

有明海北岸低地における水害防止に関する研究  
(最終報告)

Studies on the Prevention of Flood Damage in Lowland Regions  
on the Northern Coast of the Ariake Sea (Final Report)

Abstract

The present studies are aiming at obtaining the data effective in prevention and attenuation of the flood damage which recently has become remarkably frequent in coastal lowland regions of Japan, especially of the damage from inland flood. For these purposes a lowland region, the total area being about 400 km<sup>2</sup>, on the northern coast of the Ariake Sea, Northern Kyushu, where the difference between the tide rises and falls is large, was selected as the model area of the study, and it was tried to make clear the relationship between the natural conditions of the area and the occurrence of inland flood damage and to examine whatever countermeasures would be necessary. The study was conducted as the coordinative study by cooperations of the government offices and other organizations, and such studies have been continued for three years, beginning from 1964. An interim report was already published two years ago, and the present publication is the final report of the studies.

The government offices and other organizations concerned are as follows:

Geographical Survey Institute, Ministry of Construction, located in Tokyo, carried out studies on the topography and ground of the area, conducted precise investigations into the elevation of ground surface and the microgeographic features, prepared charts of flood damage classified by topography, and made considerations on the relation of topography to flood damage. Geological Survey of Japan, Ministry of International Trade and Industry, located in Tokyo, made geological studies by executing borings of deep layers (230 m) and medium layers, elucidated the layers of alluvium and diluvium, and made inquiry into the causes of ground settlement etc. Meteorological Research Institute, Ministry of Transportation, located in Tokyo, made researches in meteorology, especially on the rainfall characteristics, made observations and statistical analyses of heavy rainfalls in the above-mentioned area, and consideration was made on the relation between rainfall characteristics and flood damage. Kyushu Agricultural Administrative Bureau, Ministry of Agriculture and Forestry,

located in Kumamoto, conducted investigations into the actual state of ground settlement and into the countermeasures, and clarified the problematic points from the viewpoint of countermeasures to be taken. Saga Branch, Agricultural Engineering Research Station, Ministry of Agriculture and Forestry, located in Saga, established its test region in a creek zone, and by actual surveys of rain-water efflux and flood at the time of flood damage the branch made clear the hydrological characteristics of the creek zone. National Research Center for Disaster Prevention, Science and Technology Agency, carried out several experiments by using models, at the same time cooperating with Agricultural Engineering Research Station in the actual survey, and made consideration on the countermeasures for inland water drainage. A juridical foundation named "The Research Institute for Natural Resources", Tokyo, examined, from the standpoint of geography, the change and the present status of the nature and artificial conditions of the investigated area, and studied into the correlation of these with the change in flood damage of the area. Further, National Research Center for Disaster Prevention collected the reports of research results and made a general survey of all the papers from the coordinative viewpoints.

Main results obtained are as follows:

1) This area is a delta zone formed by floods of the rivers flowing out of the mountain regions on the north, and in this area the land formation by the nature was continued, and moreover the artificial land reclamation by drainage was added from several hundred years ago, and ever since this area has made a consistent development as a paddyfield cultural area.

2) In this area the development of microgeographic features is remarkable and there are distributed a great number of creeks, which have the functions of water utilization and flood control.

3) As for the geology of this area, on the surface there exists a thick layer of alluvium consisting of marine blue clay, and underneath there lies a deep diluvium consisting of alternating layers of silt, sand and pebble, which provides us with the sources of underground water.

4) This area is frequently subject to flood damage from heavy rainfalls caused by lines of discontinuity, and is at the same time an area of drought, and so with the increase of agricultural land the shortage of water for agriculture is increased.

5) The ground settlement of about 10 cm a year is caused at many places

in this area by overmuch pumping-up of underground water, and the settlement has become larger recently. This settlement is influenced not only by the contraction in alluvial layers, but also in addition by the contraction from dehydration in diluvial layers. The settlement makes the damage from inland flood larger.

6) The present status of outflow of fallen rainwater in the creek zone is investigated, the hydrological characteristics of waterways are clarified, and in regard to the drainage of inland water, drainage calculation was done by giving probable rainfall. At the basin of River Kase in the central part of the lowland area, the drainage of inland water is at present performed by a form of natural drainage, but in future it will be necessary to use jointly the machine drainage.

7) It is ascertained that in the creek area they practiced water storage in the periods of water shortage and flood control at the time of heavy rain. Moreover, the effectiveness of the methods of flood defence by partial division of the area with overflow control banks etc. was recognized.

8) As a conclusion, it seems that, regarding the flood damage counter-measures in this area, emphasis should be laid on the prevention of ground settlement by assuring sufficient water for agricultural use and on assuring the facilities for inland water storage by retention of creeks.

(By T. Ariga)

## 概 要

この研究は最近日本において目立って多くなった沿岸低地における水害、特に内水氾濫による被害の防止軽減を図るための有効な資料を得る目的で、干満差の大きい九州有明海北岸低地（面積約400 km<sup>2</sup>）をモデル地域として選定し、そこにおける自然条件と内水災害の発生との関連を明らかにし、どのような対策が必要であるかを検討しようとしたものである。研究は各省庁の協同による総合研究として行なわれ、1964年より3か年にわたり研究がつけられた。すでに中間報告は2年前に刊行されたが、これはこの研究の最終報告である。

関係機関として次のものがある。建設省国土地理院は地形、地盤に関する研究を行ない、精密な地盤高調査や微地形調査を行ない、水害地形分類図を作成し、地形と水害との関連について考察した。通産省地質調査所は地質に関する研究を行ない、深層（230m）、中層等ボーリングを行なって沖積層、洪積層の地層を解明し、地盤沈下の原因等について考察した。運輸省気象研究所は気象特に降雨特性に関する研究を行ない、同地域の強雨の観測と統計解析を行ない、降雨特性と水害との関連について考察した。農林省九州農政局は地盤沈下の実情と対策についての調査を行ない、対策上の問題点を明らかにした。農林省農業土木試験場佐賀支場はクリーク地帯に試験地区を設け、水害時の雨水流出、氾濫について実測を行ない、クリーク地域の水理特性を明らかにした。科学技術庁国立防災科学技術センターは農業土木試験場の実測に協力すると共に、若干の模型実験を行ない、内水排除対策について考察した。

財団法人資源科学研究所は地理学の立場から同地域の古くからの自然、人為条件の変遷と現況を調べ、これと同地域の水害の変遷との相関について研究した。なお防災センターは研究全体のとりまとめと研究の総合考察を行なった。

得られた成果の主なものは次のとおりである。

1) この地域は北に控える山地から流れ出た河川の洪水により作られたデルタ地帯で、自然陸化がけいぞくし、これに加えて人工による干拓が数世紀前から加わり、一貫して水田耕作地域として発展して来た。

2) 微地形の発達が著しく低地には数多くのクリークが分布し、利水治水の機能をもつ。

3) 地質は表面に海成青色粘土たる沖積層が厚く存在し、シルト・砂礫の互層よりなる深い洪積層があって、地下水水源をなしている。

4) この地域は不連続線豪雨による水害が多く、また同時にかんばつ地域でもあって、農地の増大にともない、農業用水の不足をきたしている。

5) 地域内の多くの地区で地下水過剰揚水による地盤沈下（年10cm位）を起しており、最近ひどくなっている。沈下は沖積層だけの収縮でなく洪積層の脱水収縮の影響が加わっている。沈下は内水害の被害を激化させる。

6) クリーク地帯における降雨流出の実態を調べ、また、水路の水理特性を明らかにし、内水排除について確率降雨を与えて排水計算を行なった。低地の中央の嘉瀬川流域では、現在自然排水方式で内水排除をしているが、将来機械排水を併用する必要も出てくる。

7) クリークは渇水時は用水貯留、強雨時は洪水調節を行なっていることが確められた。また、水受堤などによる地域の分割防禦の方式の有効さを認めた。

8) 結論としてこの地域の水害対策の重点は、農業用水の十分な確保による地盤沈下の防止とクリークの存置による内水貯留施設の確保であると思われる。（有賀世治記）