LOCATIONS
Earthquakes and Related Volcanic Events
DEPTH (KM)
0
-10
-20
-30
-40
-50
-60
80 F M A M J J A S O N D 81
1 J 80, 0 0
TIME

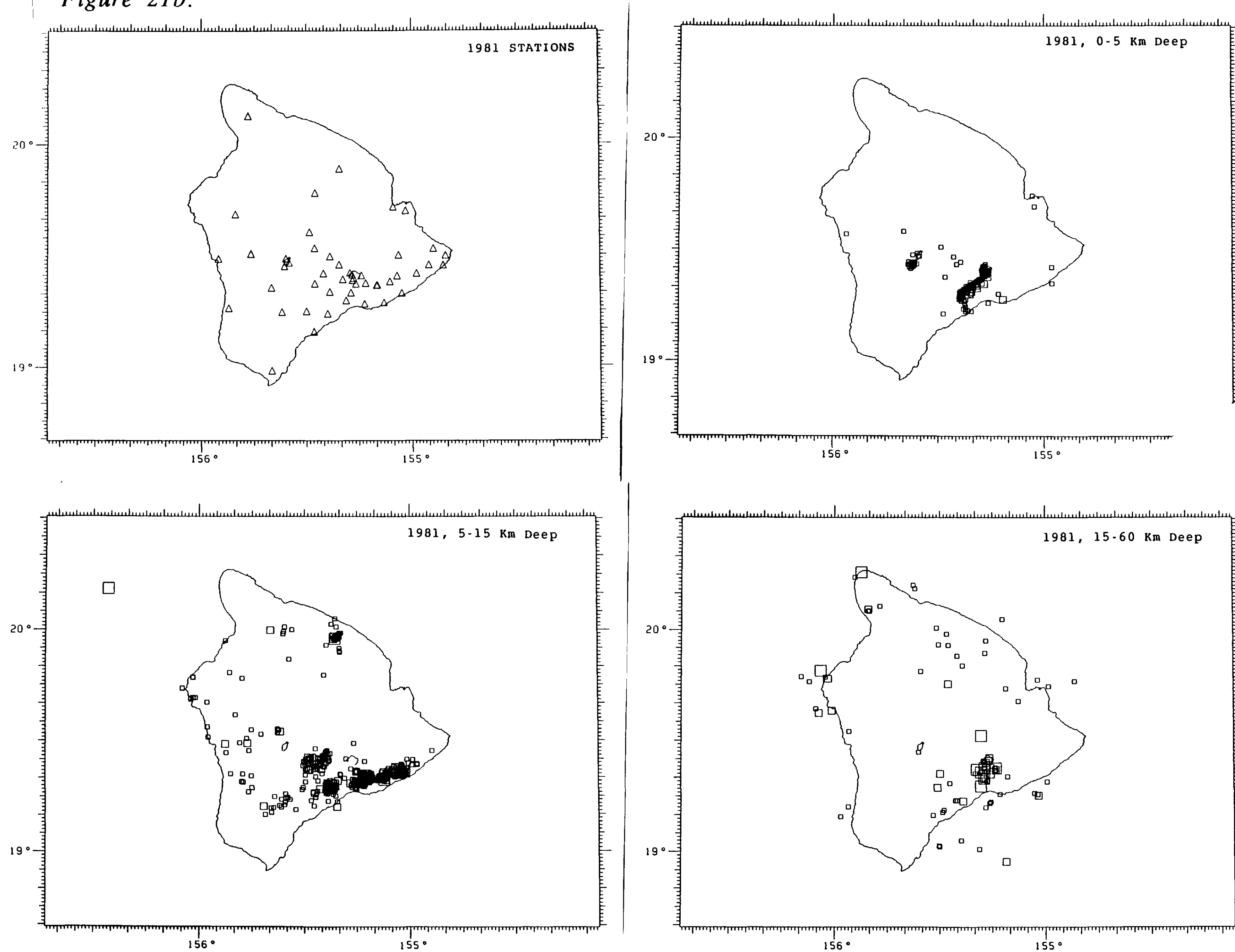
Figure 20c:

Figure 21a:



1981
KAUAI
OAHU
MOLOKAI
MAUI
HAWAII
DEPTHS
0.0+
5.0+
13.0+
20.0+
MAGNITUDES
4.0+
5.0+
6.0+
7.0+
20 KM
23°
22°
21°
20°
19°
18°
LAT-N
161°
160°
159°
158°
157°
156°
155°
154°
LON-W

Figure 21b:



1981 STATIONS
1981, 0-5 Km Deep
1981, 5-15 Km Deep
1981, 15-60 Km Deep
20°
19°
156°
155°

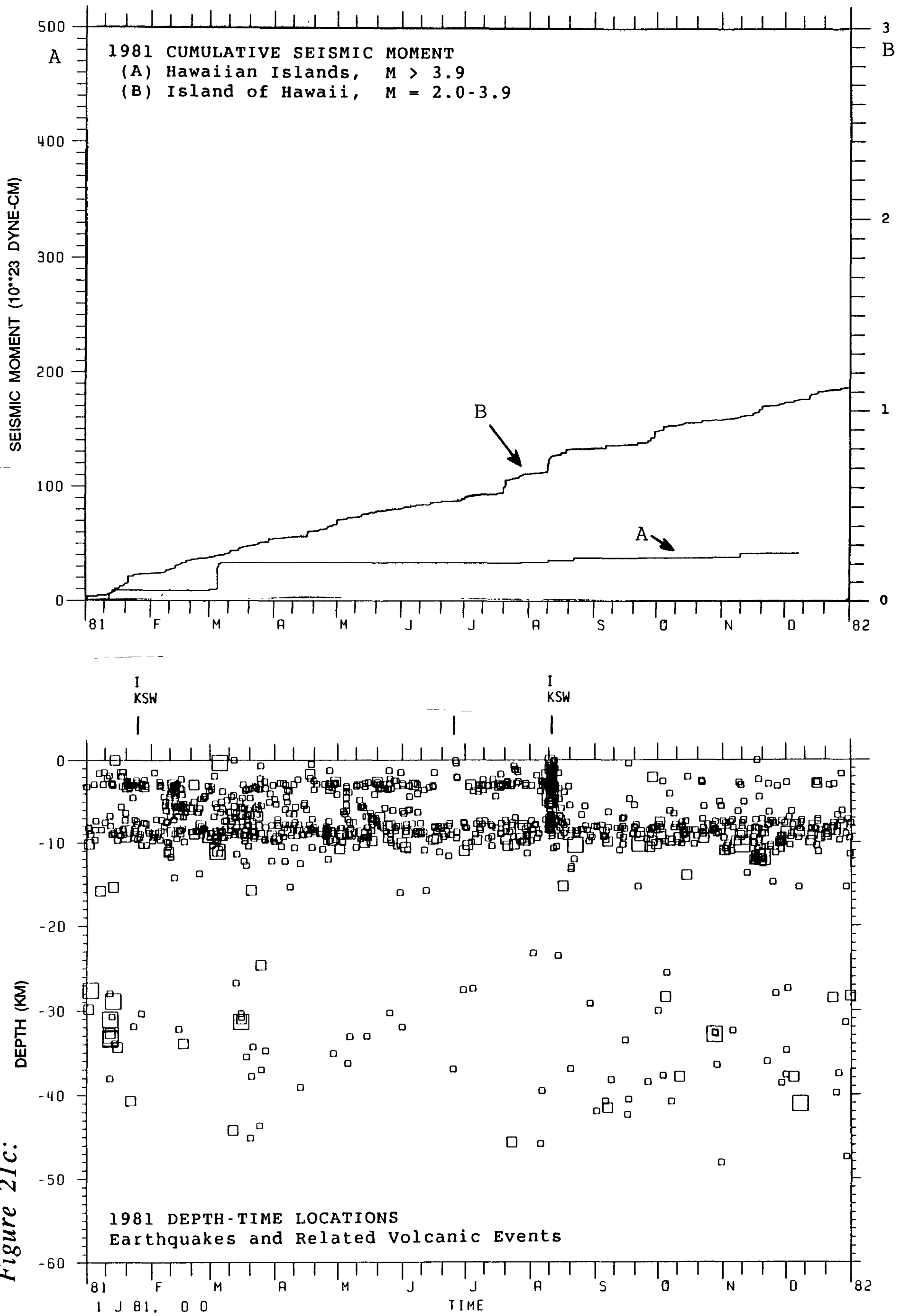

1981 CUMULATIVE SEISMIC MOMENT
(A) Hawaiian Islands, M > 3.9
(B) Island of Hawaii, M = 2.0-3.9
SEISMIC MOMENT (10**23 DYNE-CM)
A
B
500
400
300
200
100
0
3
2
1
0
81 F M A M J J A S O N D 82
KSW
KSW
1981 DEPTH-TIME LOCATIONS
Earthquakes and Related Volcanic Events
DEPTH (KM)
0
-10
-20
-30
-40
-50
-60
81 F M A M J J A S O N D 82
1 J 81. 0 0
TIME

Figure 21c:

Figure 22a:

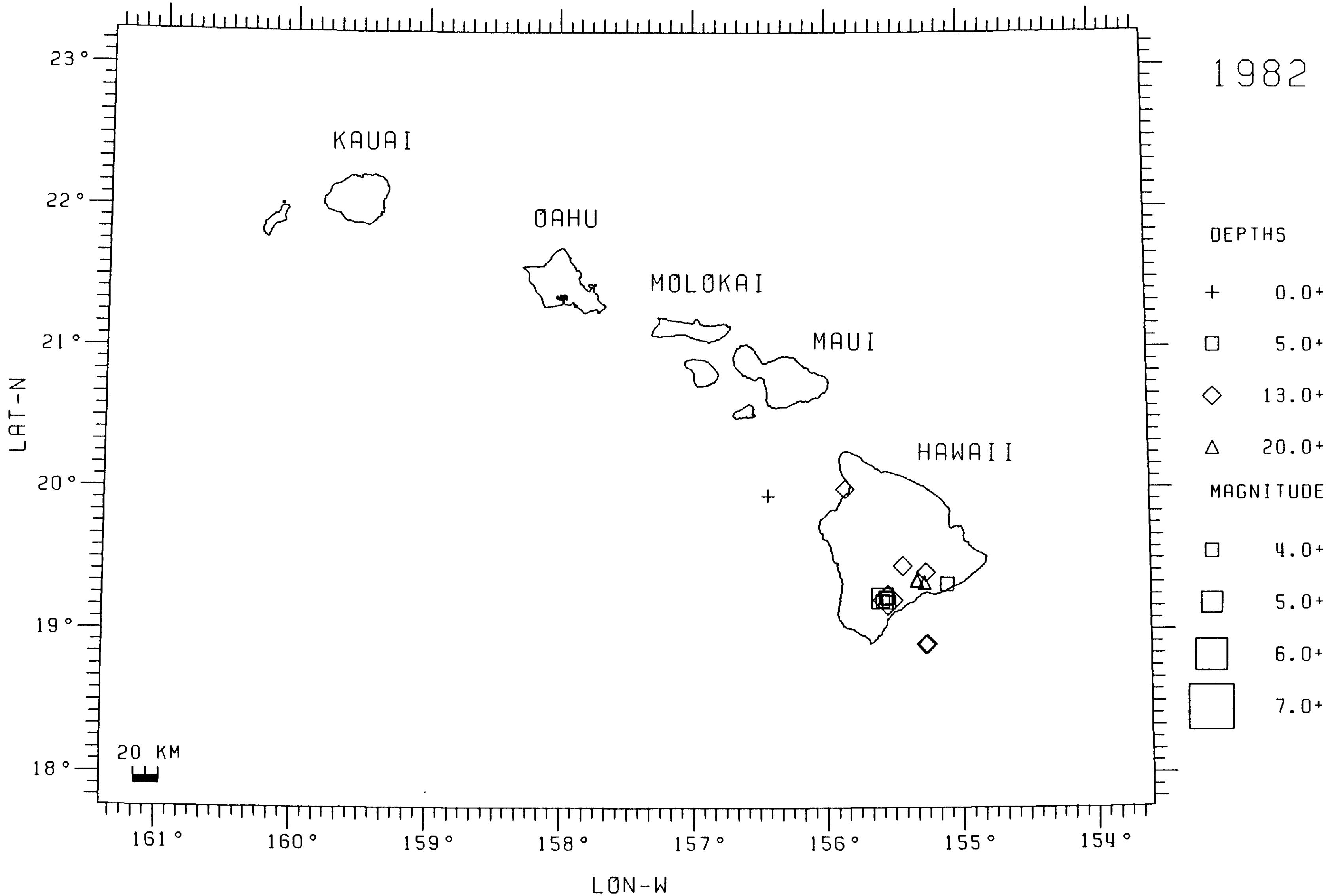
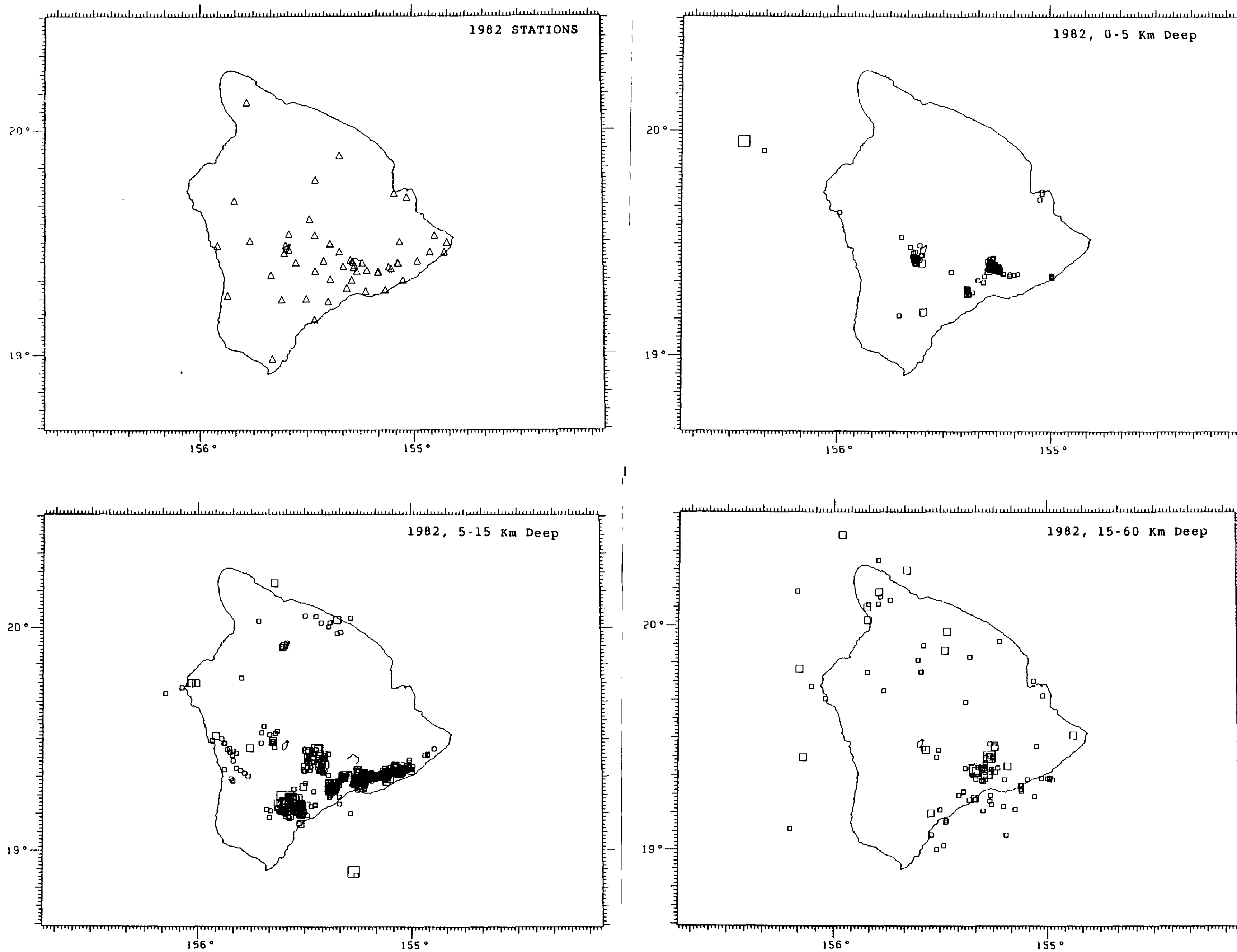

1982
KAUAI
OAHU
MOLOKAI
MAUI
HAWAII
DEPTHS
0.0+
5.0+
13.0+
20.0+
MAGNITUDES
4.0+
5.0+
6.0+
7.0+
20 KM
23°
22°
21°
20°
19°
18°
LAT-N
161°
160°
159°
158°
157°
156°
155°
154°
LON-W

Figure 22b:


1982 STATIONS
1982, 0-5 Km Deep
1982, 5-15 Km Deep
1982, 15-60 Km Deep
20°
19°
156°
155°

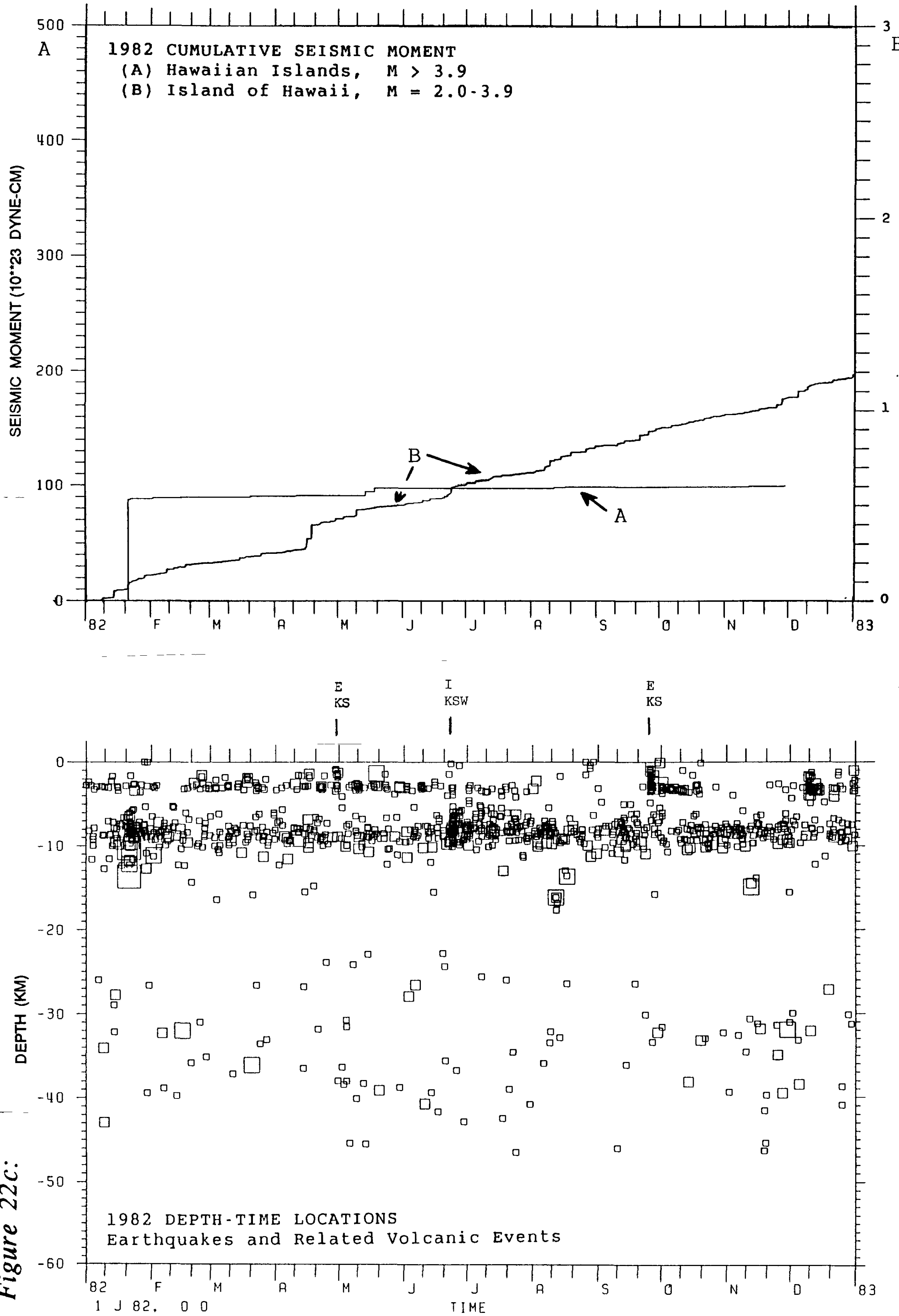

1982 CUMULATIVE SEISMIC MOMENT
(A) Hawaiian Islands, M > 3.9
(B) Island of Hawaii, M = 2.0-3.9
SEISMIC MOMENT (10**23 DYNE-CM)
A
B
500
400
300
200
100
0
3
2
1
82
F
M
A
M
J
J
A
S
O
N
D
83
E KS
I KSW
E KS
1982 DEPTH-TIME LOCATIONS
Earthquakes and Related Volcanic Events
DEPTH (KM)
-10
-20
-30
-40
-50
-60
1 J 82. 0 0
TIME

Figure 22c:

Figure 23a:

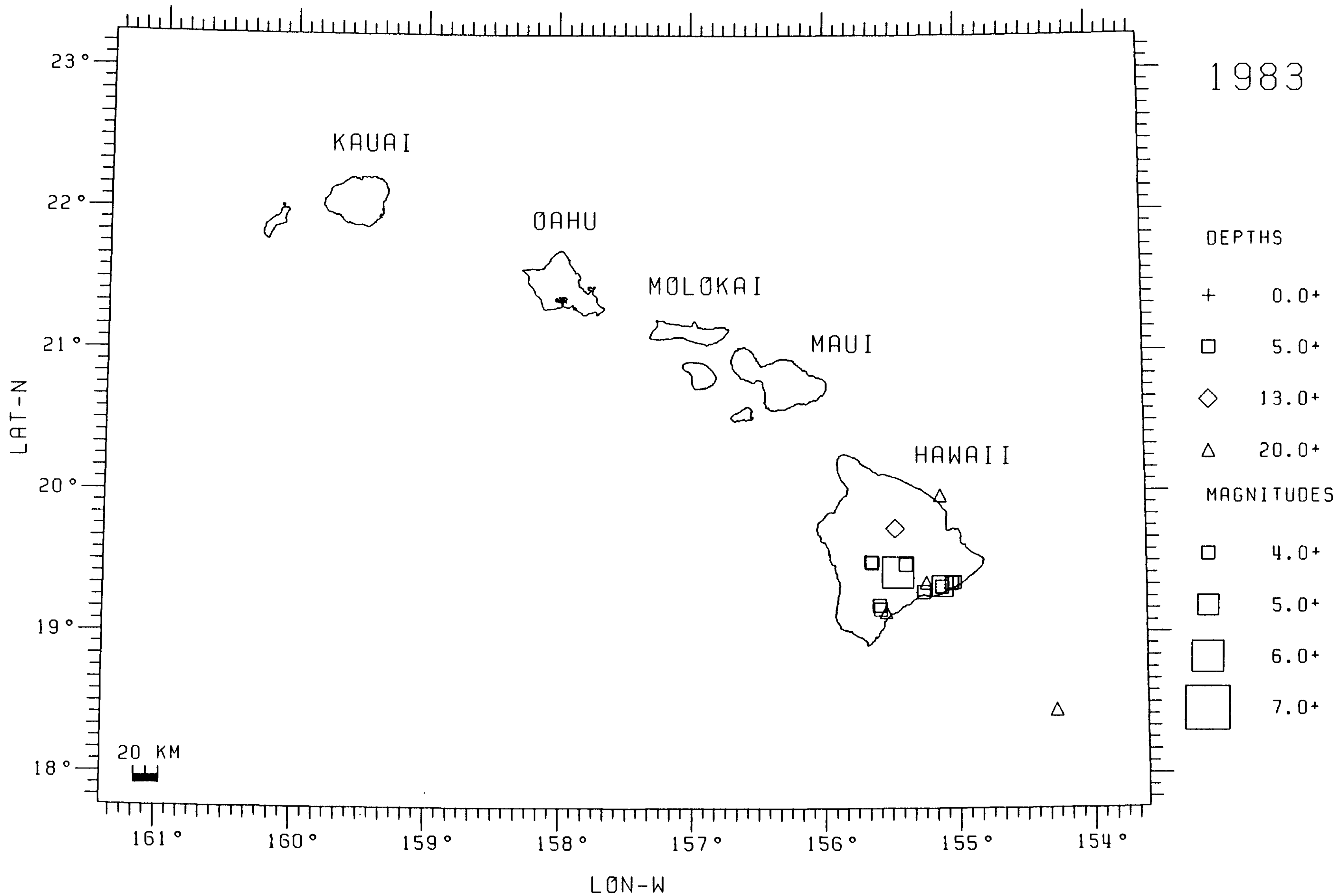
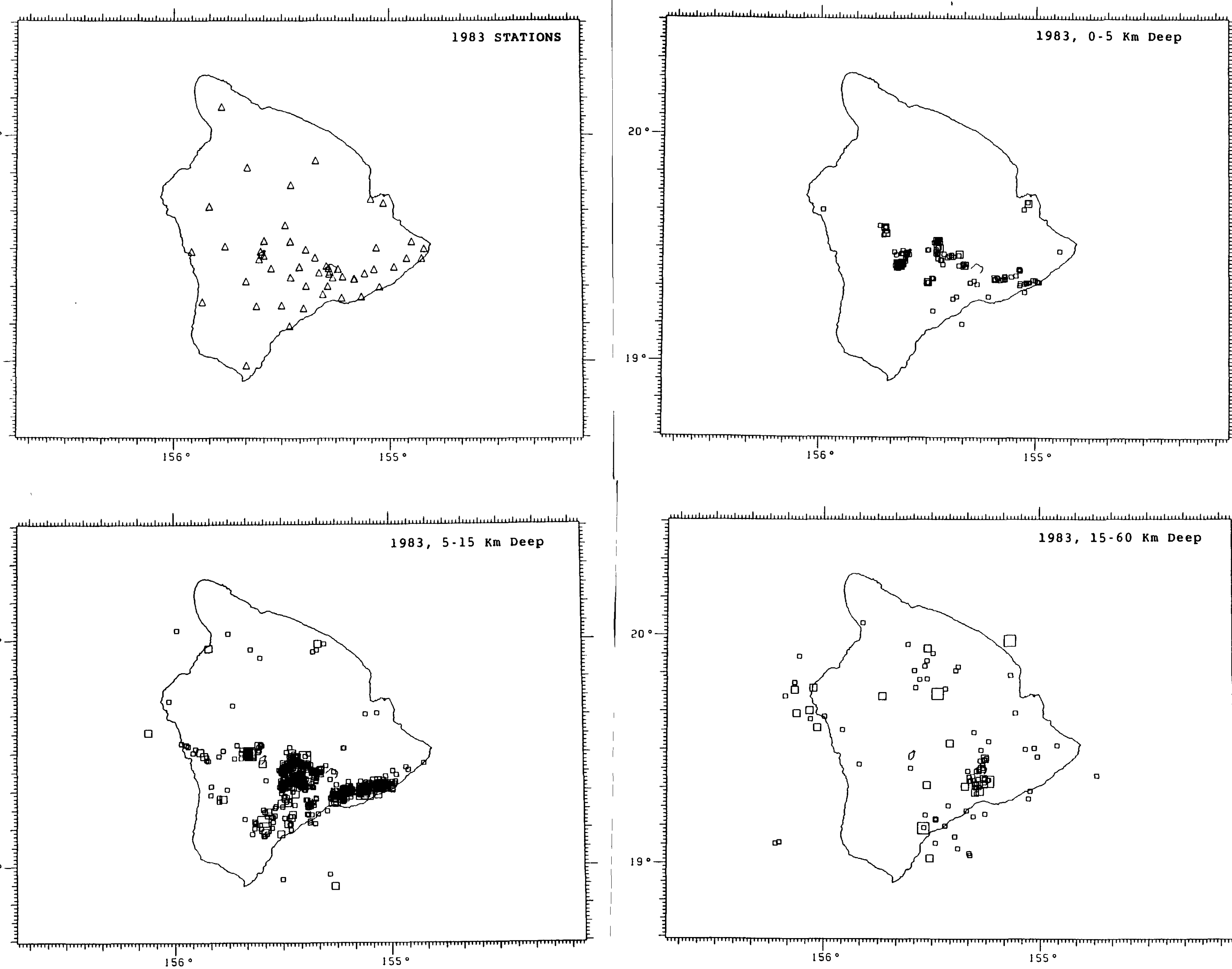
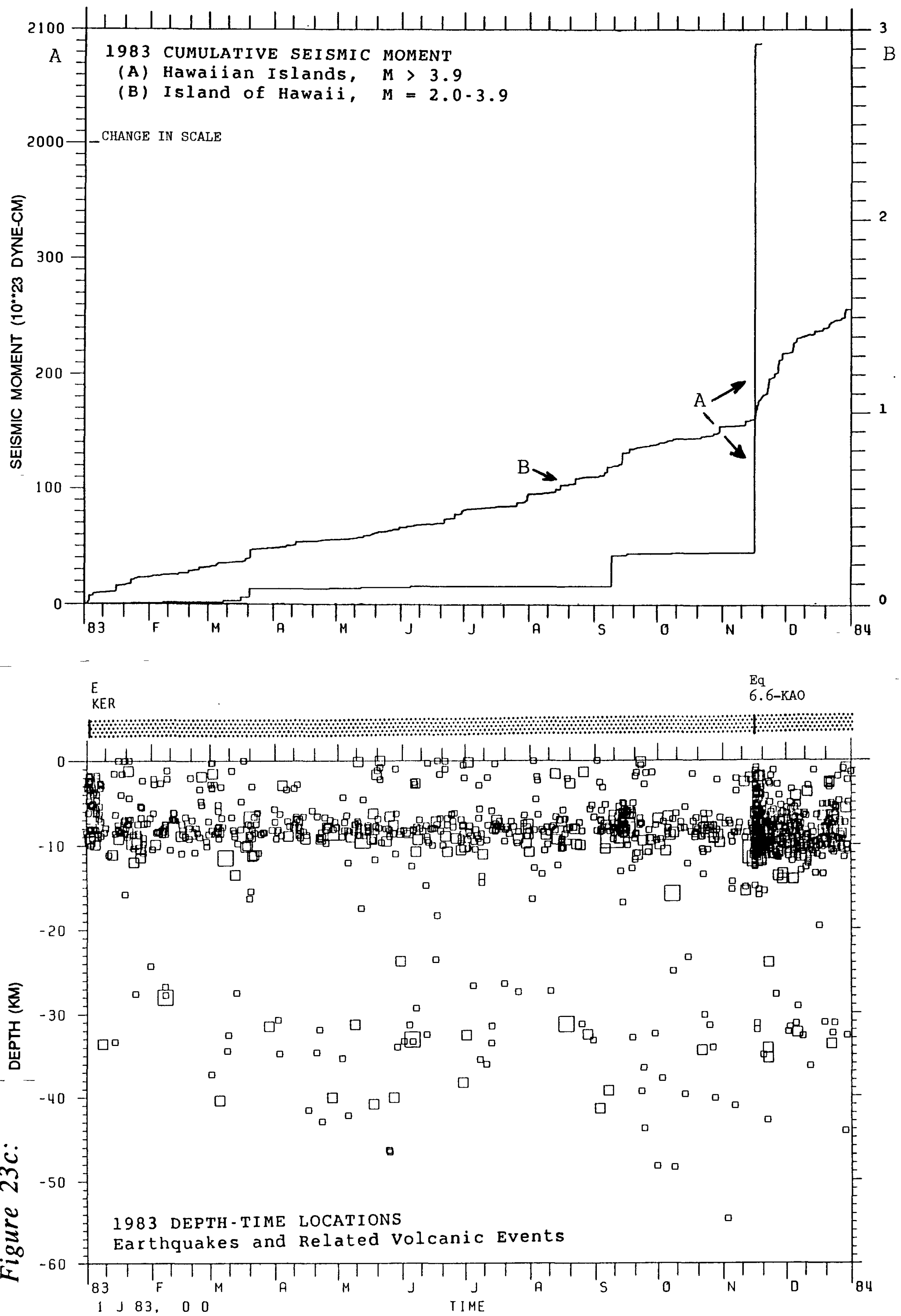

1983
KAUAI
OAHU
MOLOKAI
MAUI
HAWAII
DEPTHS
0.0+
5.0+
13.0+
20.0+
MAGNITUDES
4.0+
5.0+
6.0+
7.0+
20 KM
LAT-N
23°
22°
21°
20°
19°
18°
LON-W
161°
160°
159°
158°
157°
156°
155°
154°

Figure 23b:

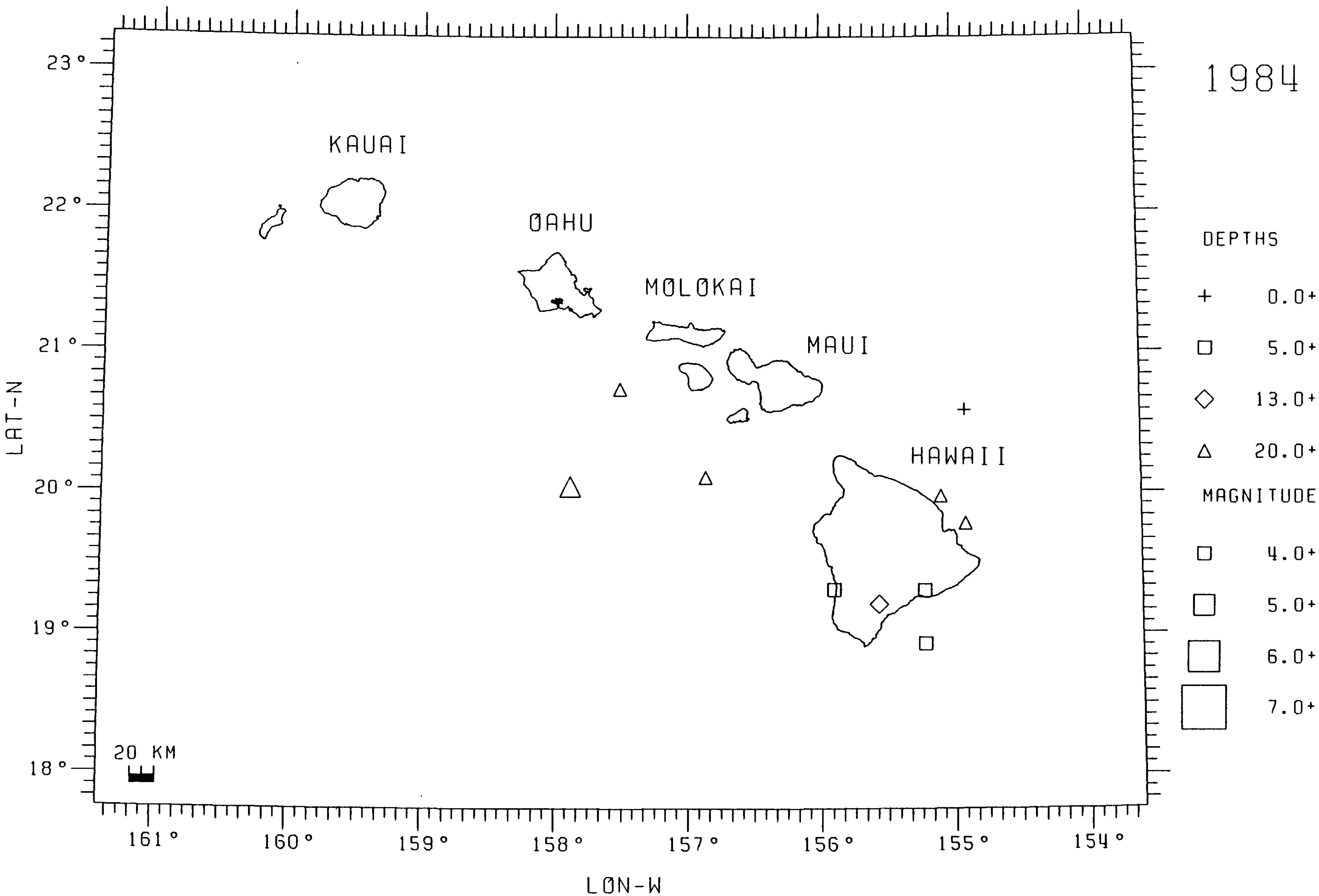

1983 STATIONS
1983, 0-5 Km Deep
1983, 5-15 Km Deep
1983, 15-60 Km Deep
20°
19°
156°
155°



1983 CUMULATIVE SEISMIC MOMENT
(A) Hawaiian Islands, M > 3.9
(B) Island of Hawaii, M = 2.0-3.9
CHANGE IN SCALE
SEISMIC MOMENT (10**23 DYNE-CM)
A
B
1983 DEPTH-TIME LOCATIONS
Earthquakes and Related Volcanic Events
E
KER
Eq
6.6-KAO
DEPTH (KM)
TIME
1 J 83, 0 0

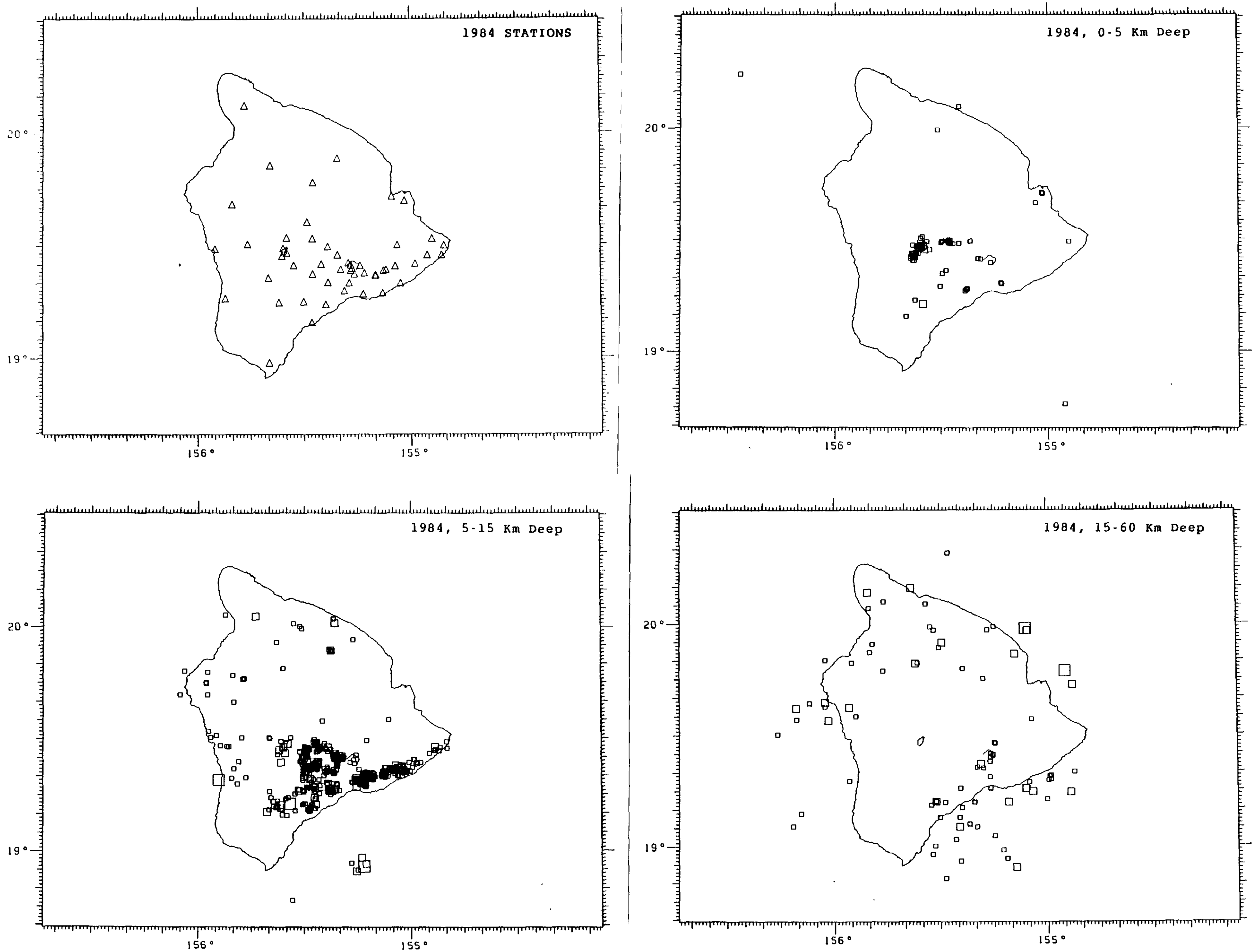
Figure 23c:

Figure 24a:

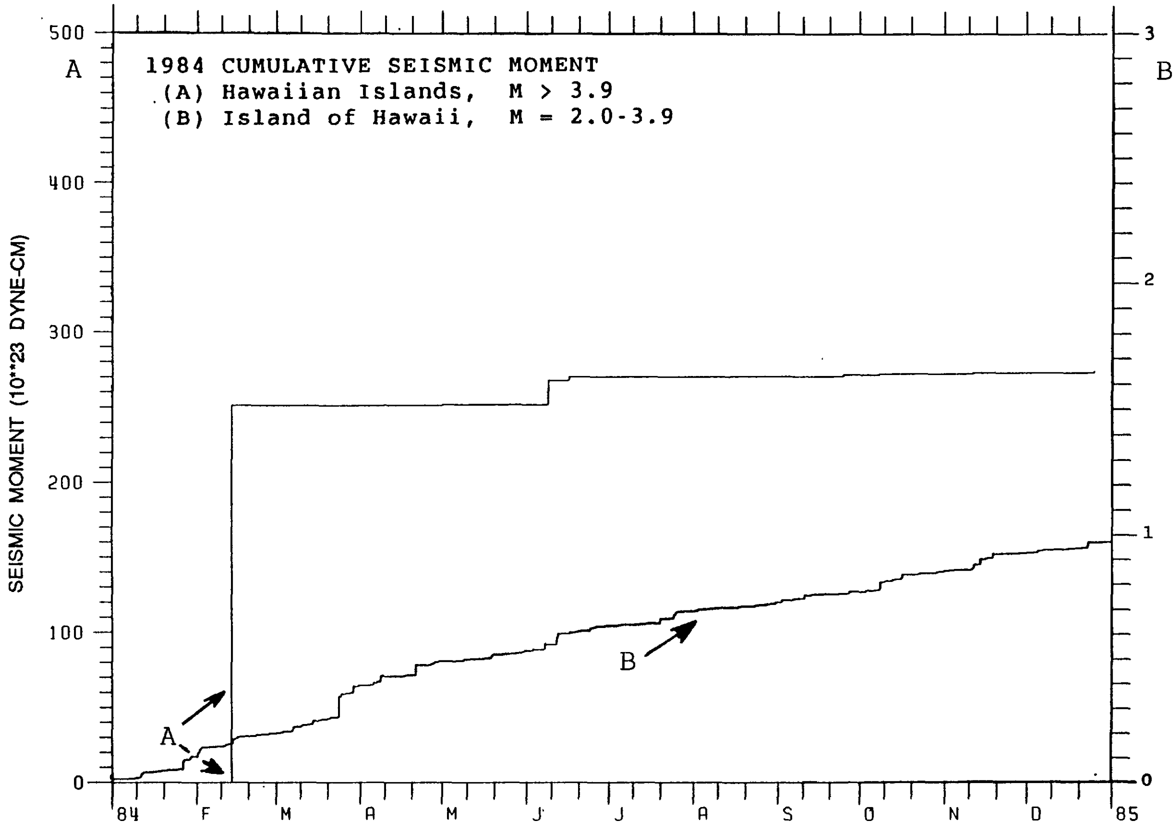


1984
KAUAI
OAHU
MOLOKAI
MAUI
HAWAII
DEPTHS
0.0+
5.0+
13.0+
20.0+
MAGNITUDES
4.0+
5.0+
6.0+
7.0+
20 KM
23°
22°
21°
20°
19°
18°
LAT-N
161°
160°
159°
158°
157°
156°
155°
154°
LON-W

Figure 24b:



1984 STATIONS
1984, 0-5 Km Deep
1984, 5-15 Km Deep
1984, 15-60 Km Deep
20°
19°
156°
155°


1984 CUMULATIVE SEISMIC MOMENT
(A) Hawaiian Islands, M > 3.9
(B) Island of Hawaii, M = 2.0-3.9
SEISMIC MOMENT (10**23 DYNE-CM)
A
B
500
400
300
200
100
0
3
2
1
0
84
F
M
A
M
J
J
A
S
O
N
D
85

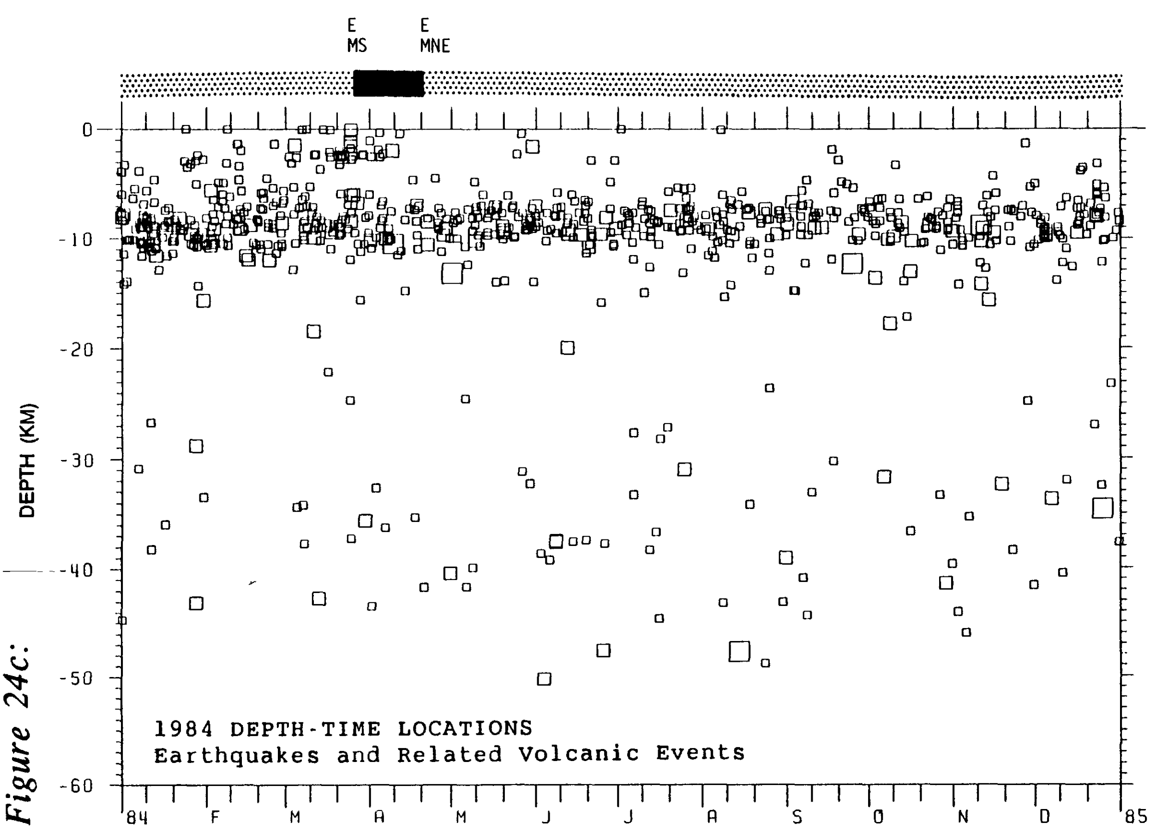
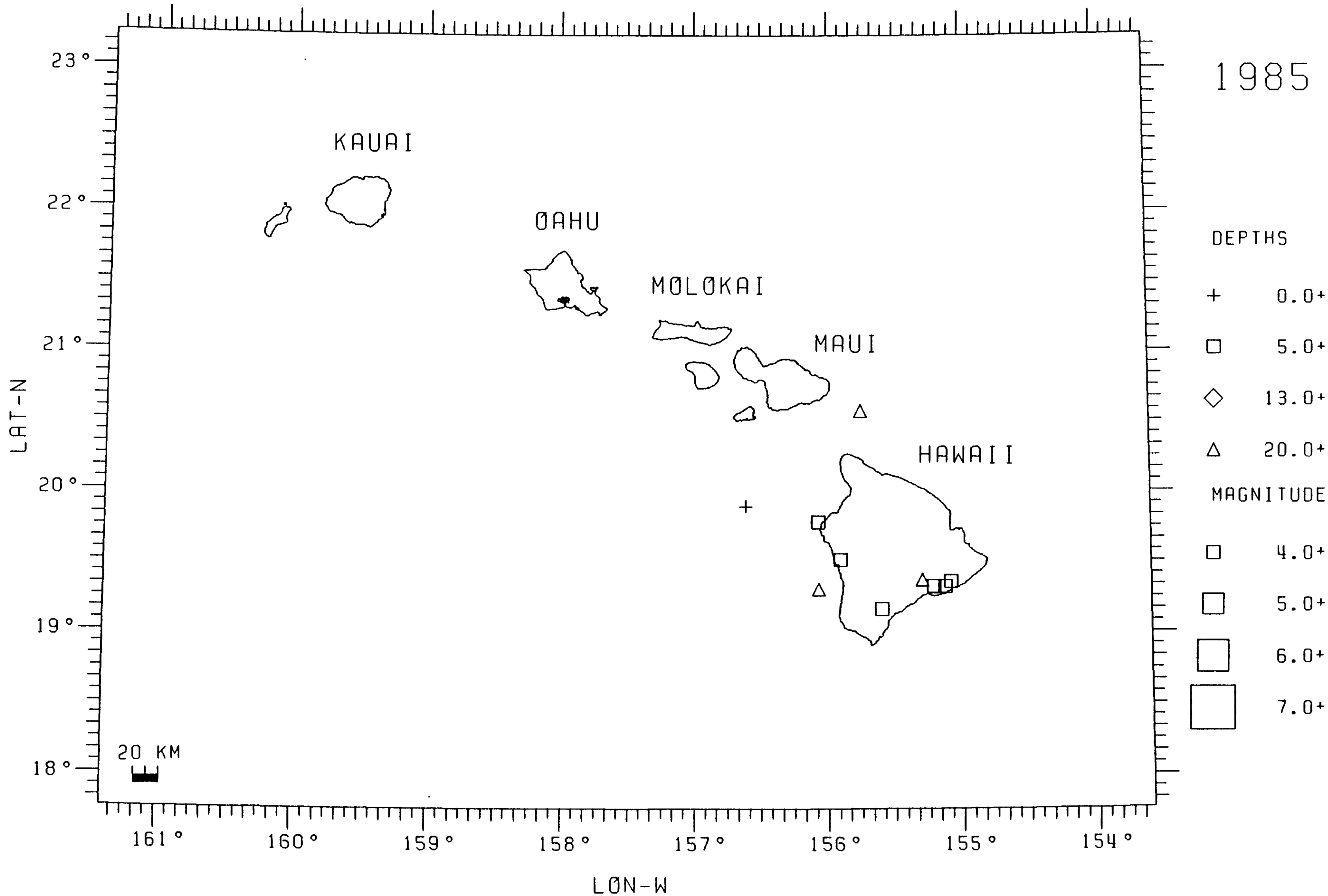

E
MS
E
MNE
1984 DEPTH-TIME LOCATIONS
Earthquakes and Related Volcanic Events
DEPTH (KM)
0
-10
-20
-30
-40
-50
-60
84
F
M
A
M
J
J
A
S
O
N
D
85
1 J 84, 0 0
TIME

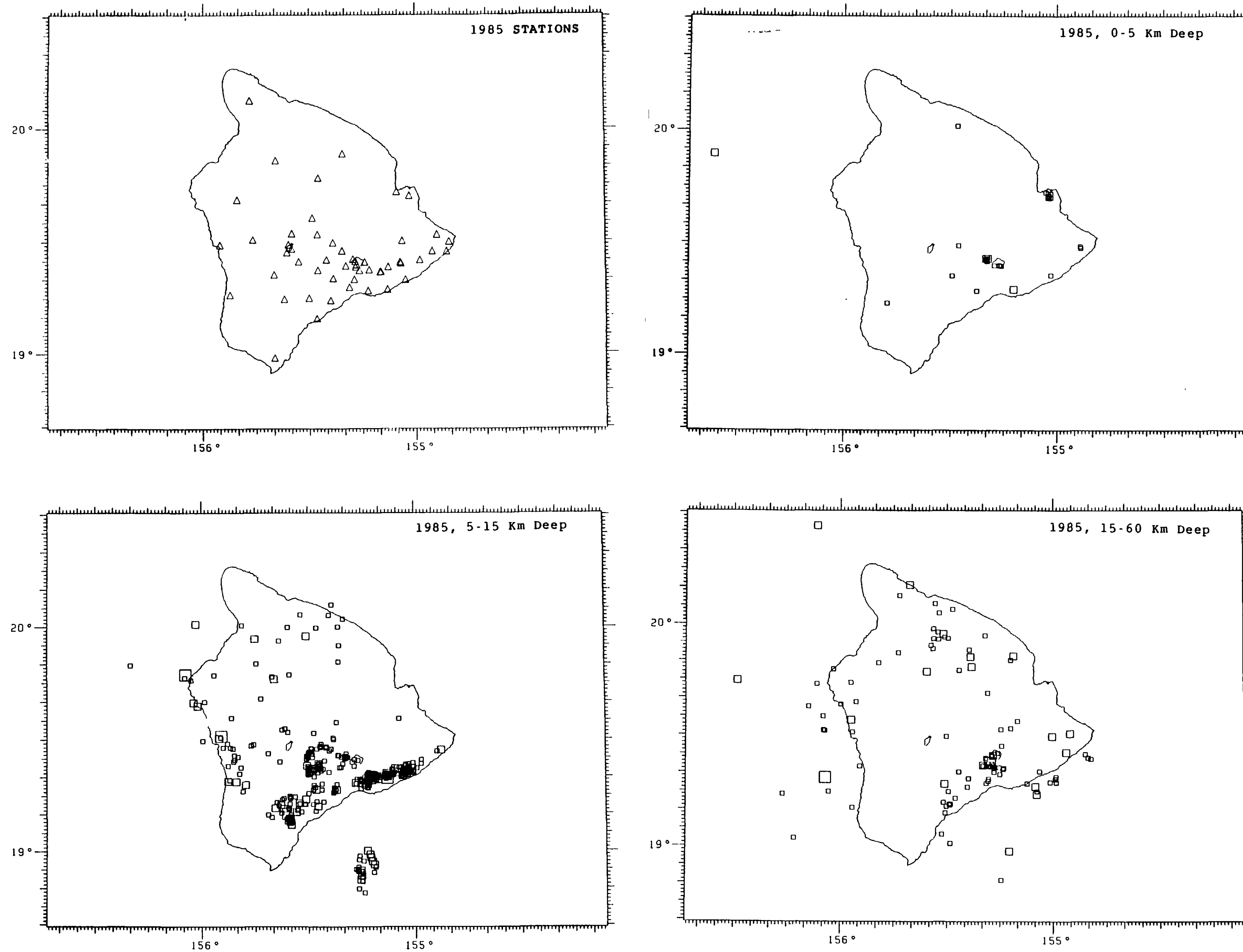
Figure 24c:

Figure 25a:

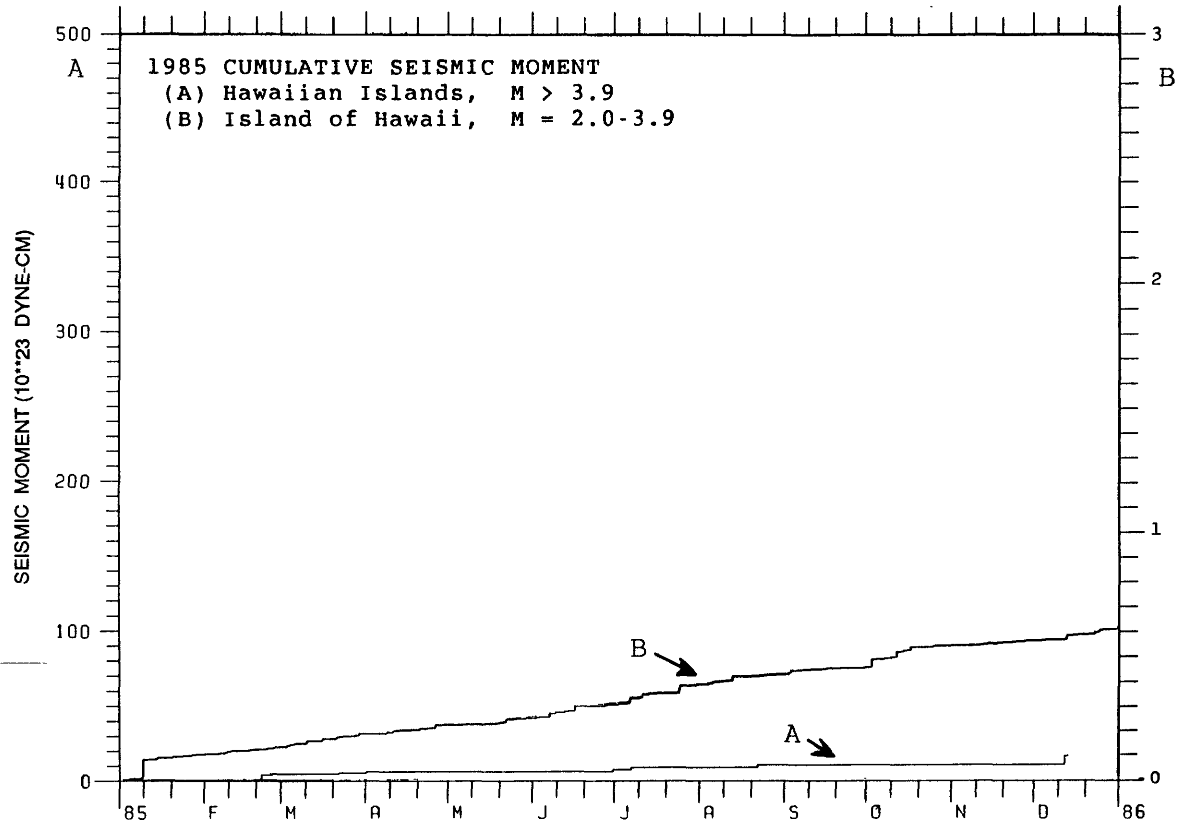


1985
DEPTHS
0.0+
5.0+
13.0+
20.0+
MAGNITUDES
4.0+
5.0+
6.0+
7.0+
KAUAI
OAHU
MØLOKAI
MAUI
HAWAII
20 KM
23°
22°
21°
20°
19°
18°
LAT-N
161°
160°
159°
158°
157°
156°
155°
154°
LØN-W

Figure 25b:



1985 STATIONS
1985, 0-5 Km Deep
1985, 5-15 Km Deep
1985, 15-60 Km Deep
20°
19°
156°
155°


1985 CUMULATIVE SEISMIC MOMENT
(A) Hawaiian Islands, M > 3.9
(B) Island of Hawaii, M = 2.0-3.9
SEISMIC MOMENT (10**23 DYNE-CM)
A
B
500
400
300
200
100
0
3
2
1
0
85 F M A M J J A S O N D 86

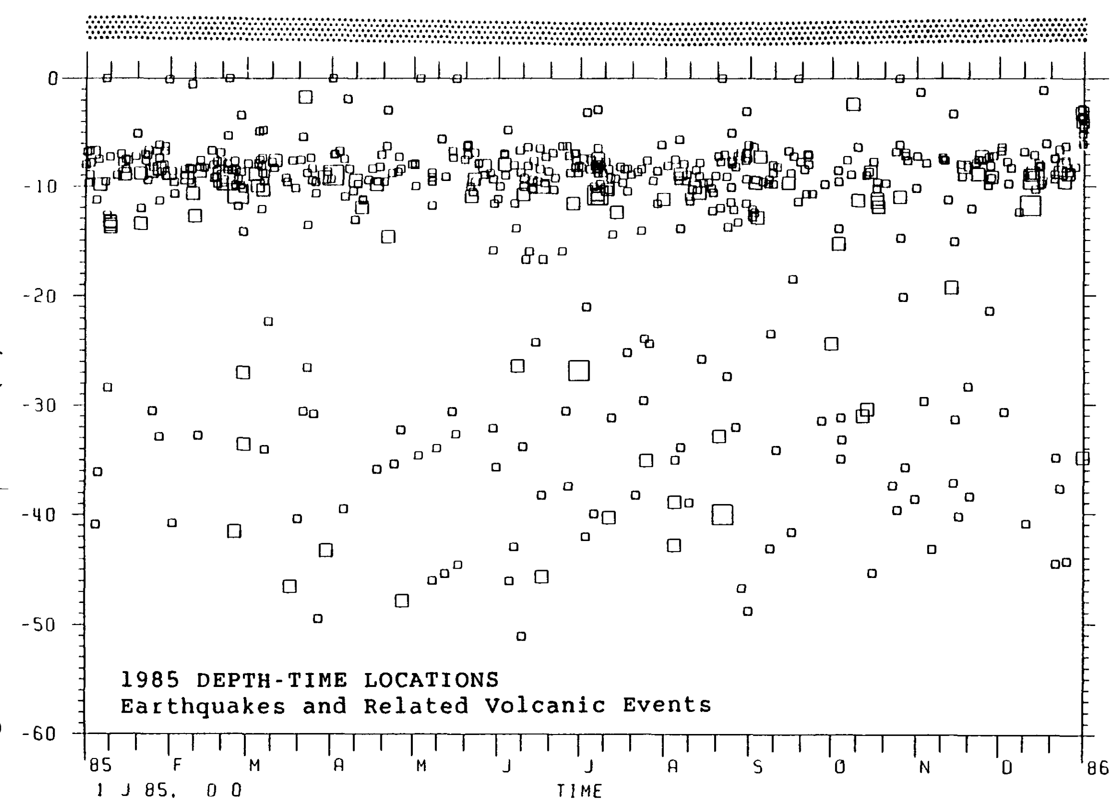

1985 DEPTH-TIME LOCATIONS
Earthquakes and Related Volcanic Events
DEPTH (KM)
0
-10
-20
-30
-40
-50
-60
85 F M A M J J A S O N D 86
1 J 85. 0 0
TIME

Figure 25c: