Wuhan University, China 21-22 November, 2008

Research on Deterioration of Water Quality and Its Improvement Caused by Dam Construction in Japan ～Case Study of ISAHAYA Bay Reclamation Project～

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我 是 青 山 貞 一

感謝邀请我来武汉大学

遇到武汉大学的大家能很高兴

The Purpose of the Research

The main purpose of this research is to evaluate and examine the possibility of analyzing the ***impact of water pollution*** and also the ***improvement of water quality*** caused by ***the dam construction*** here in Japan, by applying ***Spline interpolation method*** and ***3 dimensional multi layer tidal simulation method*** developed by the authors.

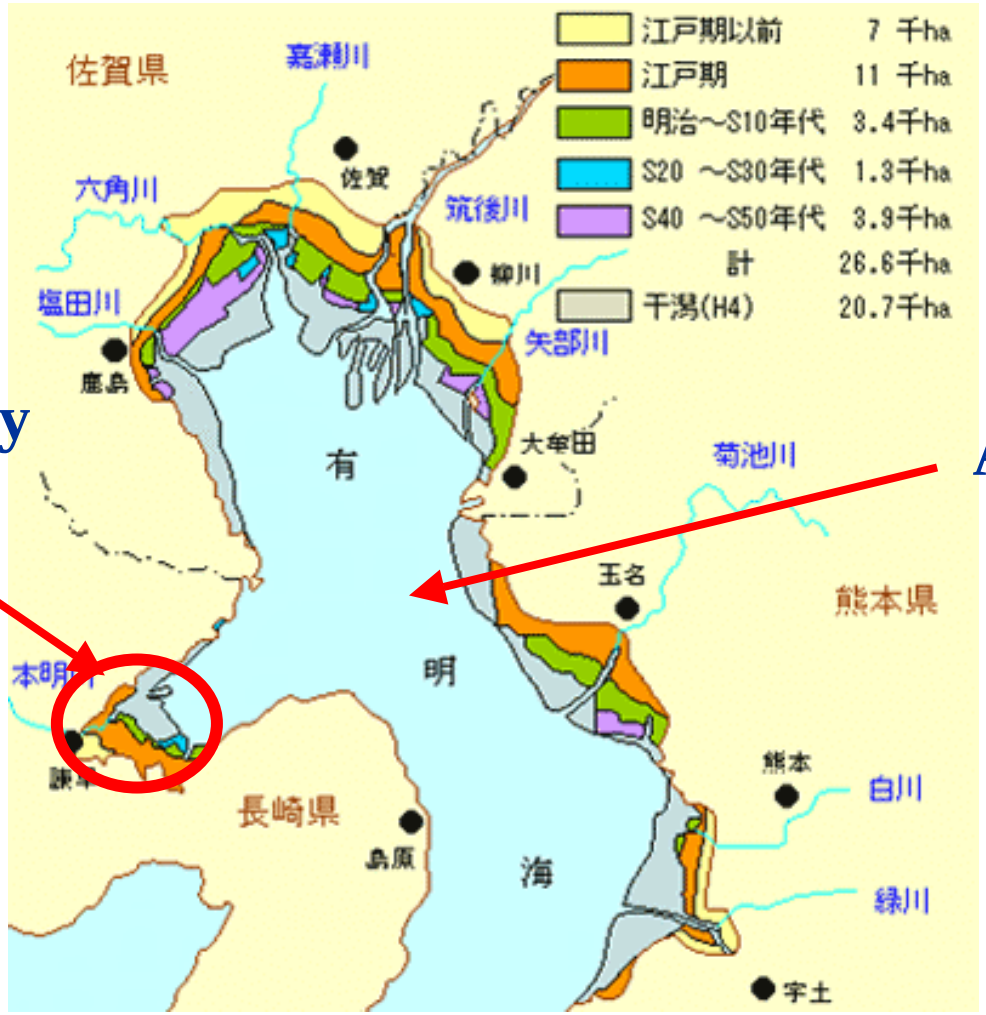
Keyword:
Environmental
Advocacy

■GEOGRAPHICAL LOCATION of the PROJECT site

is in a part of **ARIAKE Sea**, the dead end part of **ISAHAYA Bay** in the west Kyushu Island.

LOCATION of the RECLAMATION PROJECT in ARIAKE Sea

Location of ISAHAYA Bay



ARIAKE Sea

Source: Office of ISAHAYA Bay Reclamation

The collection waters Area in ARIAKE SEA

有明海の集水域

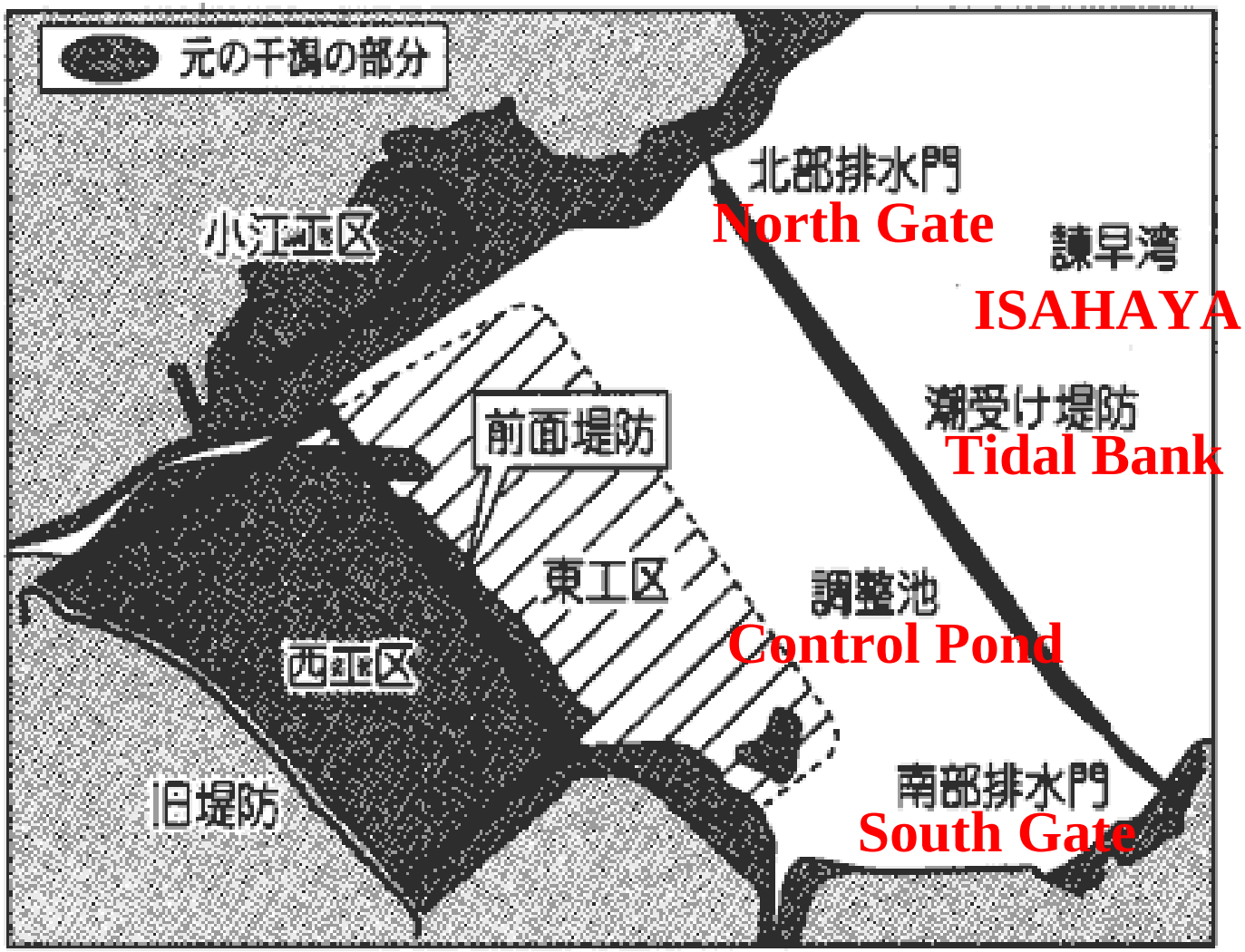
出典：九州農政局

■ISAHAYA Bay

Before constrution of Reclamation Project

Source:Environmental Research Institute, Tokyo

■ISAHAYA Bay Reclamation Project Plan
Its Phisical Features



ISAHAYA of Reclamation Project(Compleation)

Source: Google Earth

■ISAHAYA Bay Reclamation Project Plan

is one of the huge development projects taking almost **40 years** from the planning to completion, totally spending about **300 billion yen**.

1986

Formaly approved as a name of Isahaya Bay Disaster Prevension Comprehensive Project

- **Total Project Expense: 1,35 billion yen**
- Shut Down Area: 3,550ha
- Reclamation land Area: 1,635ha
- Control Pond Area: 1,710ha
- The completion in fiscal year 1999 is decided.

1999

- Total Project Expense was doubled as **249billion yen**

HISTORY of the ISAHAYA Reclamation Project

1956 The reclamation project was planned for the first time after WW2 for food supply difficulities

1970 South Nagasaki Region Comprehensive Plan

1982 Comprehensive Plan discontinued

1986 Name change to Isahaya Bay Disaster Prevension Comprehensive Project

1988 Name change again to ISAHAYA Reclamation Project

1990 Starting Tidal Bank Construction

1997 Shutting the Tidal Bank

40years

■**The INITIAL PURPOSE of this project**

is to develop agricultural land by shutting this back end part of **ISAHAYA Bay** by constructing tidal bank (a kind of dam that separate sea water).

However,

■**the INITIAL PURPOSE has been changed**

several times by the developers (Ministry of Agriculture, Forestry and Fisheries) and **finally settled down as disaster prevention of urban areas of Isahaya City**.

ENVIRONMENTAL and FISHERY VALUE

Originally, **ISAHAYA Bay** was one of the **important fishing area** in Kyushu having **nutritious tideland** with big tidal difference of ebb and flow which effectively purified the sea water quality to grow and cultivate various forms of life.

Source:Environmental Research Institute, Tokyo

Environmental Educaiton in Wetland Observation of ISAHAYA Bay

Source:Environmental Research Institute, Tokyo

The MAIN MARINE PRODUTS
～MUTSUGORO～

MIGRANT
in ARIAKE Sea

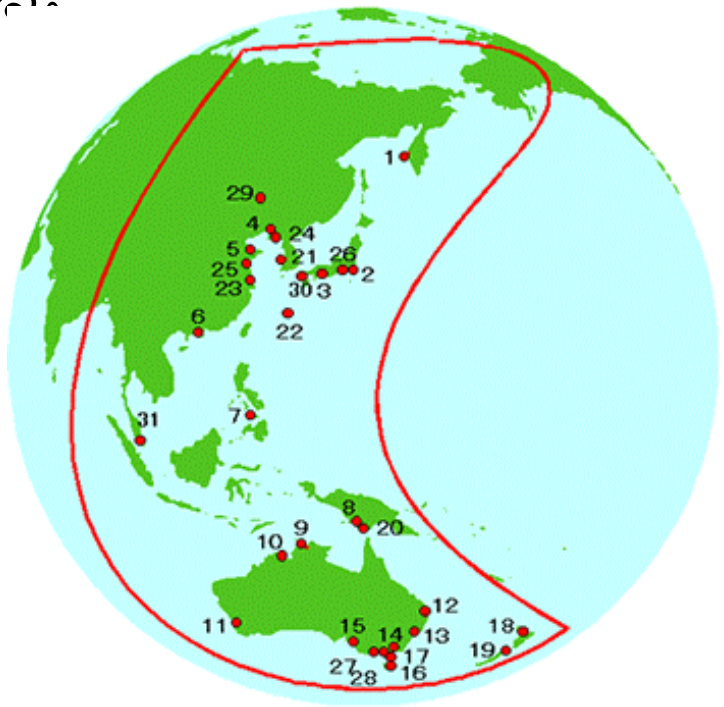
Snipe

Tidori

有明海の渡り鳥

Migrant (Bird) Flight Routs from Russia to Australia and New Zealand

シギ・チドリ類とよばれるものの中には、シベリアからオーストラリア・ニュージーランドまでその距離12,000ｋｍを旅するものがいる。



MIGRANT
in ARIAKE Sea

Snipe and Tidori

有明海の渡り鳥

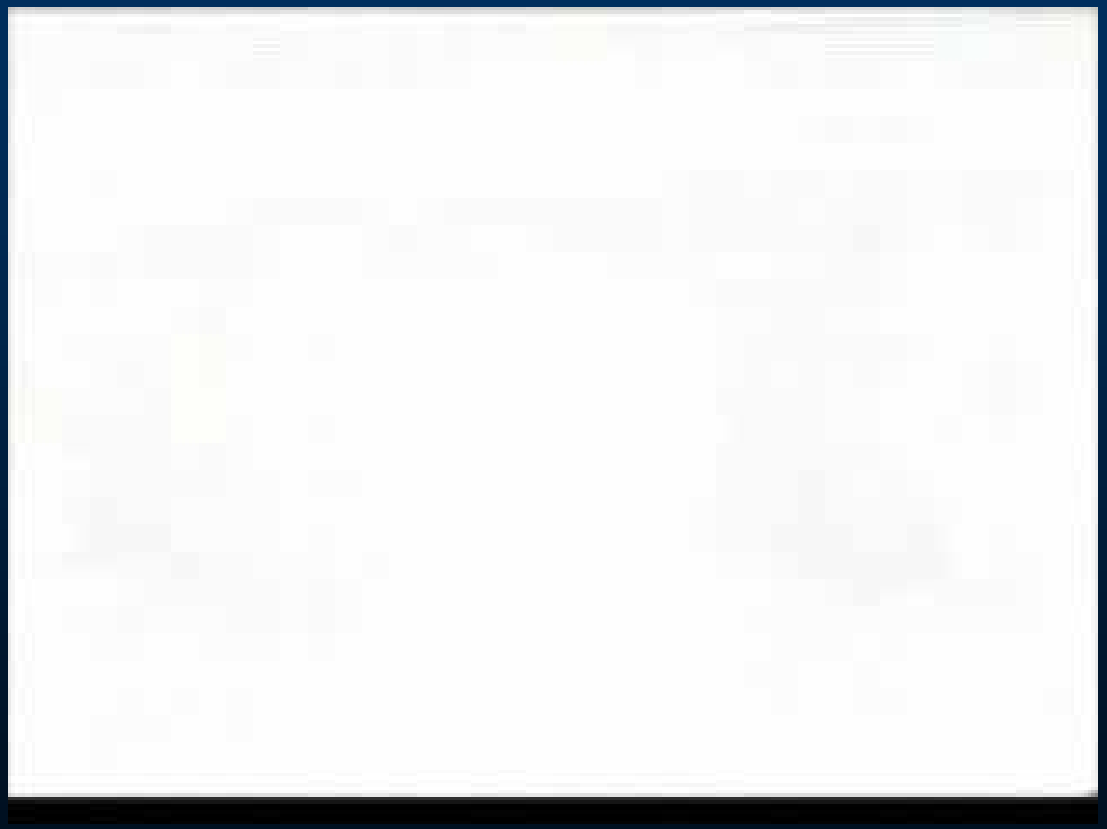
Shut Down
the ISAHAYA Bay
Separating the Bay back end
by the huge bank
In 1997

ギロチンによる諫早湾の閉め切り
１９９７年

Shutting of ISAHAYA Bay by the Tidal Bank Construction

Source: BBC Tokyo News Report
14 April 1997

Shutting of ISAHAYA Bay by the Tidal Bank Construction



Source: KBS Kyusu Asahi Broadcasting
30 May 2004

Pictures before and After Sutting of ISAHAYA Bay by Sattelite of ADEOS

Before Sutting the Bay
14 December 1996

After Sutting the Bay
27 May 1997

ISAHAYA of Reclamation Project

Source: Google Earth

Huge Tidal Bank of ISAHAYA Project

Sourece: Mr. Kozo Oshima

North Water Gate of ISAHAYA Reclamation Project

Location of ISAHAYA Bay
Before constrution of Reclamation Project

Source:MoAFF

諫早湾干拓事業事業後の干潟

First ENVIRONENMTAL ADVOCACY

AFTER Shut Down the ISAHAYA Bay Change of Water quality for the 3 Pollutants (COD, Nitrogen, Photrus)

After shut dwon, it was seriously concerned about the water quality of the newly constructed lake (water control pond) which might be heavily affected by separating the Bay end by the huge bank.

Separating the Bay end by the huge bank

■EUTROPHICATION OCCURENCE

Actually, the **eutrophication** of the artificial dam lake was estimated from the very beginning of the dam construction caused **by the inflow of organic compounds from the rivers like Honmyo-River** of Isahaya City.

However, the Ministry of Agriculture(MoA), the Developer, forecasted and evaluated in the **Environmental Impact Statement(EIS)** that the water quality of the lake could satisfy the Water Environmental Quality Standard.

In this research, the annual trend monitoring data of the water quality of 5 monitoring points concerning

①**COD**

②**Total-Nitrogen** and

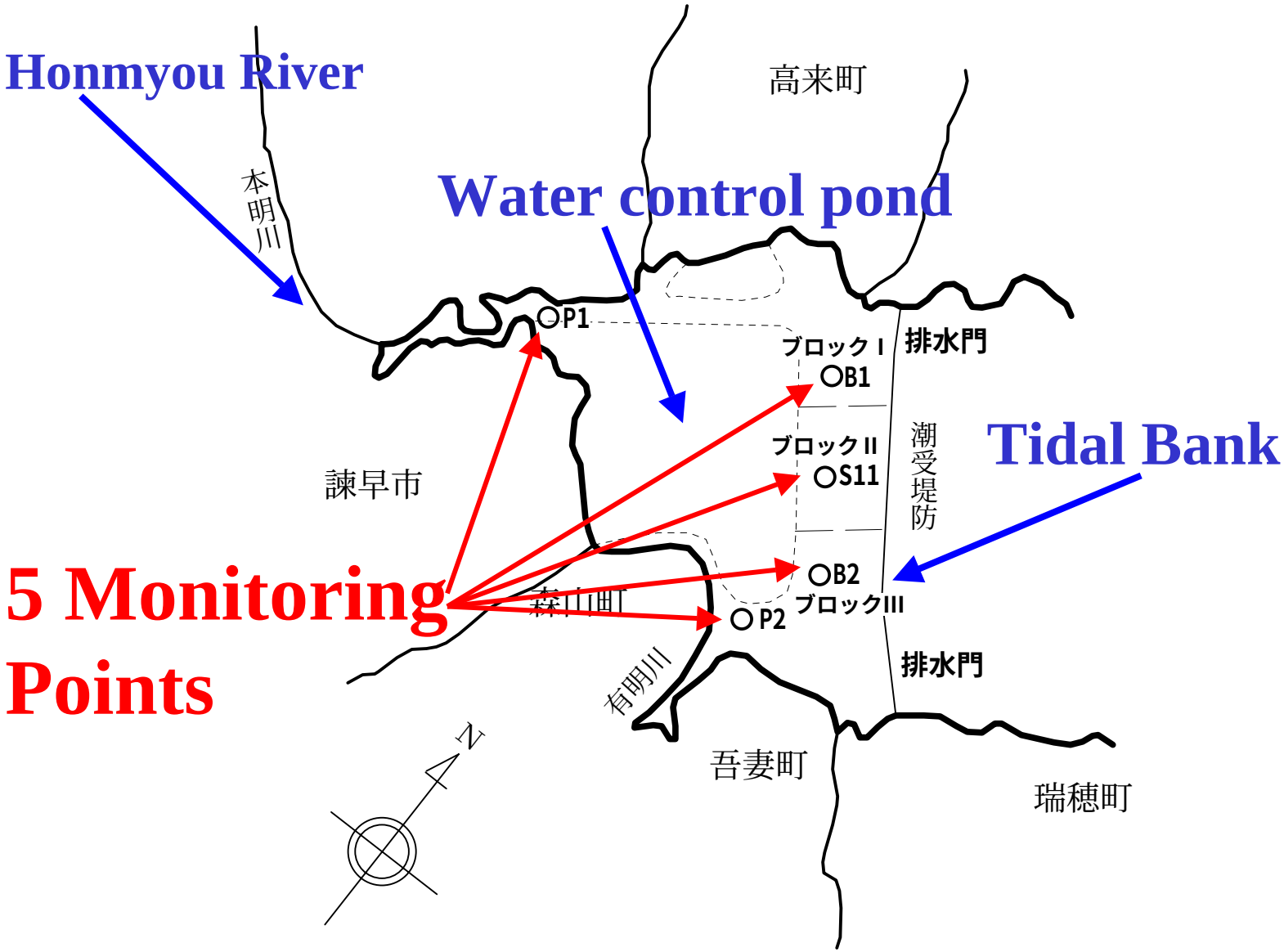
③**Total-Phosphorus**

were analyzed and evaluated in detail before and after the dam (tidal bank) construction, which separated the **ISAHAYA Bay** into sea water and artificial fresh water pond (inner bank lake).

We have applied the ***spline interpolation method*** which configurate the point data into plane dimensional data.

諫早湾潮受堤防内の水質観測地点

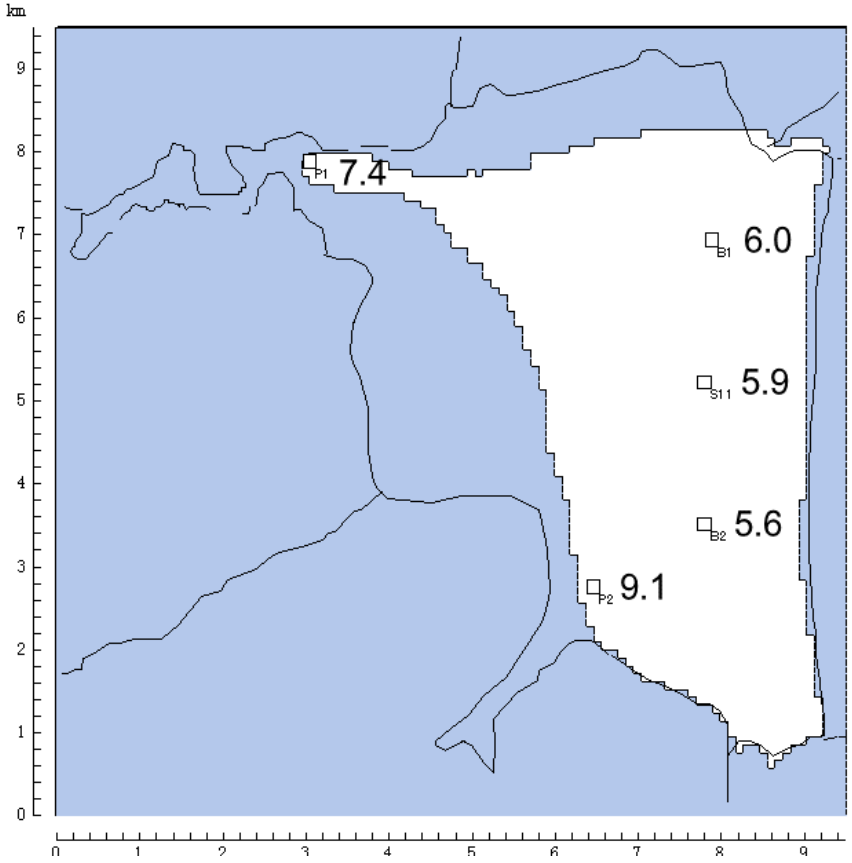
5 monitoring points for Water Quality Monitoring

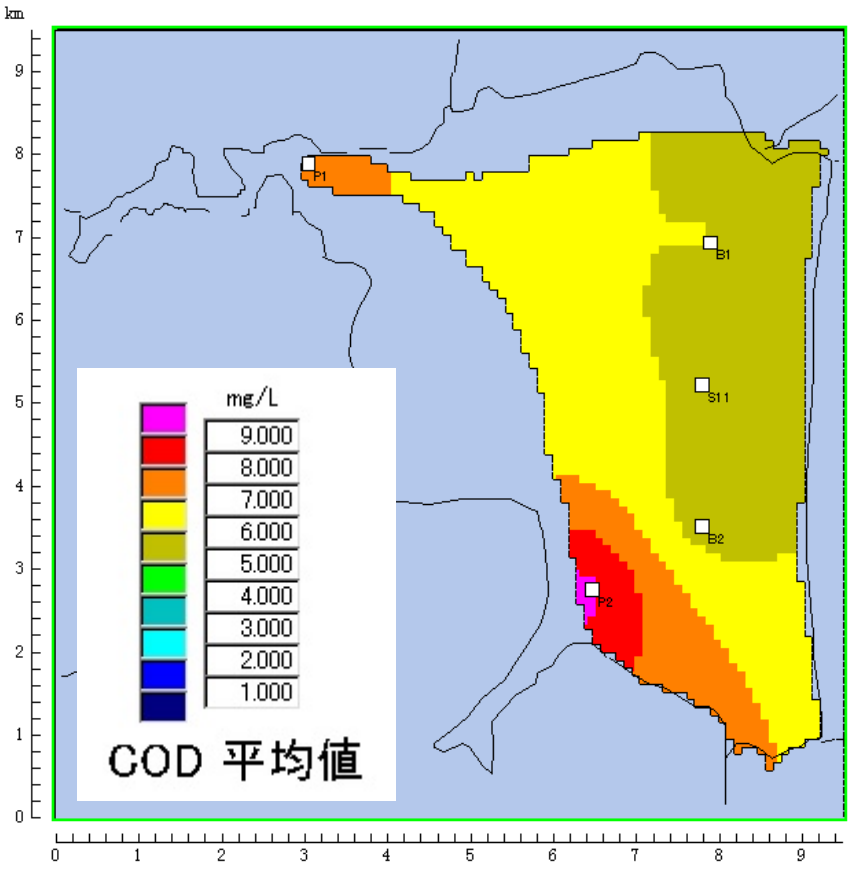


Result of Water Quality(COD) Survey in ISAHAYA Bay Pond

by *SPLINE Interpolation Method*(1997)

Unit：mg/L

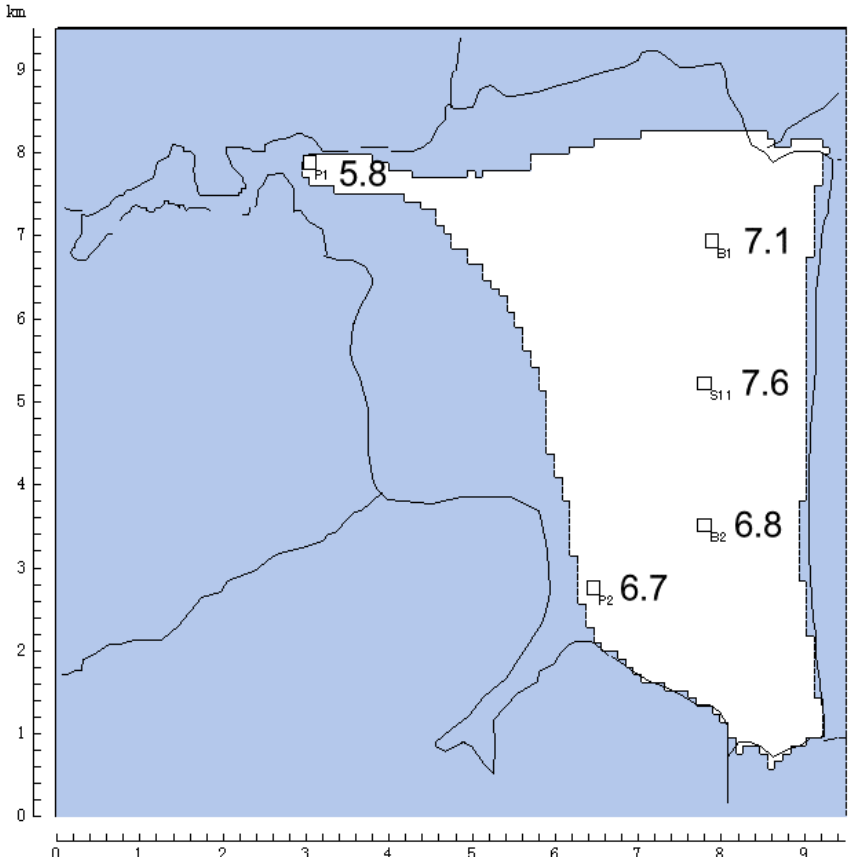


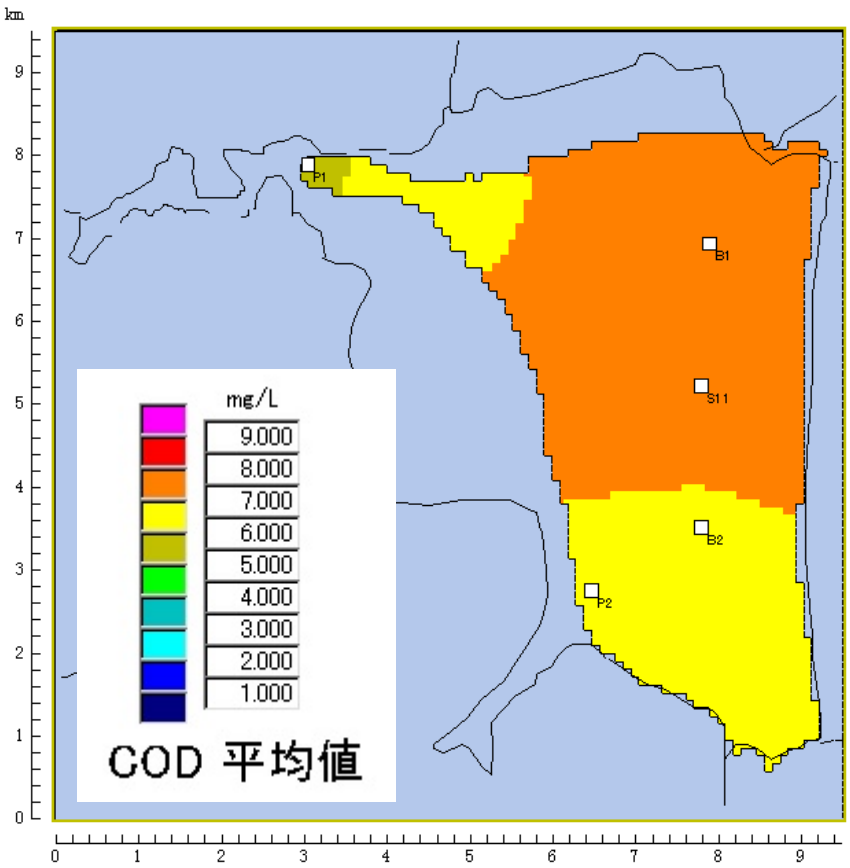


Result of Water Quality(COD) Survey in ISAHAYA Bay Pond

by *SPLINE Interpolation Method*(1998)

Unit：mg/L

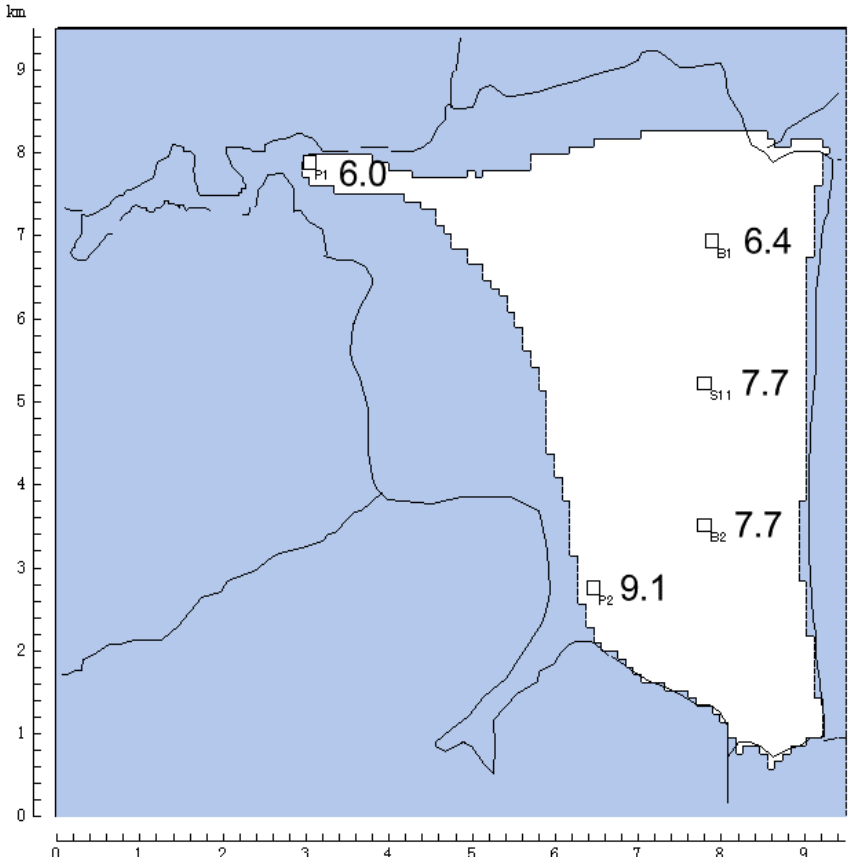


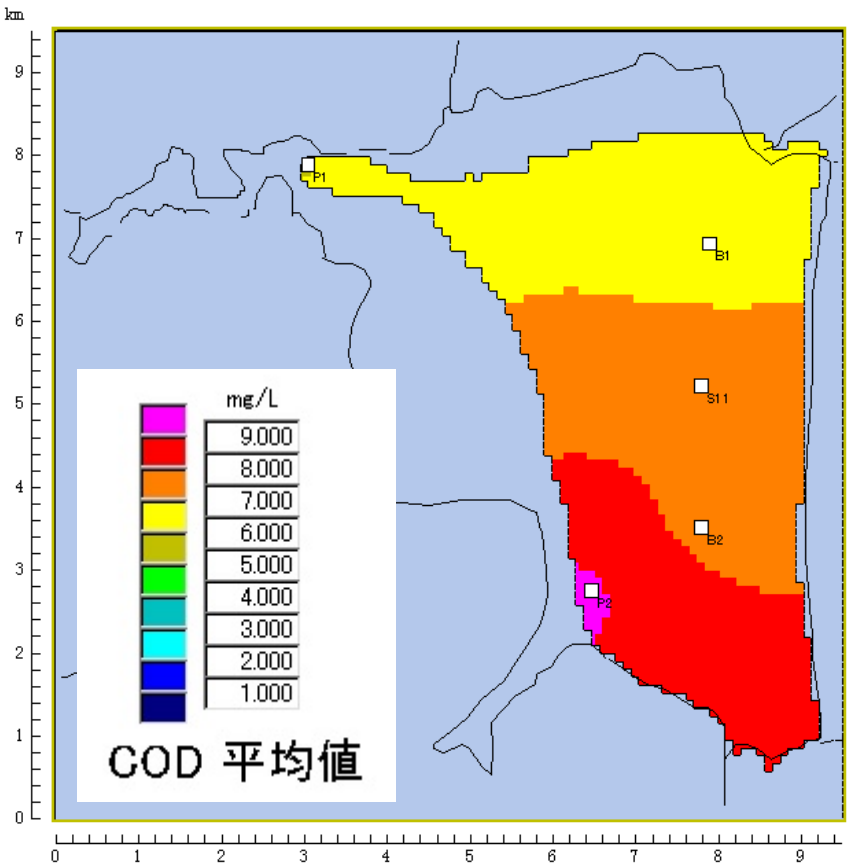


Result of Water Quality(COD) Survey in ISAHAYA Bay Pond

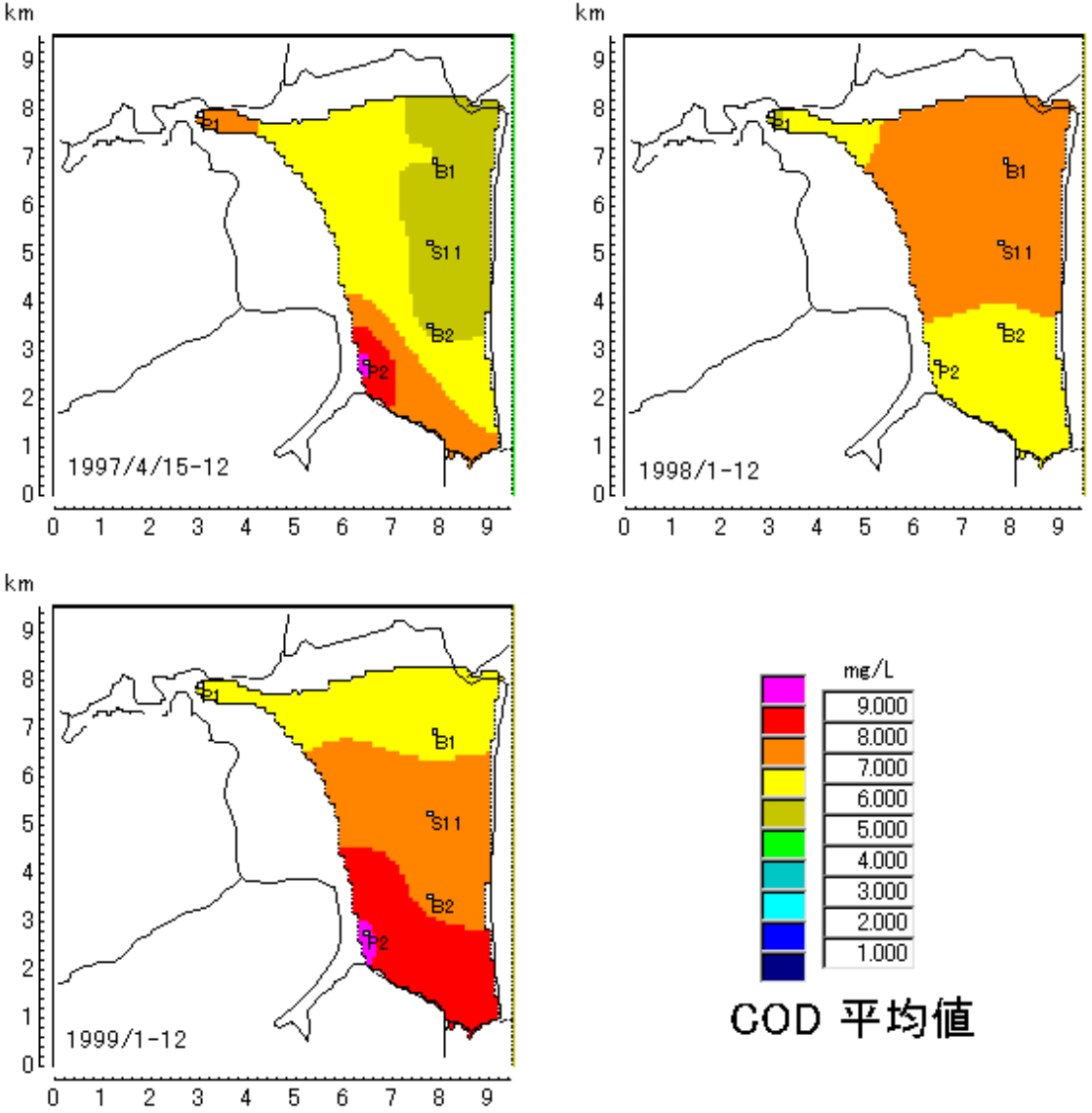
by *SPLINE Interpolation Method*(1999)

Unit：mg/L

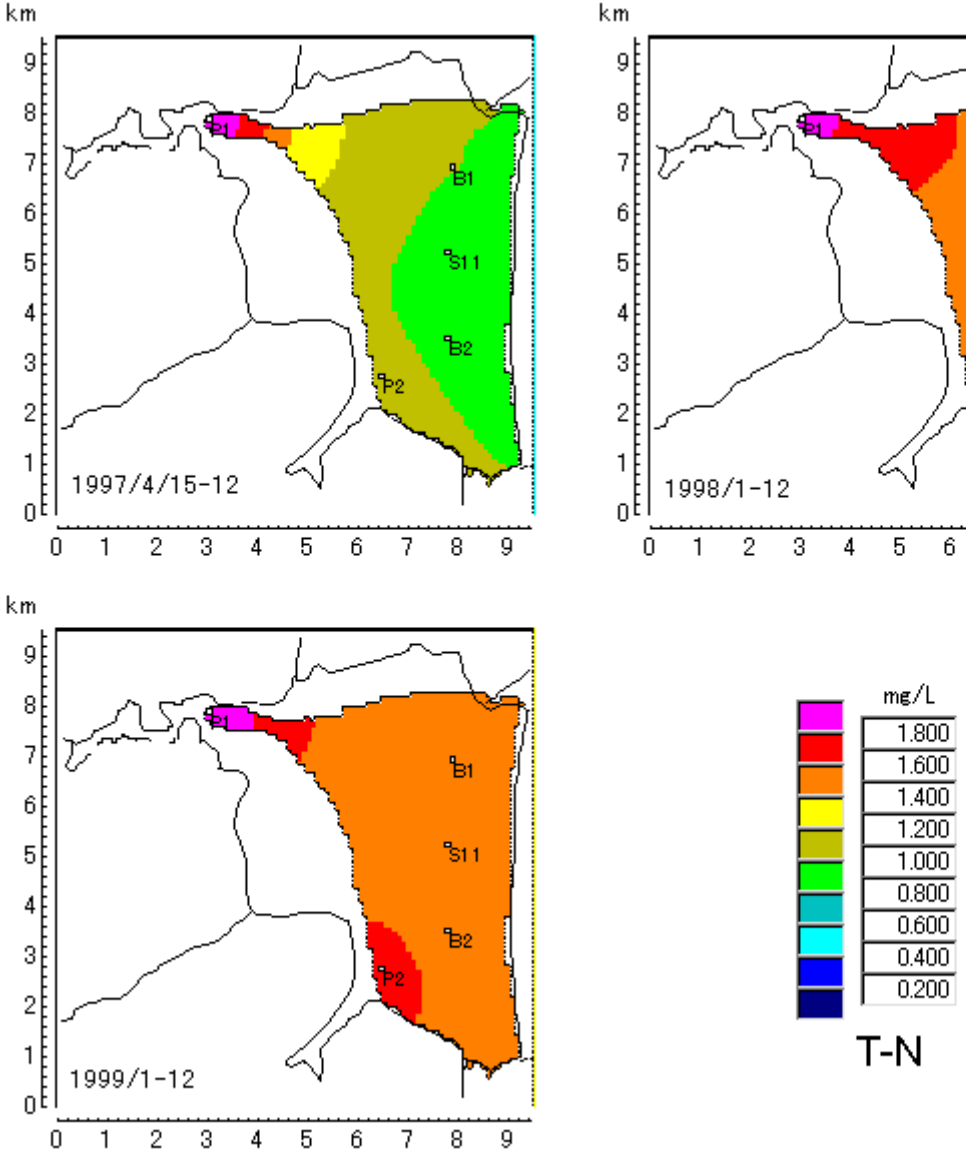




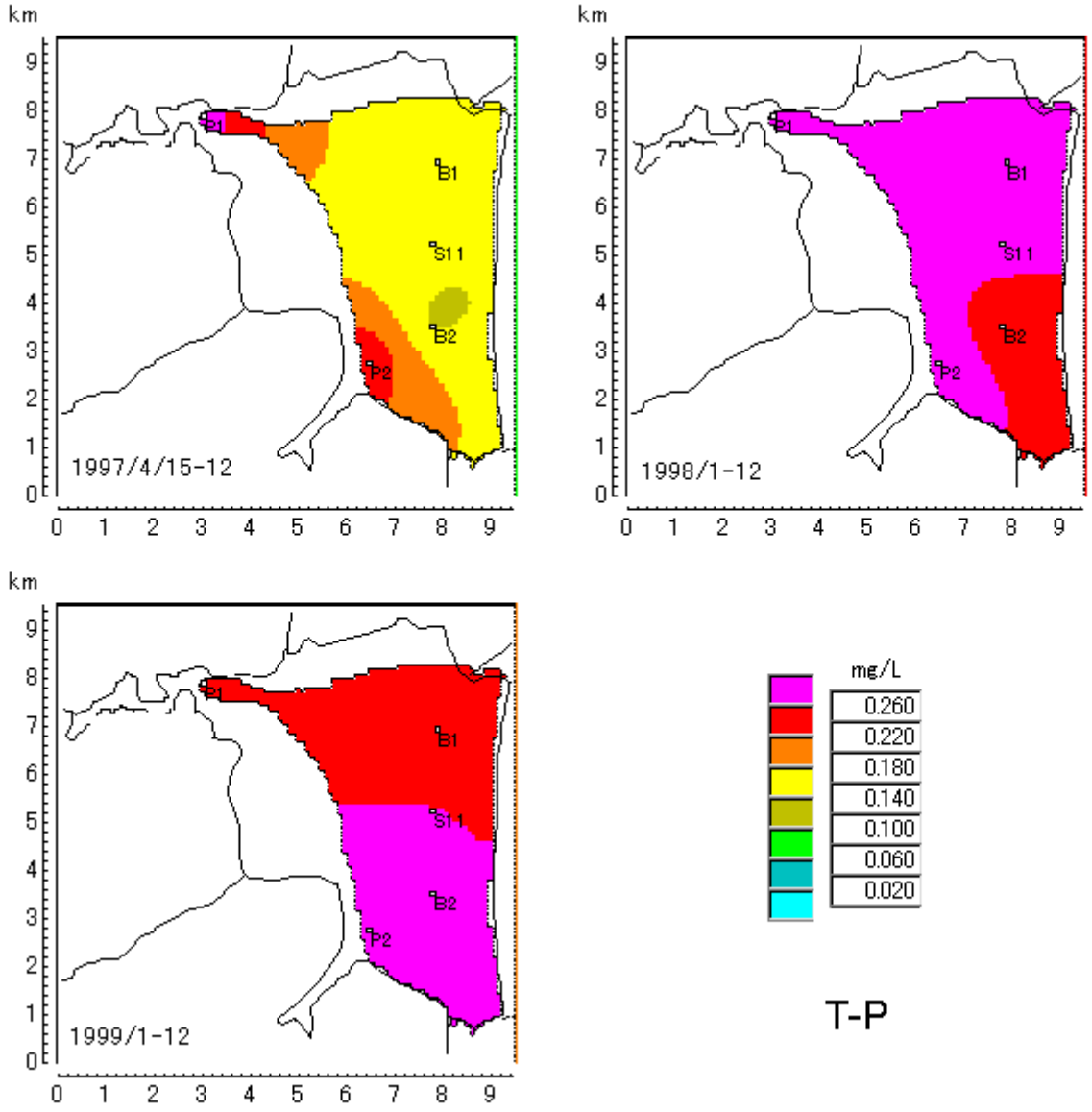
Annual Trend of COD Concentration and its Distribution in Control Pond from 1997 to 1999

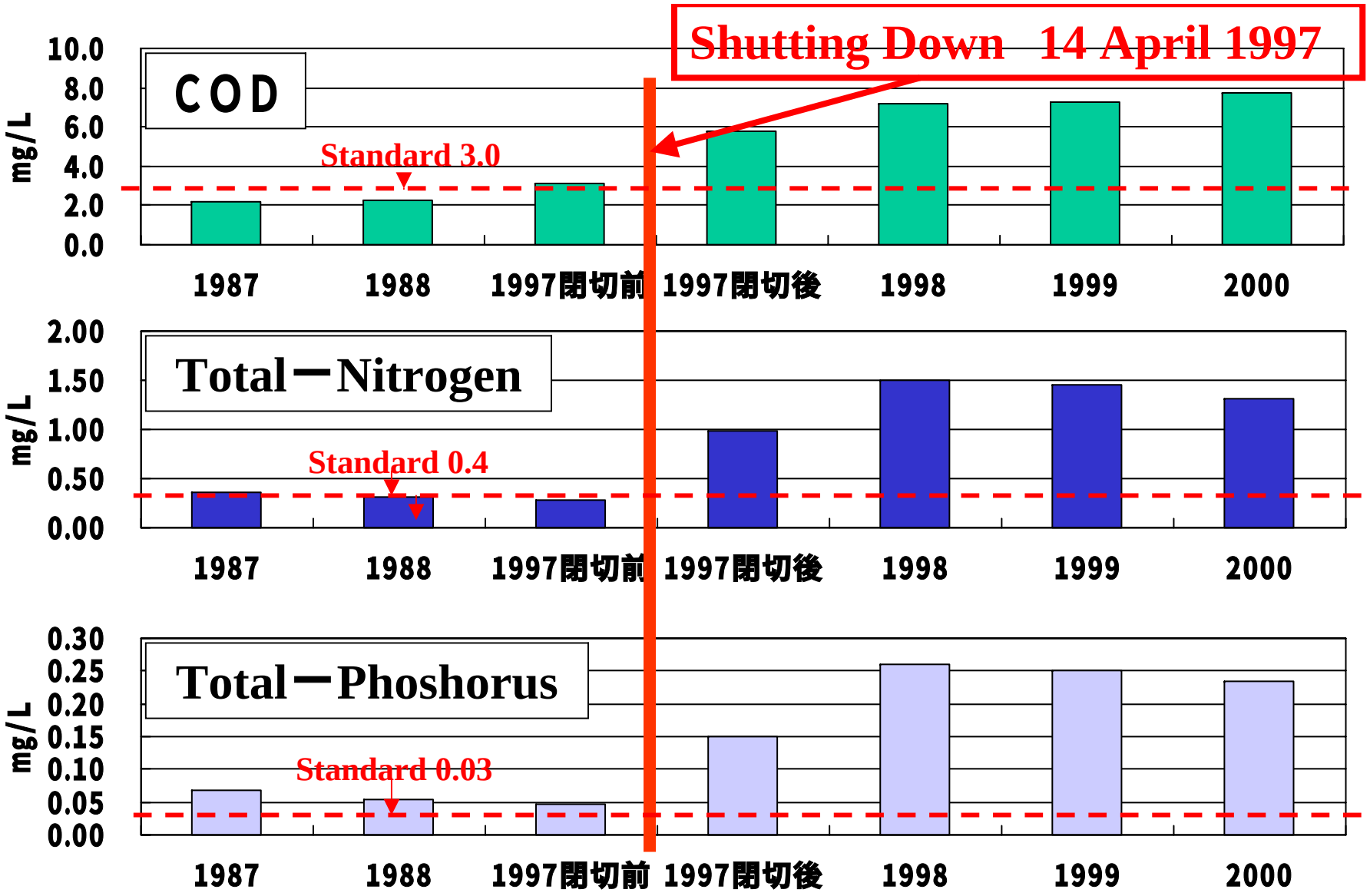


Annual Trend of Total-N Concentration and its Distribution in Control Pond from 1997 to 1999



Annual Trend of Total-Phosporus Concentration and its Distribution in Control Pond from 1997 to 1999





Trend and Change of Water quality for the 3 Pollutants after the shutting of ISAHAYA Bay by the tidal bank construction

Article of Tokyo Shimbun (Tokyo Press)東京新聞 2000年4月14日

諫早湾の衛星画像（1997年5月27日）

長崎県諫早湾で進められている農水省の干拓事業は、湾奥部が通称「ギロチン」と呼ばれる鋼板293枚で閉め切られてから14日で丸3年。この間、堤内の閉鎖性水域となった調整池の水質は環境基準を大きく上回ることが、都内の民間研究所の調査で分かった。汚濁水は水深調整のために月に数回、堤外に排水されており、有明海など周辺海域では、これが原因と思われる漁業被害が出ている。

諫早湾堤防閉め切りから3年

調整池の水質悪化 漁業被害？も

諫早湾奥部の調整池の水質悪化

COD化学的酸素要求量平均値（mg/l）

1997年1～12月

1998年1～12月

1999年1～10月

分析したのは環境問題専門のシンクタンク「環境総合研究所」（東京都品川区、青山貞一所長）。国が堤防閉め切り後の調整池の水質について評価を下さないため、地元住民の依頼を受けて、独自に行った。分析の対象としたのは、堤防閉め切り直前の一九九七年三月から農水省諫早干拓事務所が調整池の五カ所で週一回実施している十三項目の水質モニタリングデータ。九九年十月まで約三年半分、各年ごとに平均値などを算出した。

その数値を、瀬戸内海型の緩やかな環境基準と比較してみると、汚濁度の主な指標で有機物を表す化学的酸素要求量（COD）、T－N（全チッソ）、T－P（全リン）は、九七年にT－Pが一部で基準を満たした以外、どの項目も基準を大きく上回った。

また、事業前に行った環境アセス（影響評価）で算出した予測値を実測値と比較すると、CODは予測値が三・〇ppm前後だったのに対し、実測値は二三倍、T－Nは予測値の約二倍、T－Pは予測値の三－四倍と大幅に超えていた。

さらに、複数地点の濃度データから、エリア全体の濃度を推定する「スプライン補間法」で解析したところ、年を追って調整池の水質が悪化していることが分かった（グラフ参照）。

この水質変化について農水省の構造改善局農村環境保全室は「調整池はまだ造成中で水質評価はできない。調整池の水は干拓地工事が終わっていないために、一時的に汚れているだけ。完成後は環境基準をクリアできる」と説明。

しかし青山所長は「事業前の諫早湾の環境は最高ランクにあった。それだけに、調整池の汚濁が相当に進んでいるのは明らかで、環境アセスの予測値もまったく現状を反映しておらず、信ぴょう性に乏しい」と厳しく指摘する。

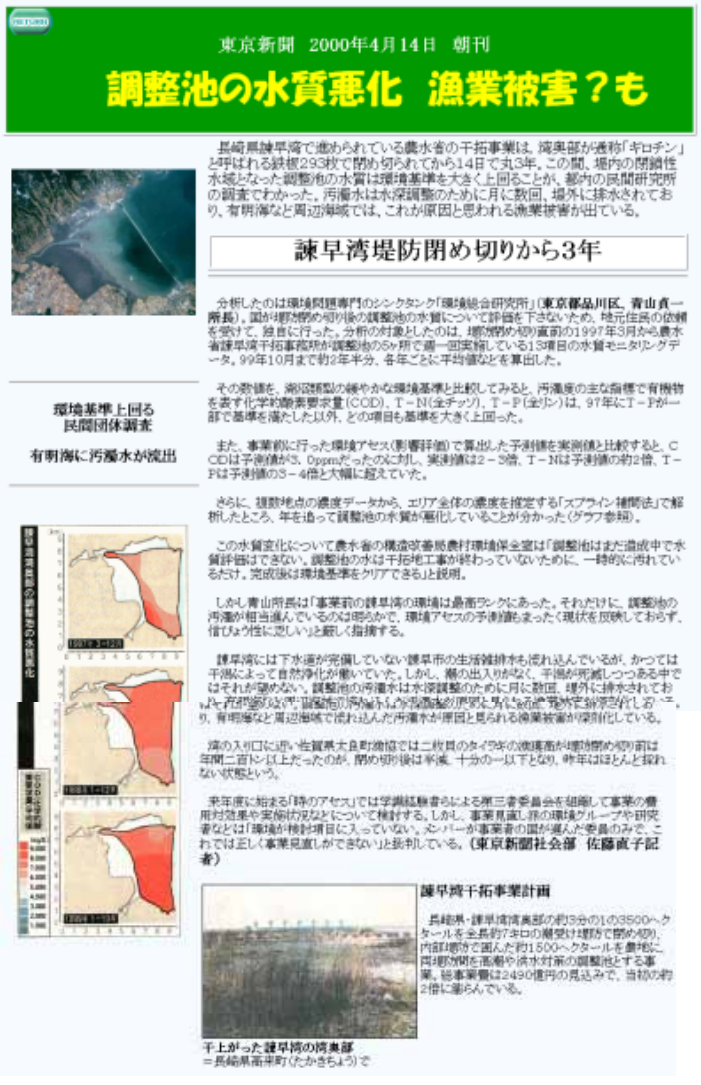
諫早湾には下水道が完備していない諫早市の生活雑排水も流れ込んでいるが、かつては干潟によって自然浄化が働いていた。しかし、潮の出入りがなく、干潟が死滅しつつある中ではそれが望めない。調整池の汚濁水は水深調整のために月に数回、堤外に排水されており、有明海など周辺海域で流れ込んだ汚濁水が原因と思われる漁業被害が深刻化している。

湾の入り口に近い佐賀県太良町漁協では二枚貝のタイラギの漁獲高が堤防閉め切り前は年間二百トン以上だったのが、閉め切り後は半減、十分の一以下となり、昨年はほとんど採れない状態という。

来年度に始まる「時のアセス」では学識経験者らによる第三者委員会を組織して事業の費用対効果や実施状況などについて検討する。しかし、事業見直し派の環境グループや県民会議などは「環境が検討項目に入っていない。メンバーが事業者の国が選んだ委員のみで、これでは正しく事業見直しができない」と批判している。

諫早湾干拓事業計画
・諫早湾湾奥部の約3分の1の3500㌶を全長約7㌔の潮受け堤防で閉め切り、内部堤防で囲んだ約1500㌶を農地に、両堤防間を高潮や洪水対策の調整池とする事業。総事業費は2490億円の見込みで、当初の約2倍に膨らんでいる。

干上がった諫早湾の湾奥部＝長崎県高来町（たかきちょう）で



東京新聞 2000年4月14日 朝刊

調整池の水質悪化 漁業被害？も

諫早湾堤防閉め切りから3年

環境基準上回る
民間団体調査

有明海に汚濁水が流出

諫早湾干拓事業計画

干上がった諫早湾の湾奥部
＝長崎県高来町（たかきちょう）で

www version

Eutrophication and Trend of Decresing of Fishery in ISAHAYA Bay and ARIAKE Sea

■DRAMATIC DECREASE OF of the FISHERY(Fish Harvest)

It was revealed that not only the inner fresh water pond of the shut down **ISAHAYA Bay**, but the sea water quality of the whole **ISAHAYA Bay** and **ARIAKE Sea** had been gradually degraded after the construction of the tidal bank.

This severe water quality damage caused the sudden **decrease of the fishery** in **ISAHAYA Bay** Area.

Eco-System Damage Mechanism by Eutrophicaion

干拓事業工事による富栄養化と海洋生態系への影響

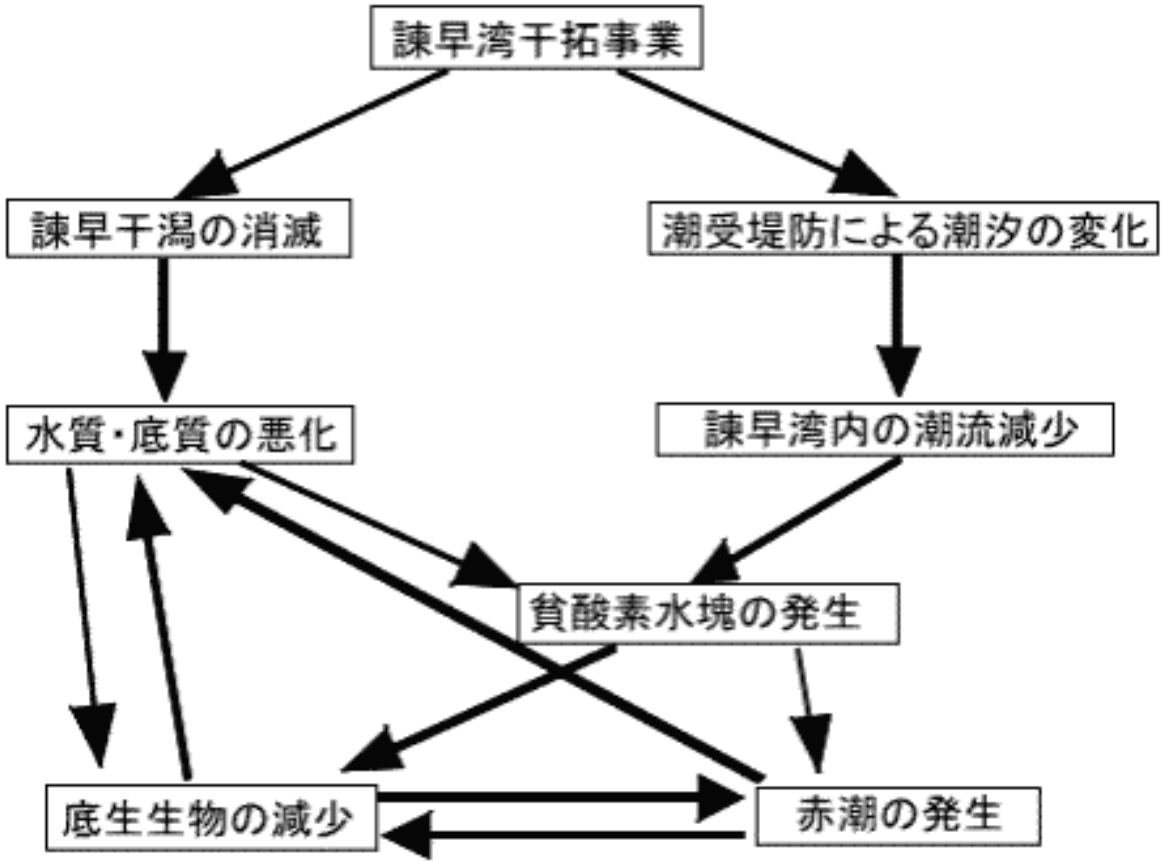
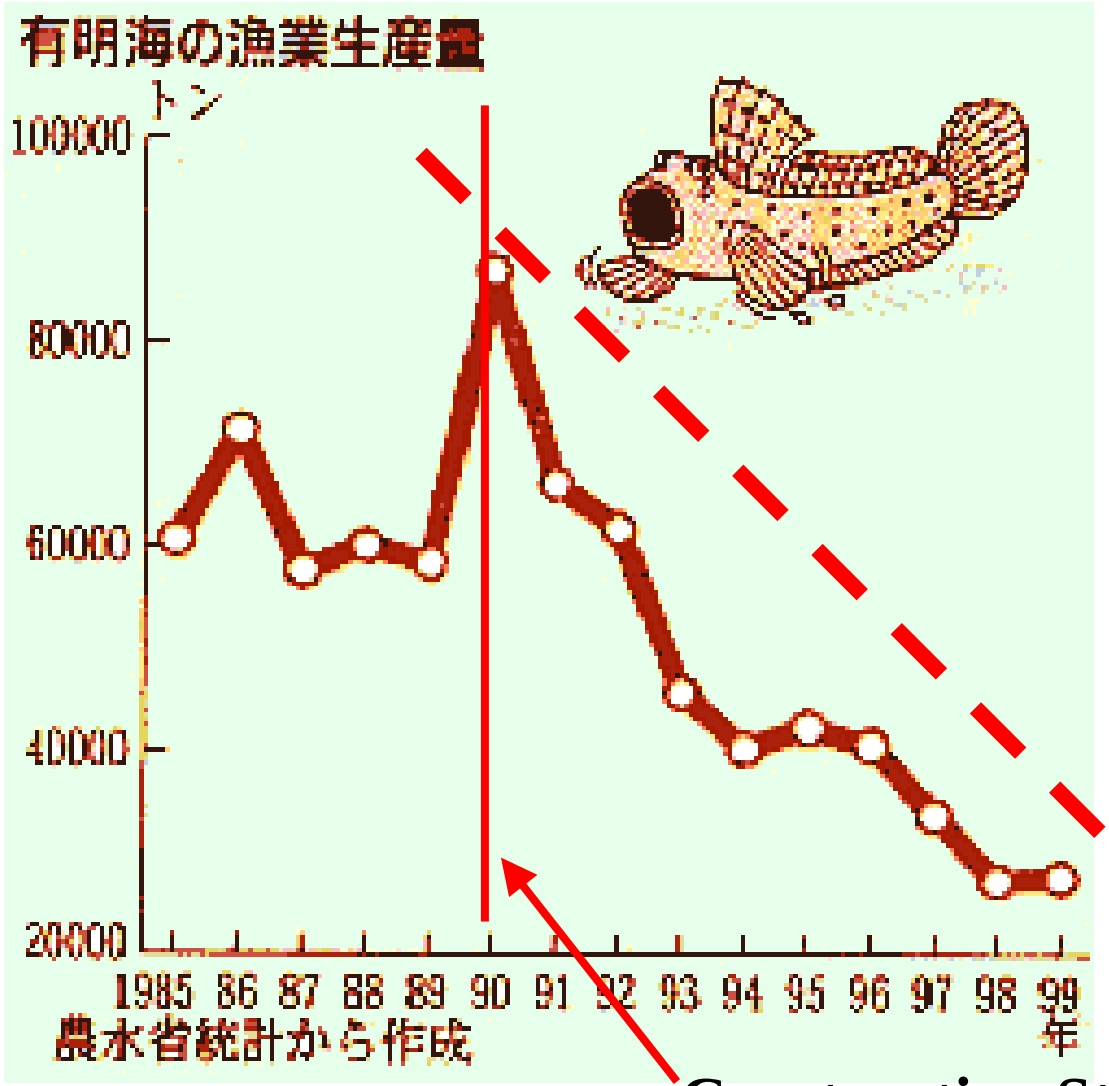


図4. 諫早湾内の環境変化の相互関係

■ SHORTAGE of OXYGEN)
(oxygen-deficient water)
of ISAHAYA BAY

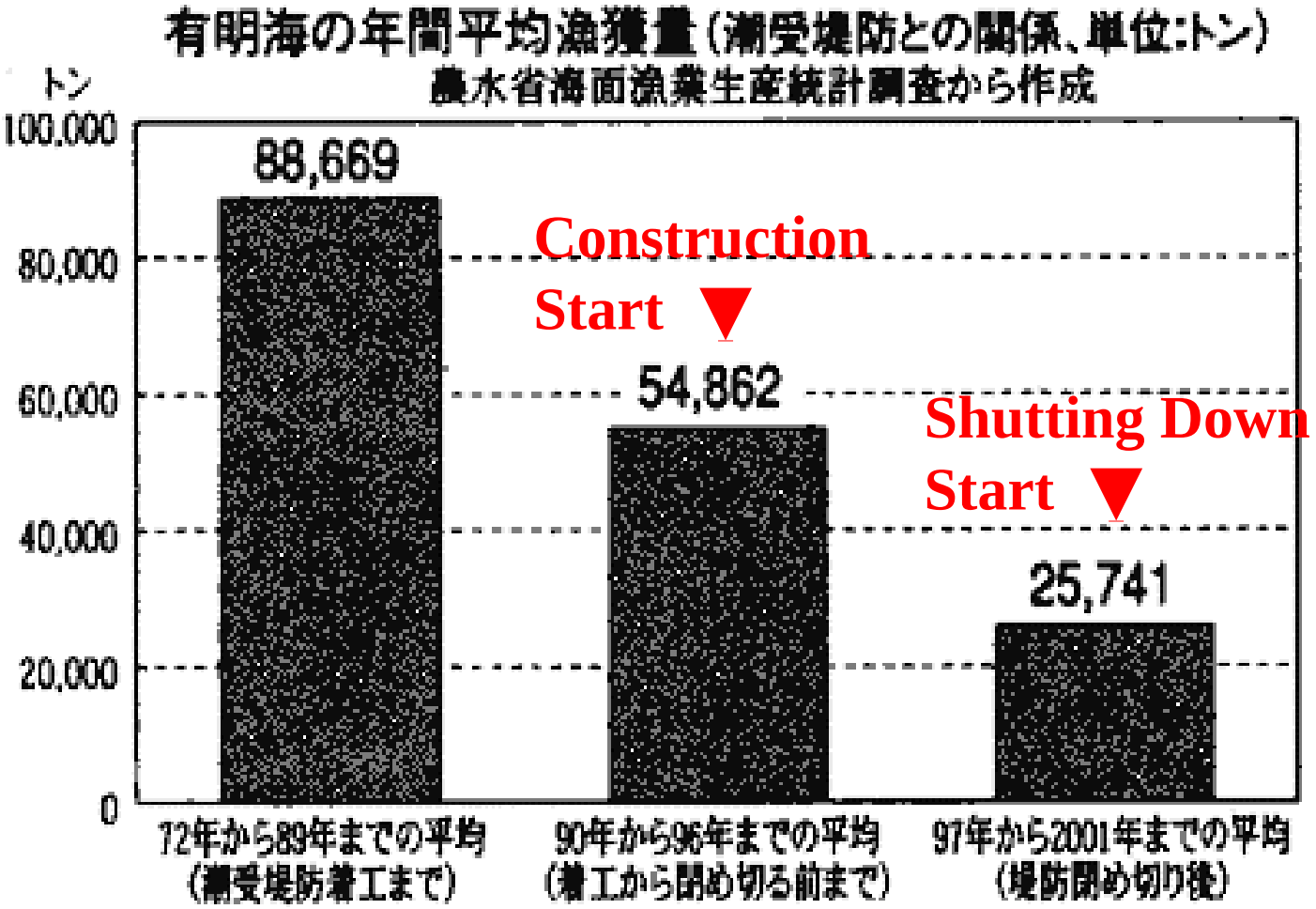
In addition to that the sand and gravel digging
caused the shortage of oxygen (oxygen-deficient water)
at the bottom of the **ISAHAYA Bay**. 貧酸素化

Trend of Fishery in ISAHAYA Bay from 1985 to 1999

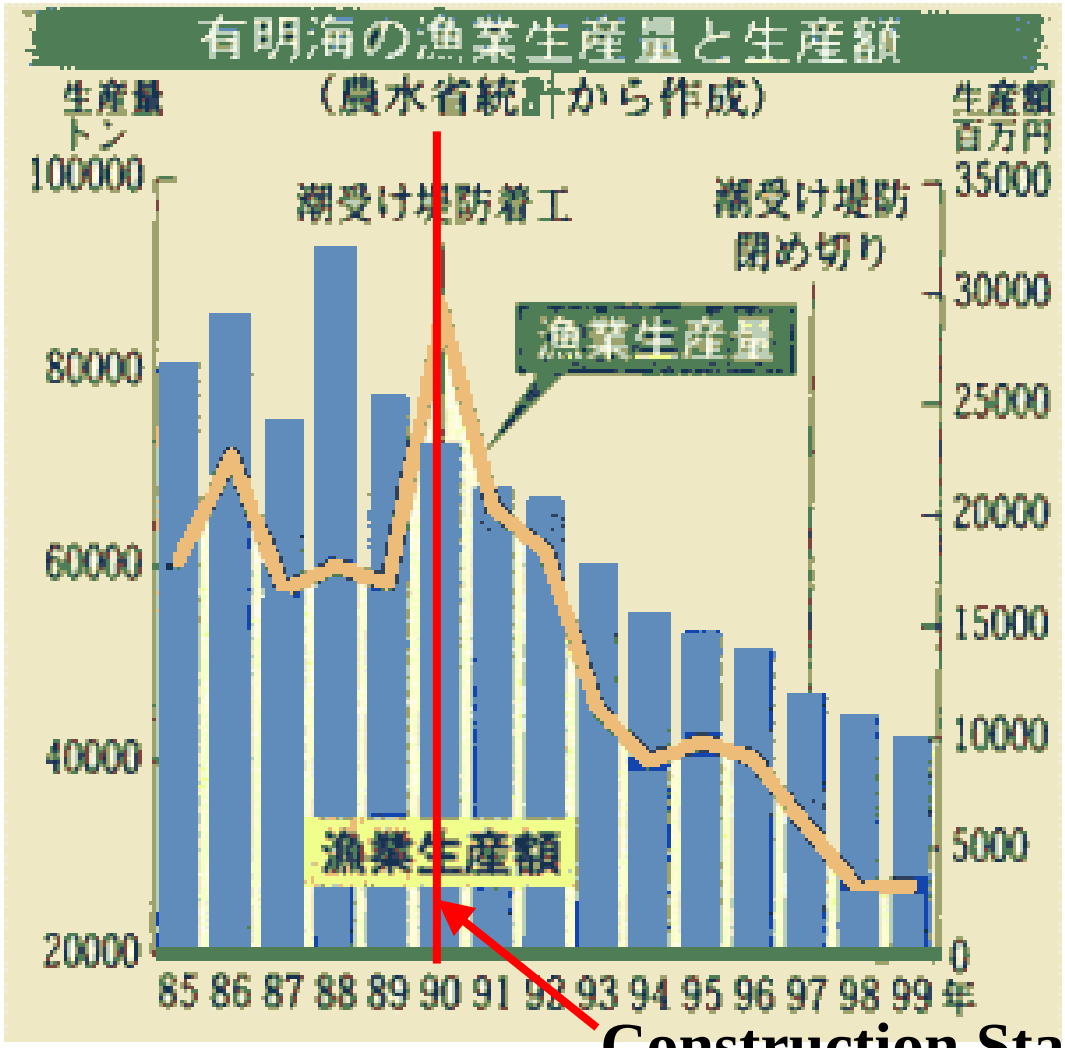


ムツゴロウ

Trend of Fishery in ISAHAYA Bay
Before and After
of Construction and Shutting Down

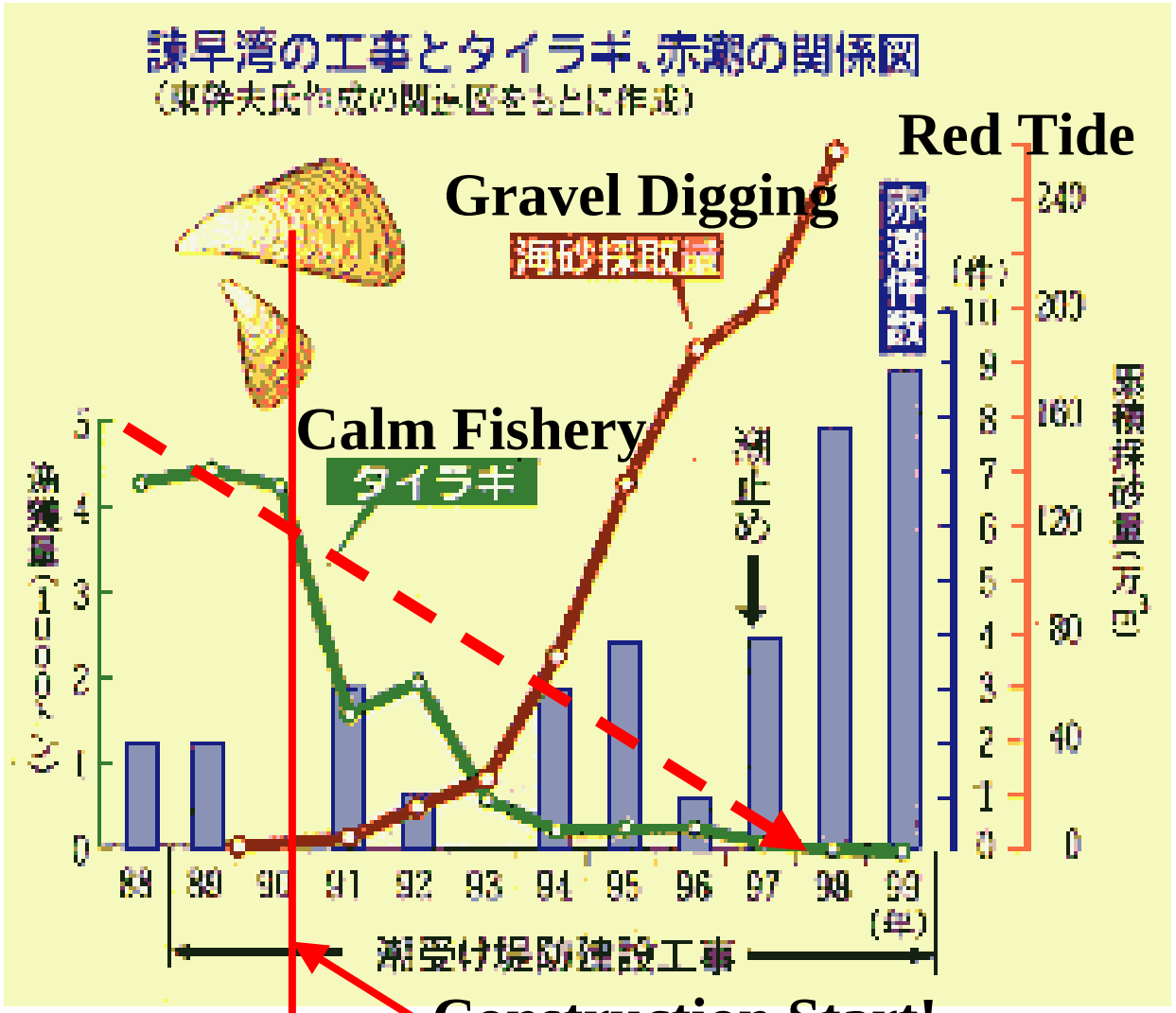


Trend of Fishery in ISAHAYA Bay from 1985 to 1999



Question in Diet
On Fishery Decrease

Trend of Shell (Tairagi) in ISAHAYA Bay from 1988 to 1999



Calm(Tairagi)
タイラギ

■DAMEGE OF the LAVER(SEAWEED) of ARIAKE Sea

Further, the cause and effect concerning the damage of the **laver(seaweed)** cultivation had also been a big controversy in the northern part of **ARIAKE Sea**.

All of these damage were caused by the constant outflow of various pollutants from the fresh water pond (artificial lake) into **ISAHAYA Bay**, which brought about **eurtrophication** and caused the damage on ecosystem of the whole bay.

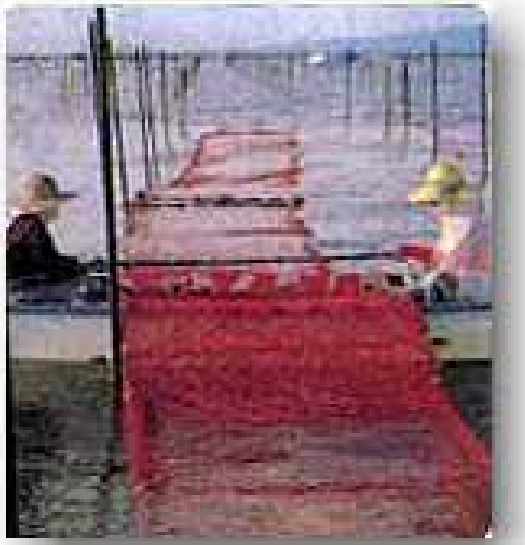
ARIAKE Sea in Kyusyu Island

Sourece: Nagasaki Bunka Hosou

有明海の海産物への影響

ノリの色落ち

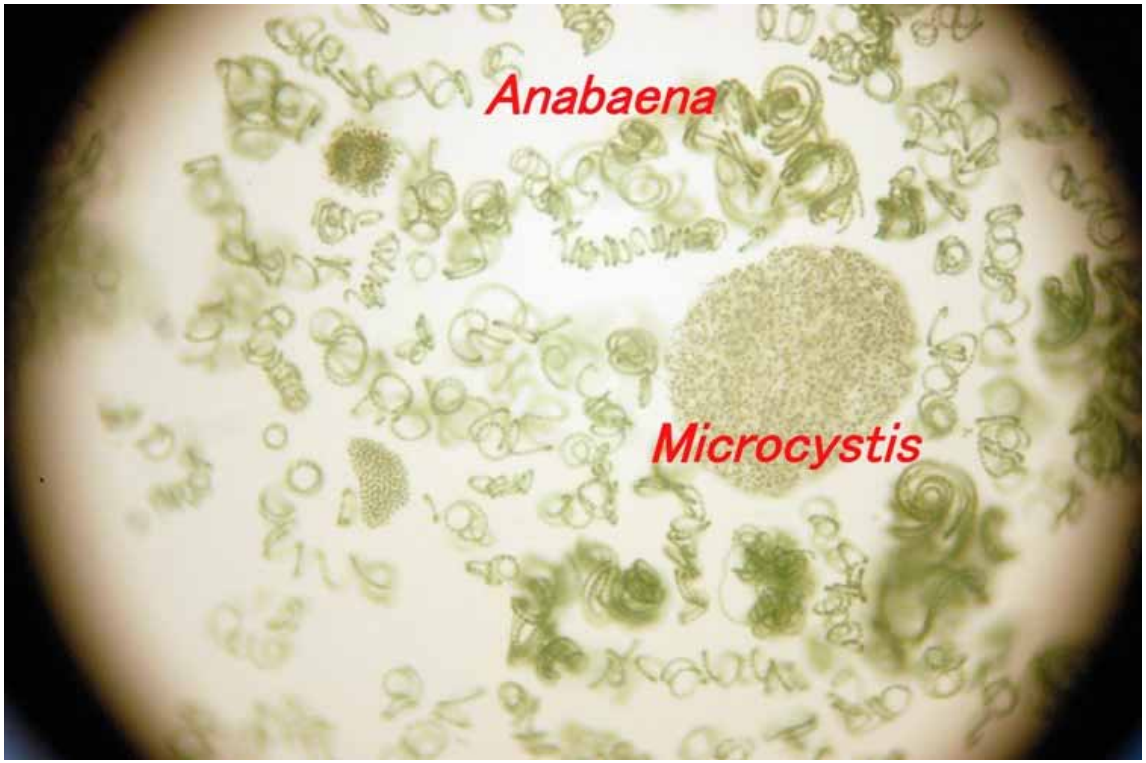
有明海の海苔への影響



Blue-green algae(Water-bloom)

アオコの顕微鏡写真

Anabaena and Microcystis



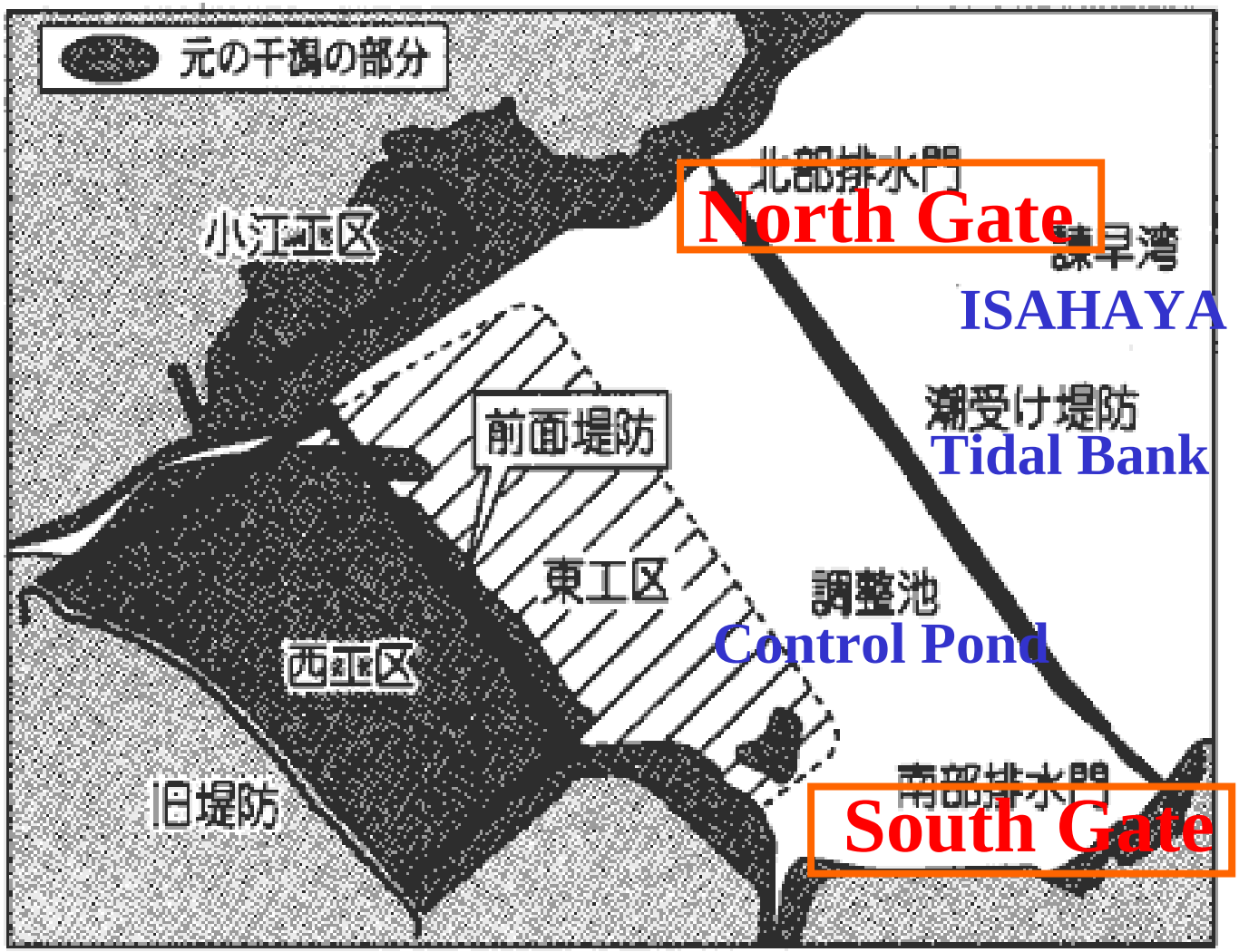
Agricultural Chemicals, Herbicide, and Insecticide Scatter in ISAHAYA Reclamation Land

Fishermen
Strongly Protest
Against
Ministry of Agriculture

After those serious situation, the fishermen of the **ISAHAYA Bay** and north of **ARIAKE Sea** area insisted that the damage was mainly caused by the dam (tidal bank) construction and strongly requested and protested against Ministry of Agriculture to keep **2 water gates** of the tidal bank **open permanently**. The fishermen's protests had escalated to file an administrative lawsuit against the National Ministry.

Fishermen's Protest Against Ministry (Developer) in ISAHAYA area

■ISAHAYA Bay Reclamation Project Plan
Its Phisical Features



Fishermen's Protest Against Ministry (Developer) in ARIAKE SEA

Fishermen's Protest Escalated to Administrative Lawsuit Against Ministry of Agriculture

Notice of
Administrative Lawsuit
Against Ministry of Agriculture

Second ENVIRONENMTAL ADVOCACY

How can Improve
the quality of Water
by keeping
the Water Gates Open ?

First, **we have started the preparatory research on how can improve the quality of water by keeping the water gates open since the tidal bank construction.**

Actually, *we have applied the 3 dimensional multi-layer tidal simulation model* developed by ***Environmental Research Institute Inc. (Director Teiichi AOYAMA)***, and simulated the change of tidal current by the opening of the water gates.

Because, the tidal current is one of the major control element of the water quality in the whole bay.

■Purpose of the GATE OPEN SIMULATION

That is, we were focusing on the facts that the tidal current and its speed was changed tremendously and caused the water quality deterioration by the shut down of ISAHAYA Bay by the tidal bank construction, we have forecasted and evaluated the improvement of water quality in case of opening of the water gates.

Here, we evaluated whether it is possible to recover the tidal speed from the zero situation caused by the dam (tidal bank) construction, based on the principle of **C = a · Q/S**.

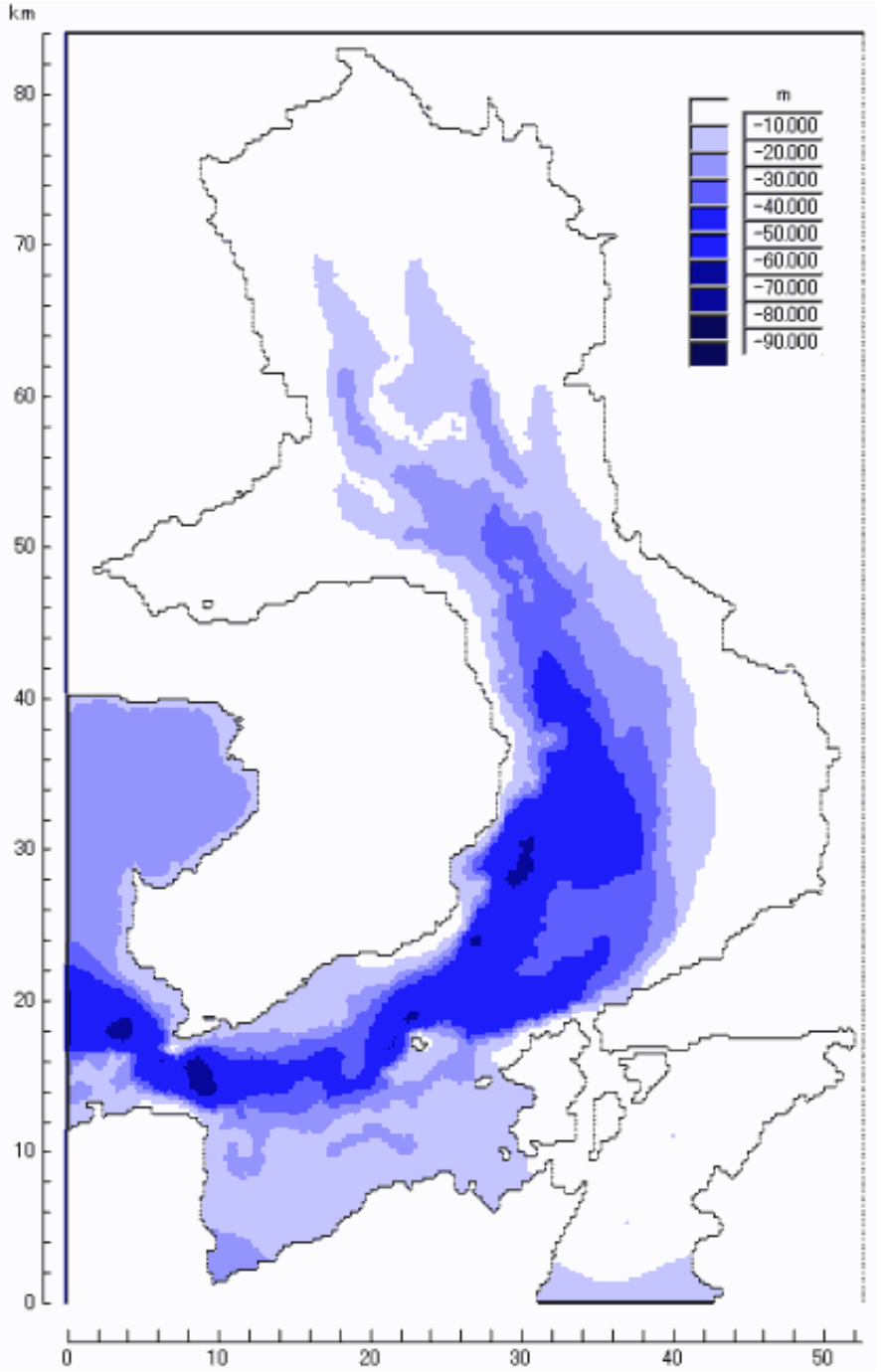
This is the physical dispersion phenomenon that the pollution concentration of the same monitoring point (C) is inverse proportion to the tidal speed (S) under the condition of the same inflow emission quantity (Q).

Tidal Current Simulation

Phase 1:
Pre-Conditions Setting

Target Sea Area of the Tidal Simulation

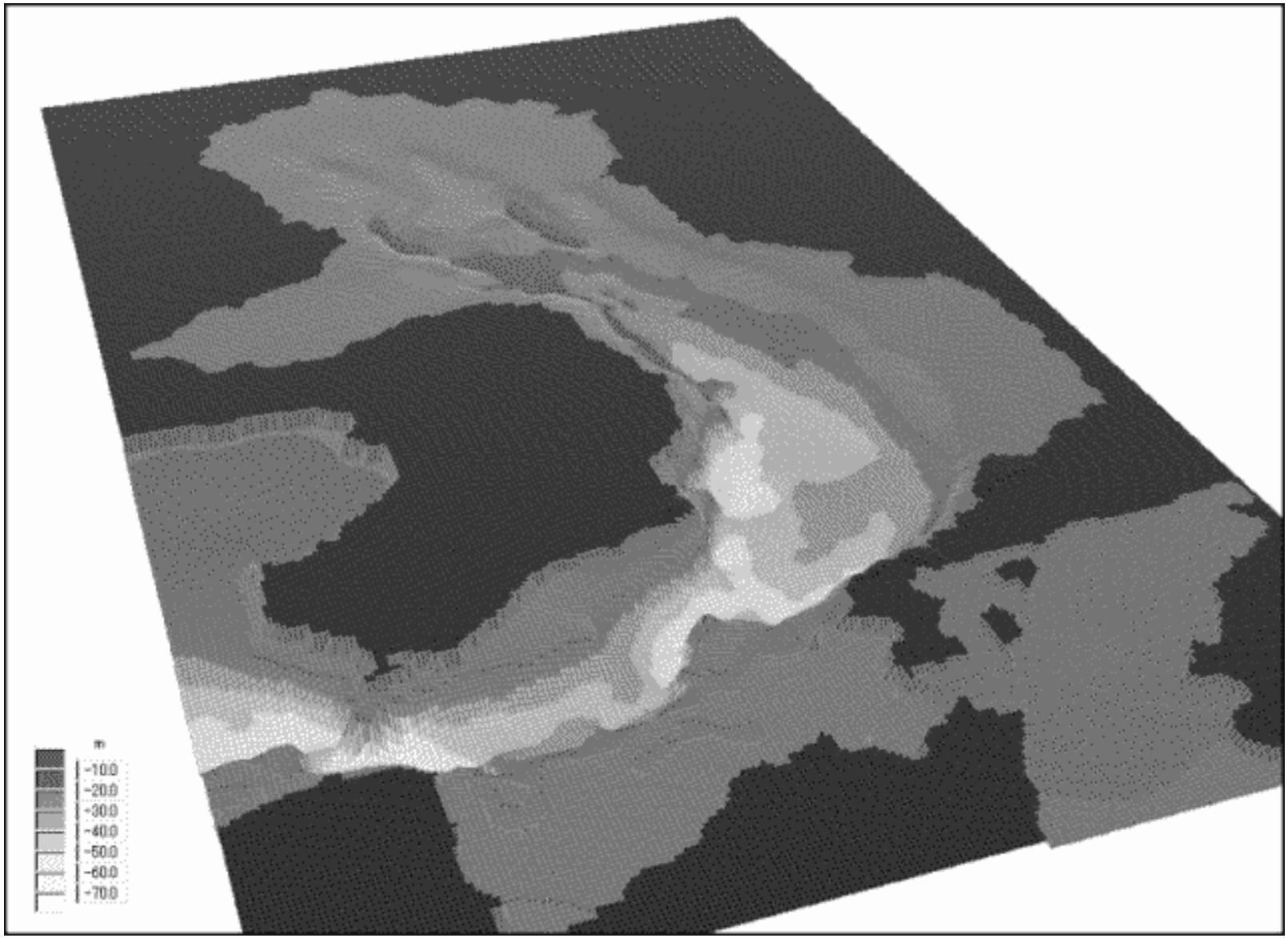
有明海
シミュレーション調査
対象範囲



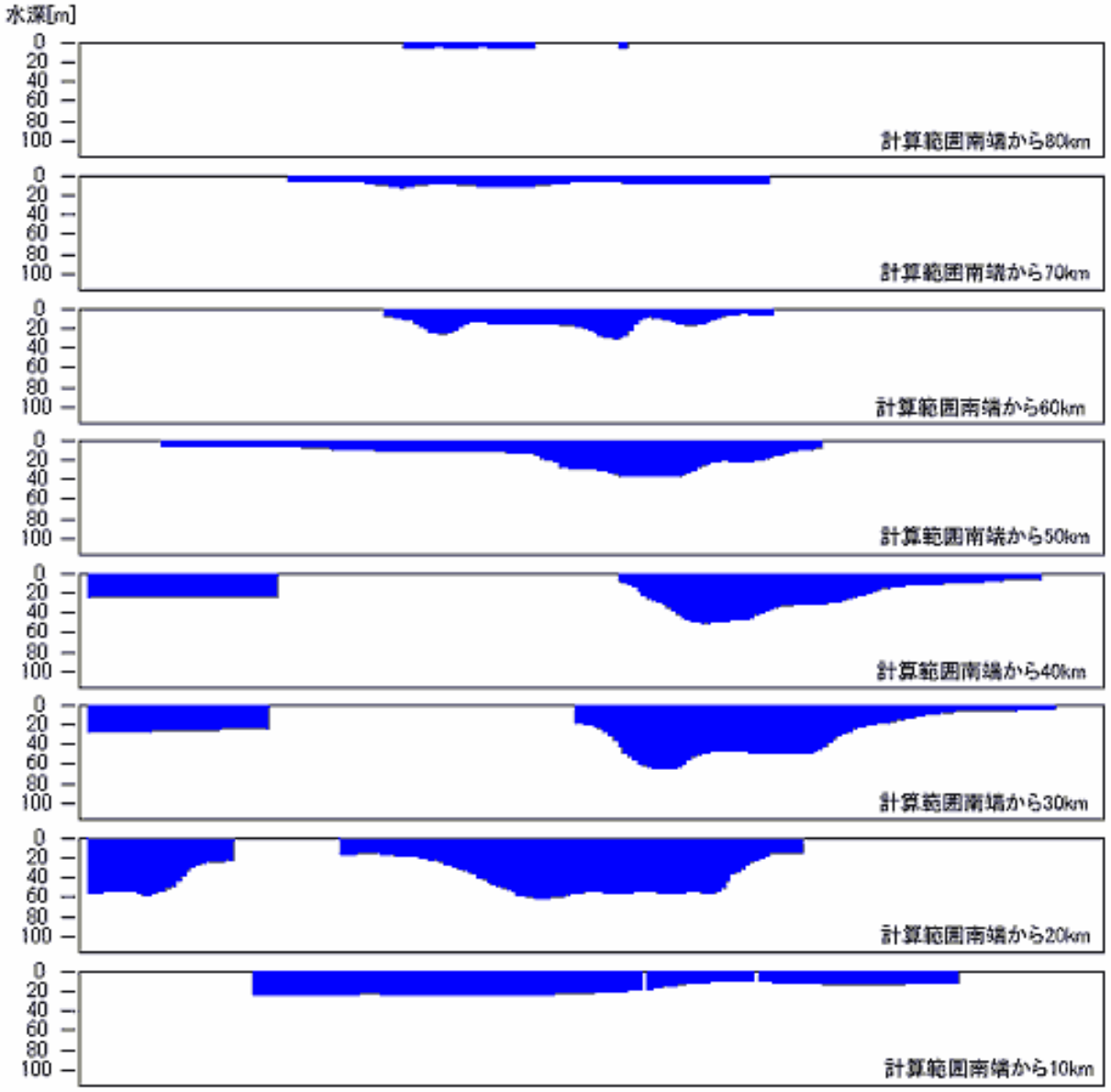
Oceanic Geographical Features of the Tidal Simulation

有明海
海洋地形平面図

3 Dimensional Oceanic Geographical Features of the Tidal Simulation 有明海海洋地形立体図

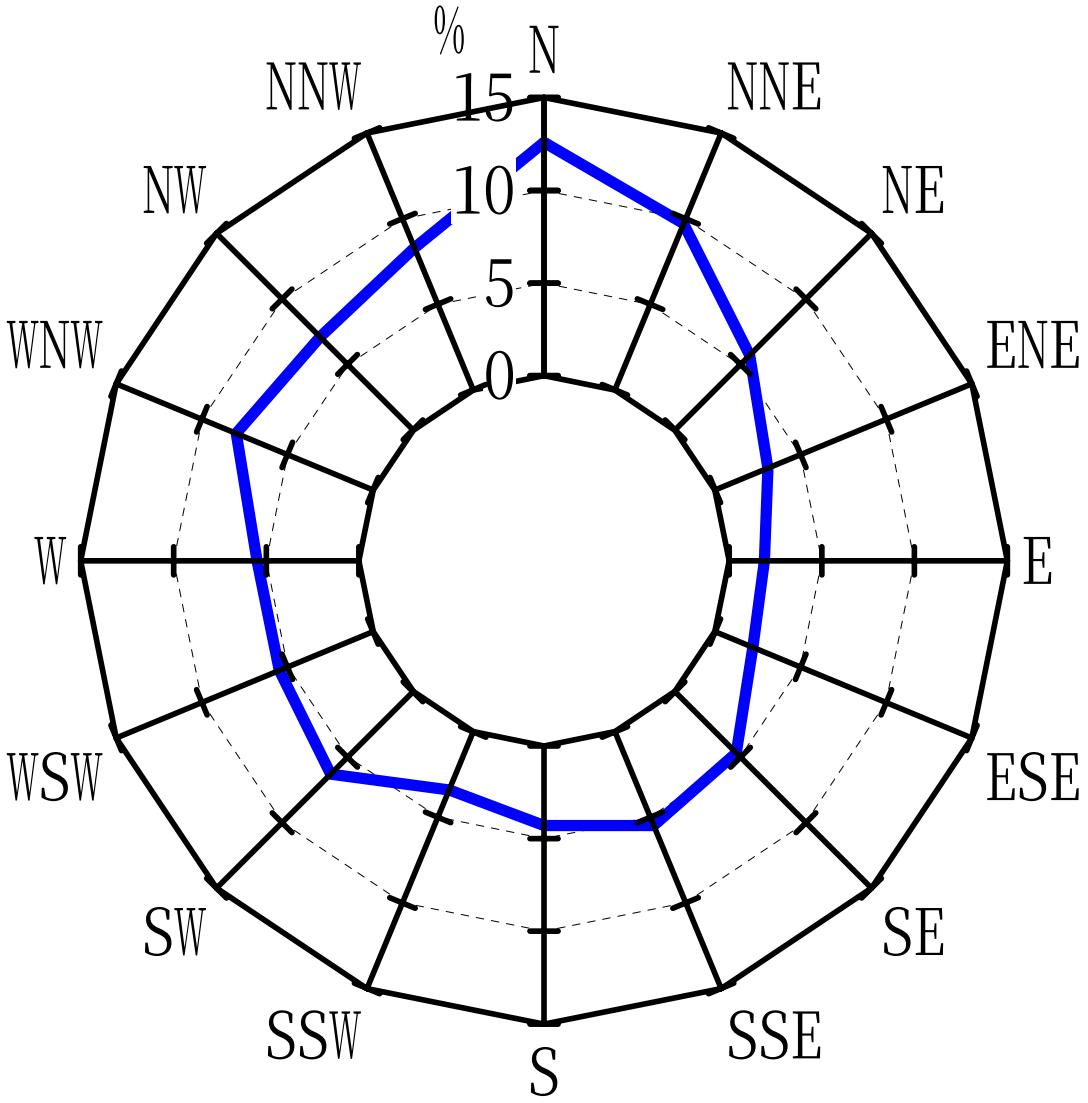


Oceanic Geographical Cross Section features of the Tidal Simulation　有明海海洋地形断面図



Wind Rose on ARIAKE Sea(Omuta City) in 1998

大牟田市（有明海側）１９９８年度年間風配図



■30 SIMULATION CASE SETTING

We have done the following cases of the tidal current simulation;

The difference between before and after the construction of the dam (tidal bank shut down)

(2) The difference between shutting and opening of the water gates of the tidal bank.

(3) The difference between high tide and low tide(ebb tide)

(4) The difference between the spring tide and the neap tide.

Table-1 shows the matrix of the different simulation cases.

30 Simulation Cases Setting

		大潮		中潮		小潮	
		干潮	満潮	干潮	満潮	干潮	満潮
ケース 1	諫早湾干拓工事前	○	○	○	○	○	○
ケース 2	諫早湾潮受け堤防工事後（閉め切り後）	○	○	○	○	○	○
ケース 3	諫早湾潮受け堤防水門開放						
3-1	①北水門のみ開放	○	○	○	○	○	○
3-2	②北水門及び南水門の両方を開放	○	○	○	○	○	○
3-3	③両門の中間にさらにひとつの水門を空けた場合	○	○	○	○	○	○

■We have done all the simulation cases

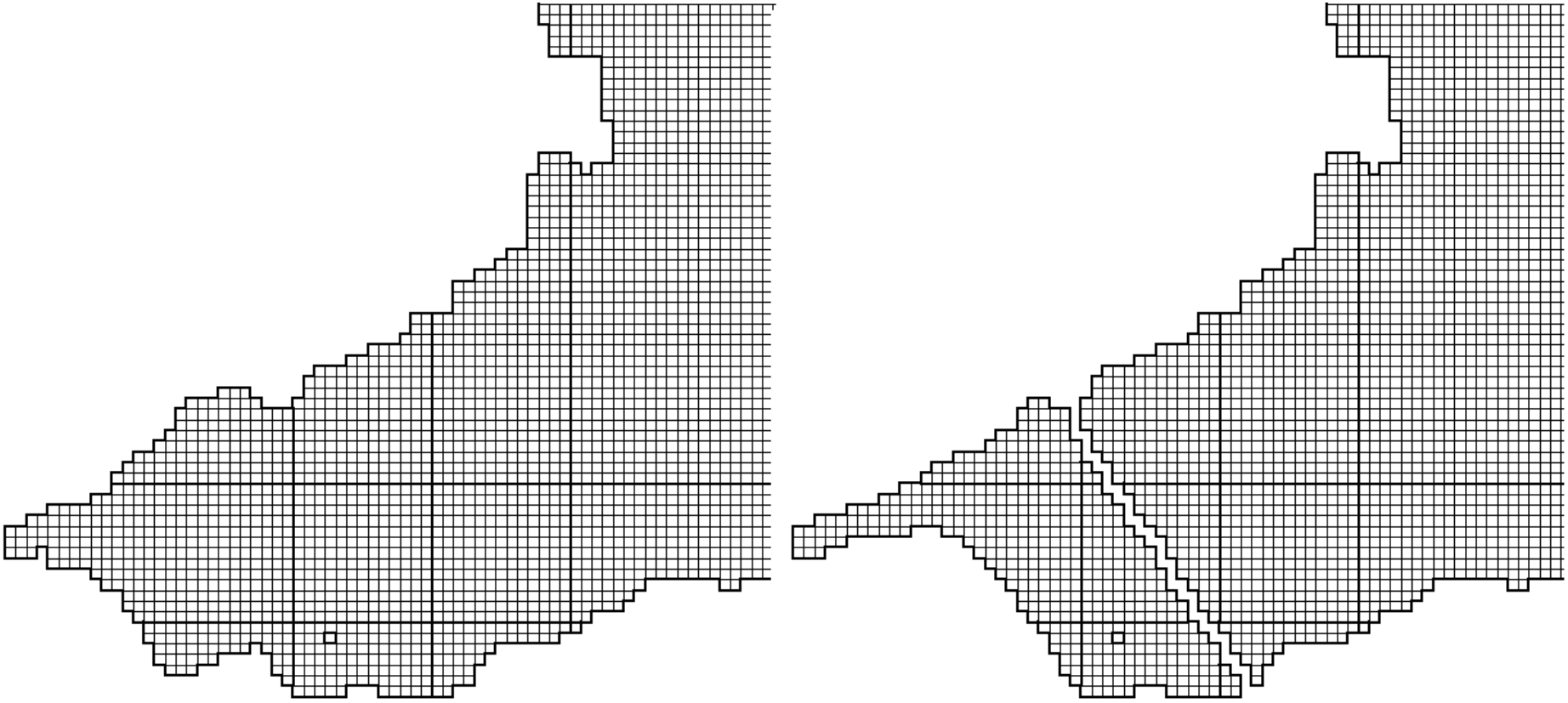
shown in previous Table-1 not only for ISAHAYA Bay, but for whole ARIAKE Sea.

Since ARIAKE Sea is shallow and semi-closed water area, the tides (the difference of the rise and fall of the sea level) of ISAHAYA Bay is so high.

] Therefore, it is necessary to simulate for targeting whole ARIAKE Sea in order to forecast the tidal change of the ISAHAYA Bay.

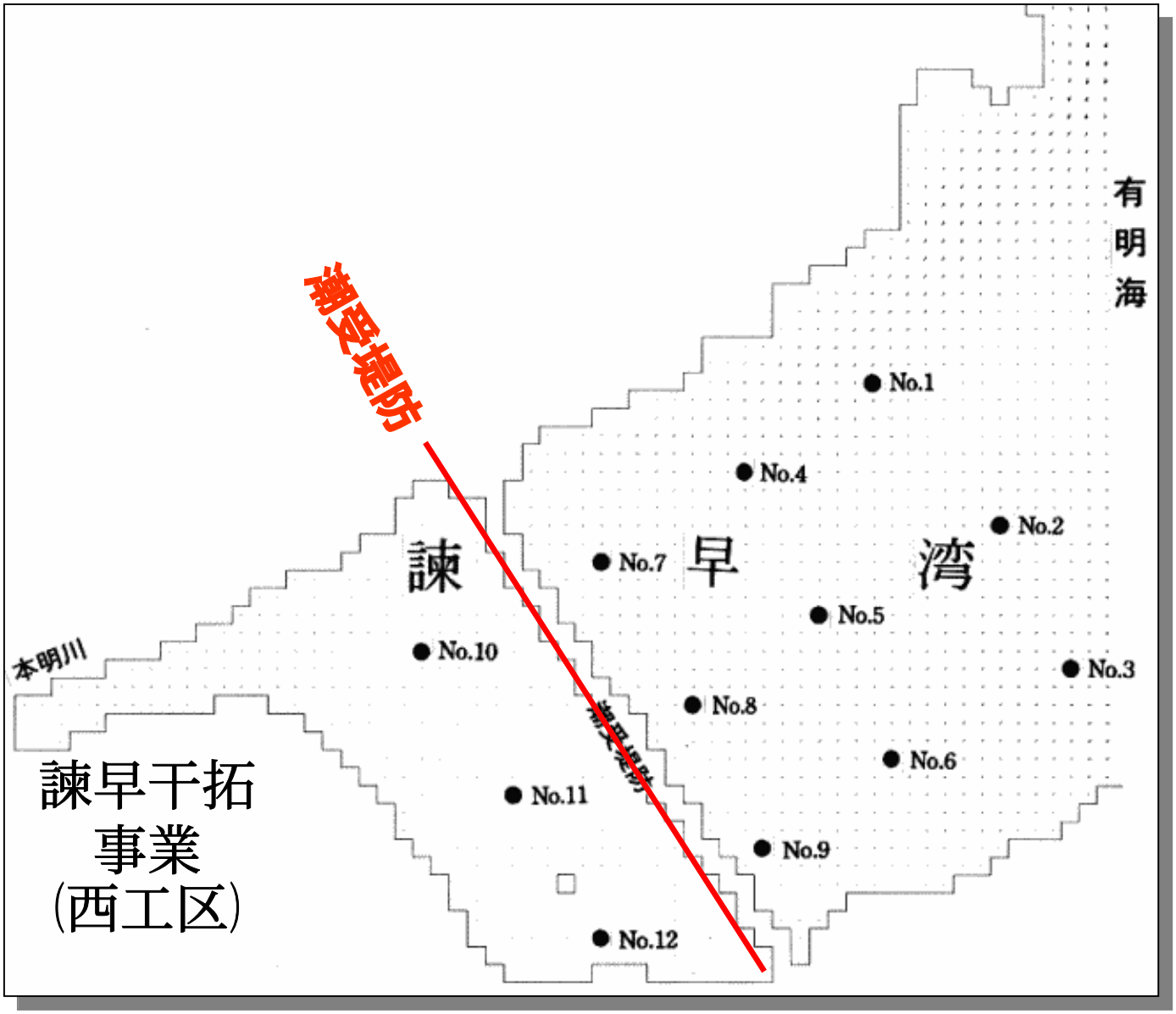
Grid Modeling of the Simulation

格子モデル（左：潮受堤防工事前、右閉切後）



Evaluation Point of Tidal Speed and Direction

諫早湾における潮流流速の評価ポイント



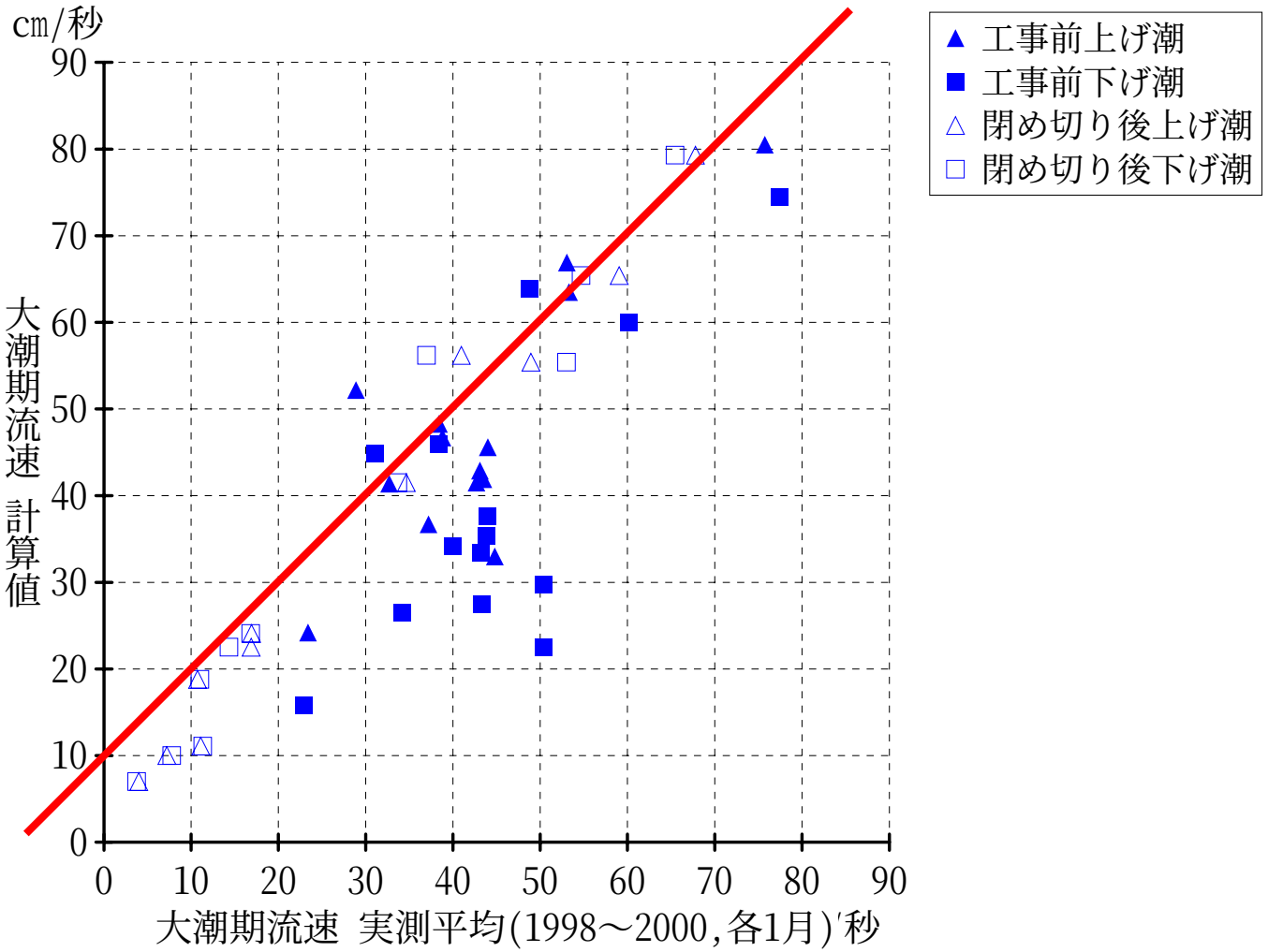
Tidal Current Simulation

Phase 2:
Reproduction Analysis

Reproduction analysis before 30 case

Simulation現況再現：流速の実測値と計算値の比較

(工事前後：大潮期、上げ潮・下げ潮最強時)

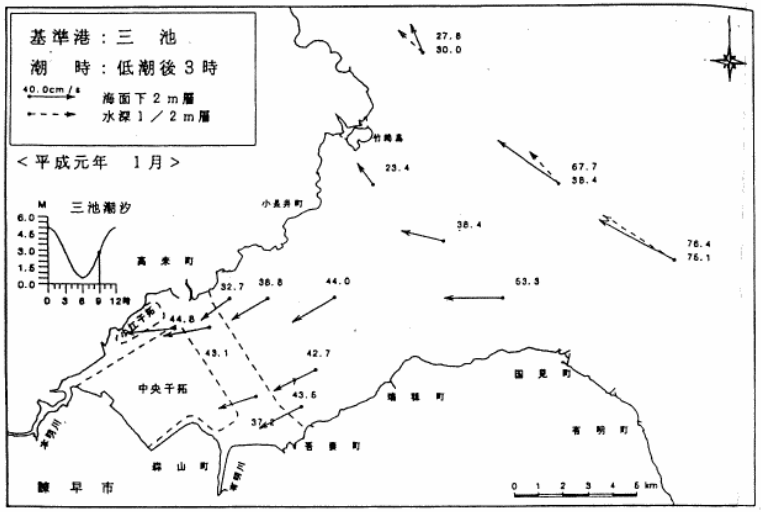


Survey Data of Tide in the Isanaya bay

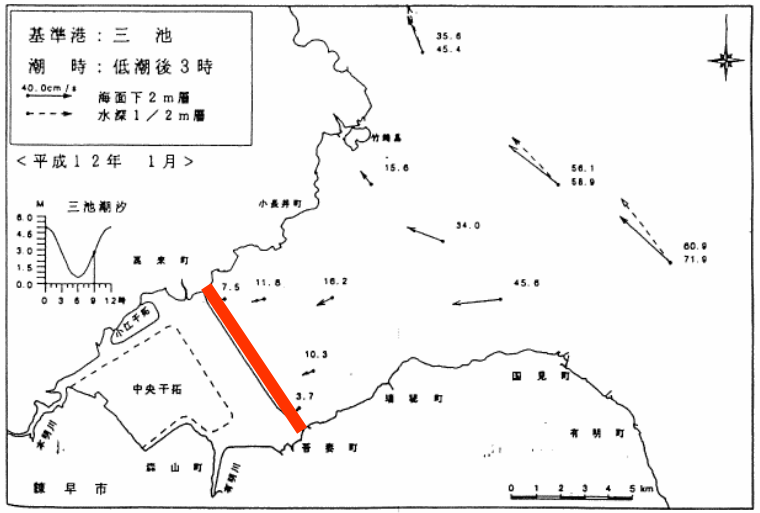
流況実測図（大潮時）

工事前　　**閉め切り後**

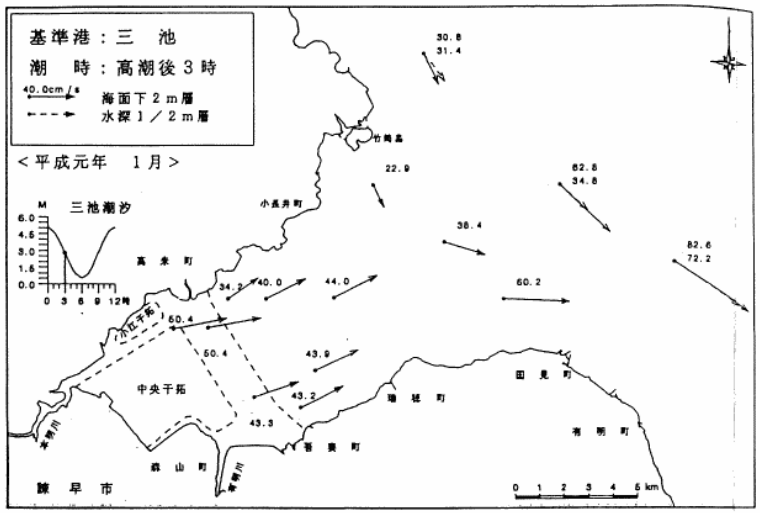
上げ潮最強時：平成元年1月



上げ潮最強時：平成１２年1月



下げ潮最強時：平成元年1月



下げ潮最強時：平成１２年1月

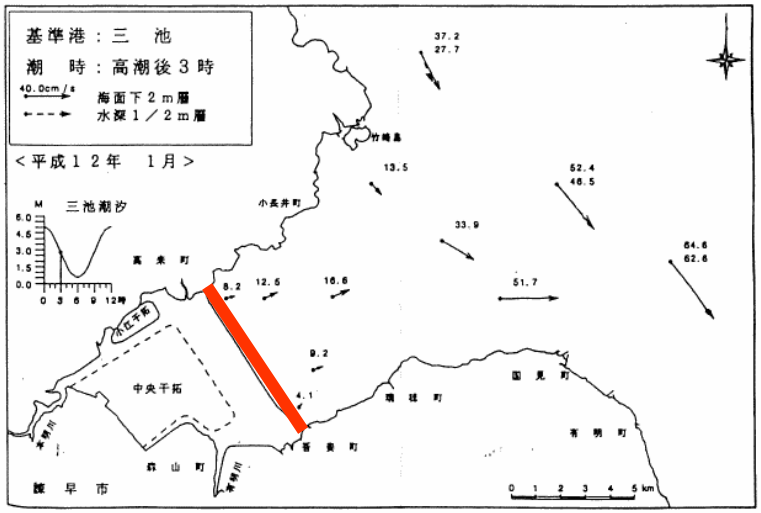


Image of Tidal Current Simulation
潮流シミュレーションイメージ

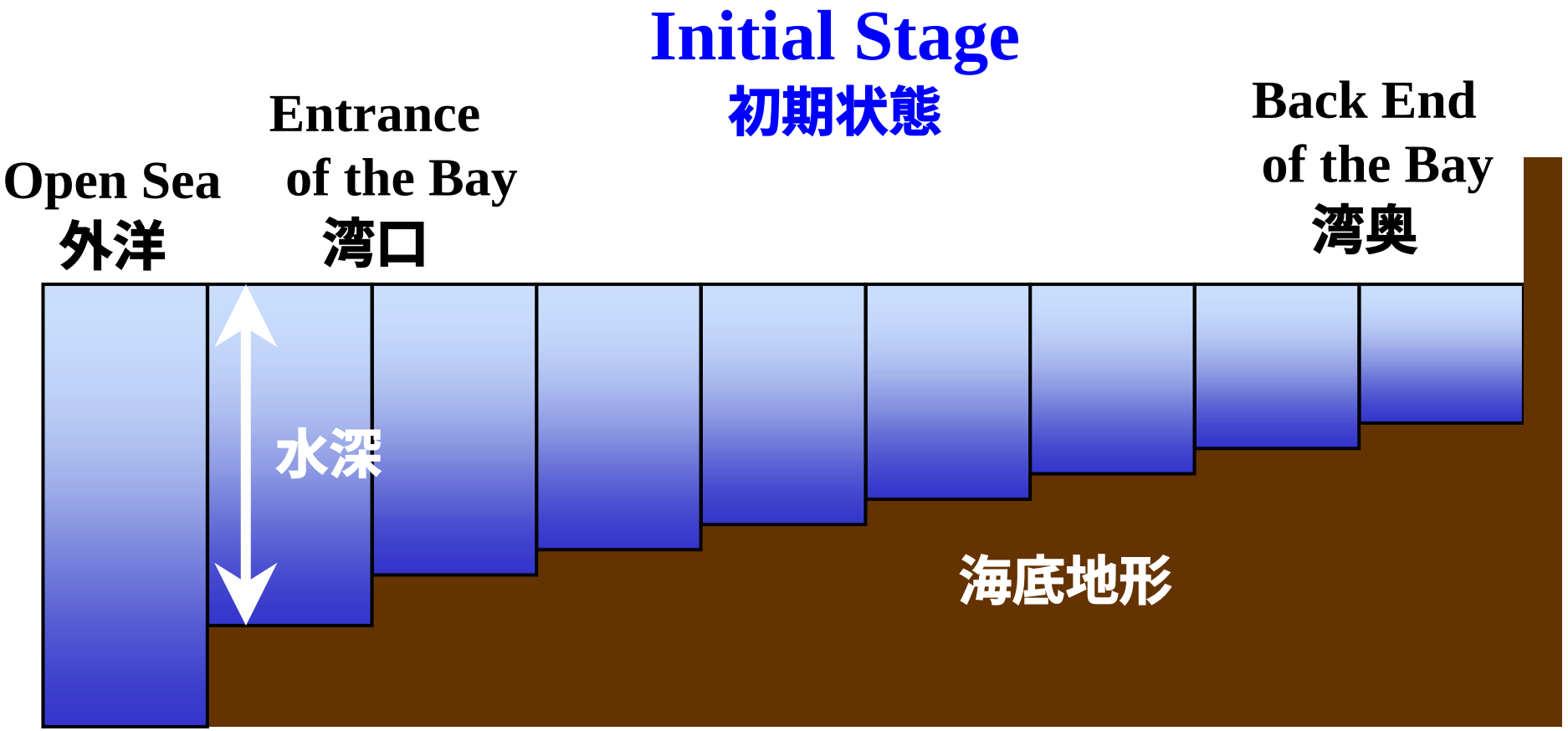


Image of Tidal Current Simulation
潮流シミュレーションイメージ

外洋部分に潮汐による変化を与える

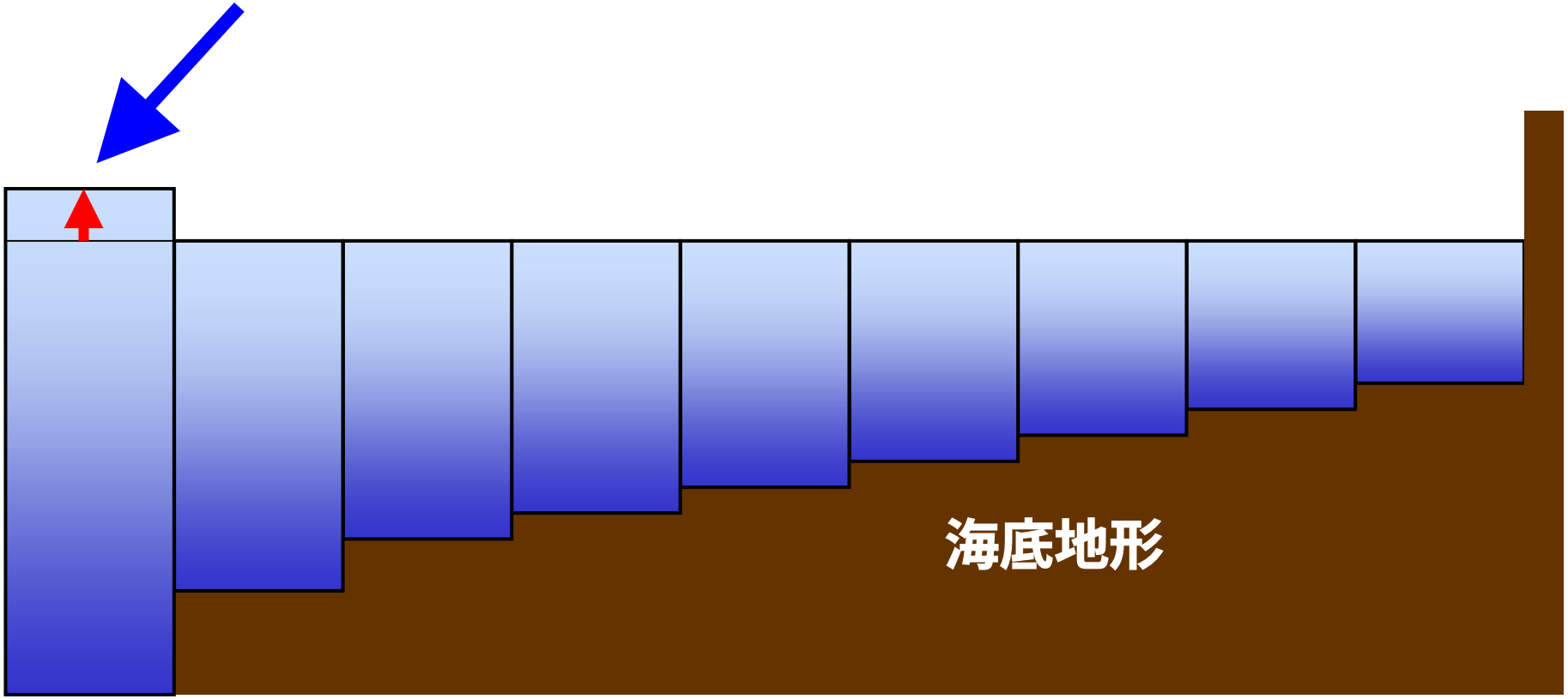


Image of Tidal Current Simulation
潮流シミュレーションイメージ

物理法則に従って水が移動し水位が変化

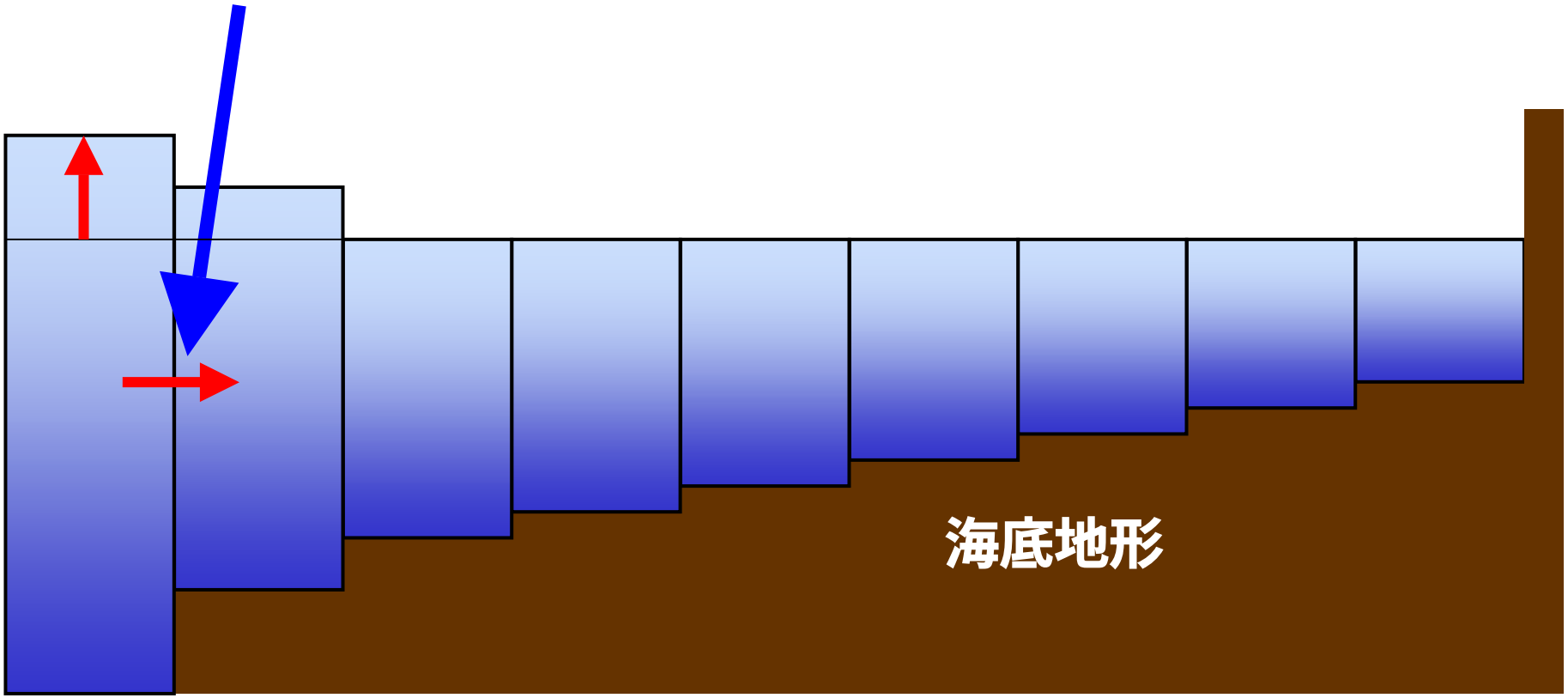


Image of Tidal Current Simulation
潮流シミュレーションイメージ

Rising Tide
上げ潮

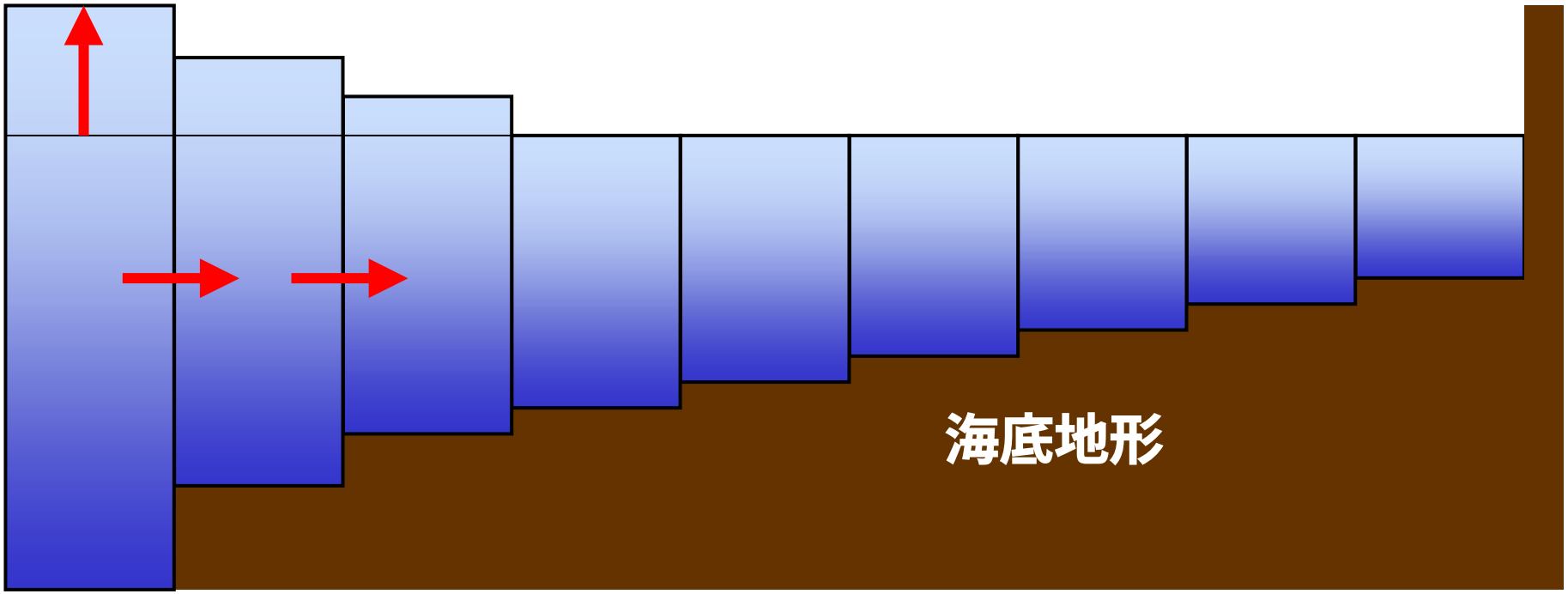


Image of Tidal Current Simulation
潮流シミュレーションイメージ

Rising Tide
上げ潮

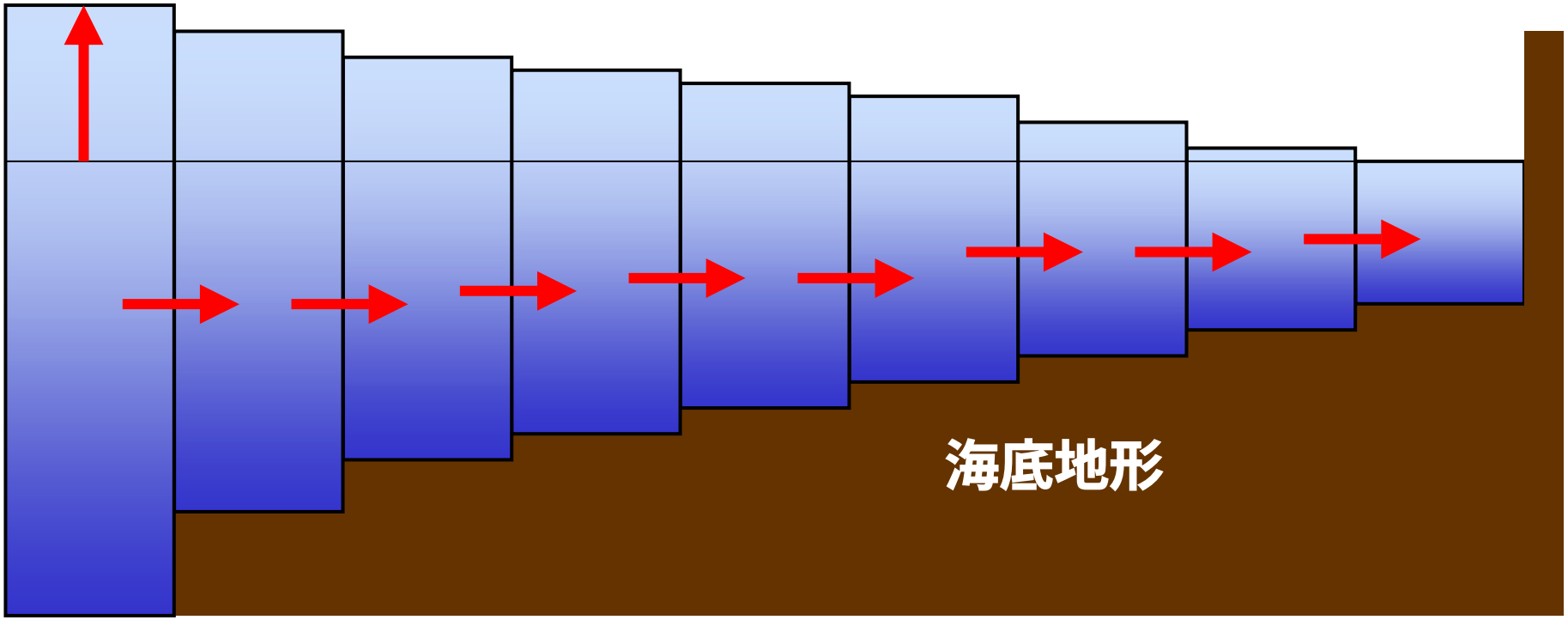


Image of Tidal Current Simulation
潮流シミュレーションイメージ

Rising Tide
上げ潮

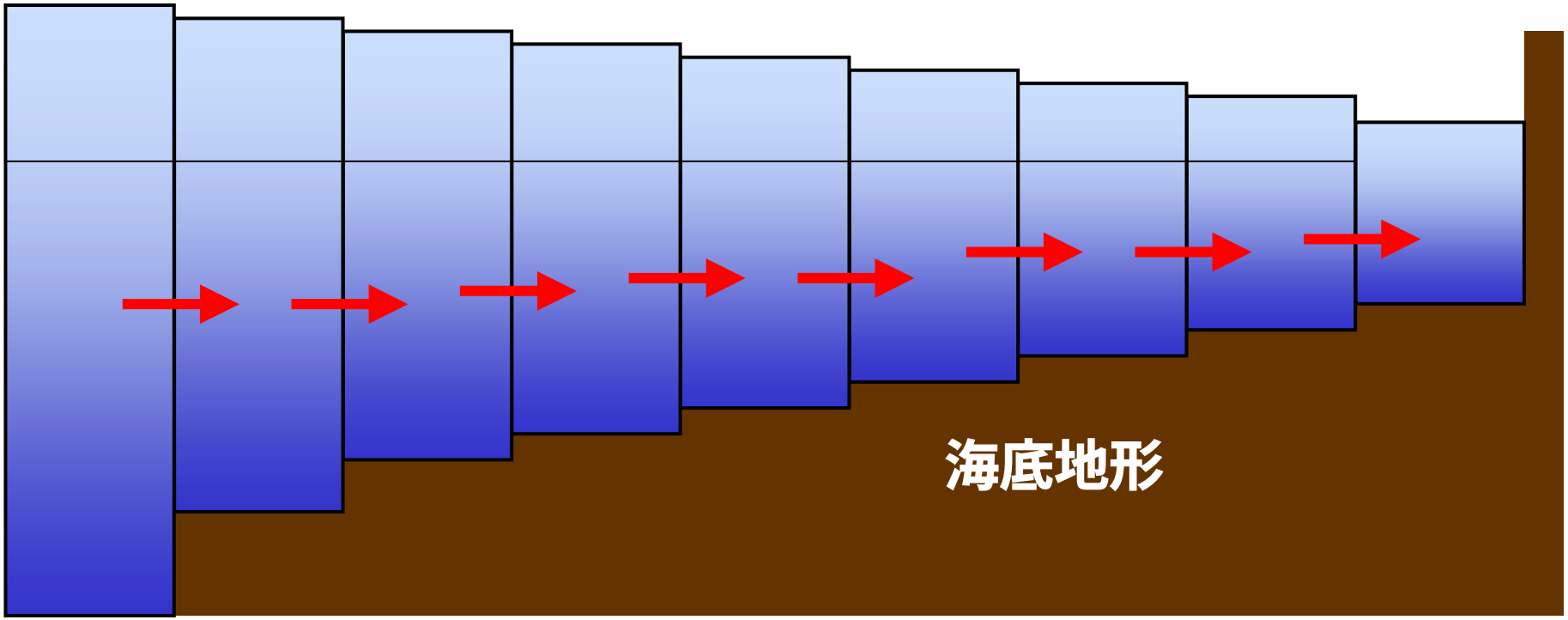


Image of Tidal Current Simulation
潮流シミュレーションイメージ

湾奥まで水位が上がり、
外洋では潮が下がり始める

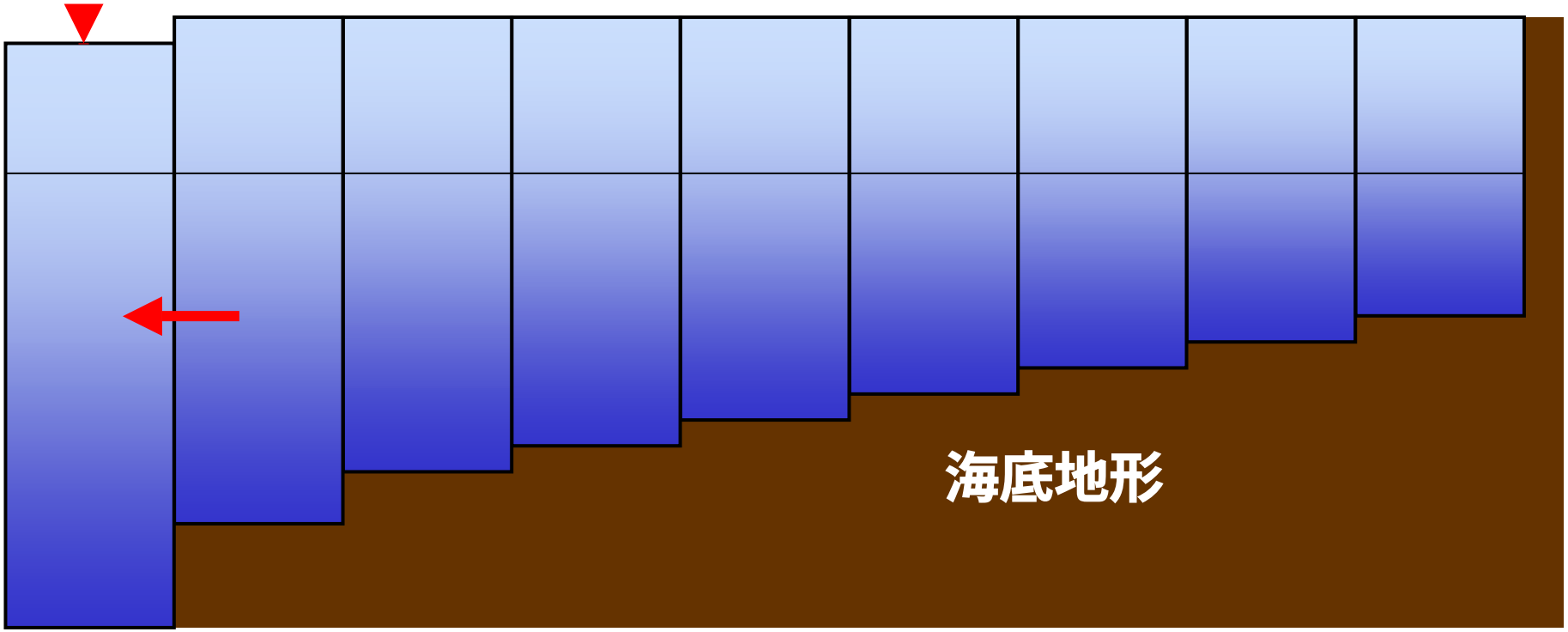


Image of Tidal Current Simulation
潮流シミュレーションイメージ

Lowering Tide
下げ潮

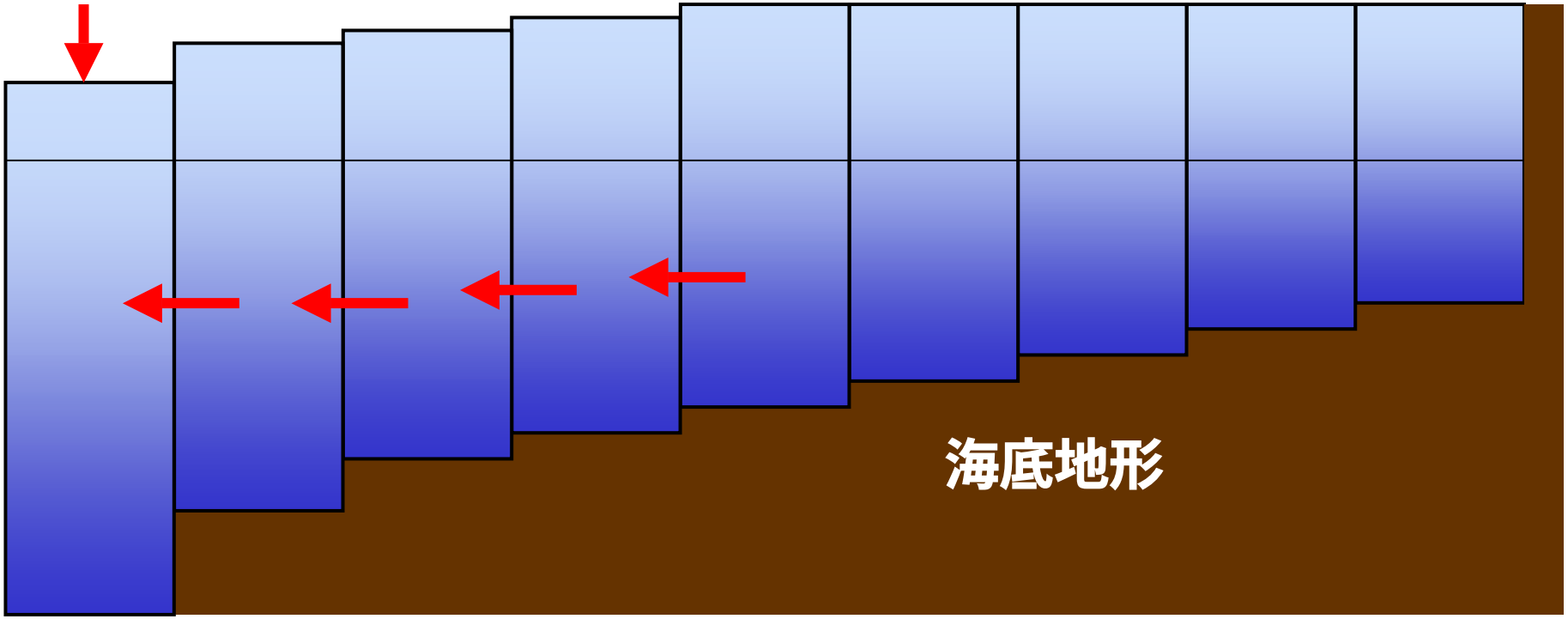


Image of Tidal Current Simulation
潮流シミュレーションイメージ

Lowering Tide
下げ潮

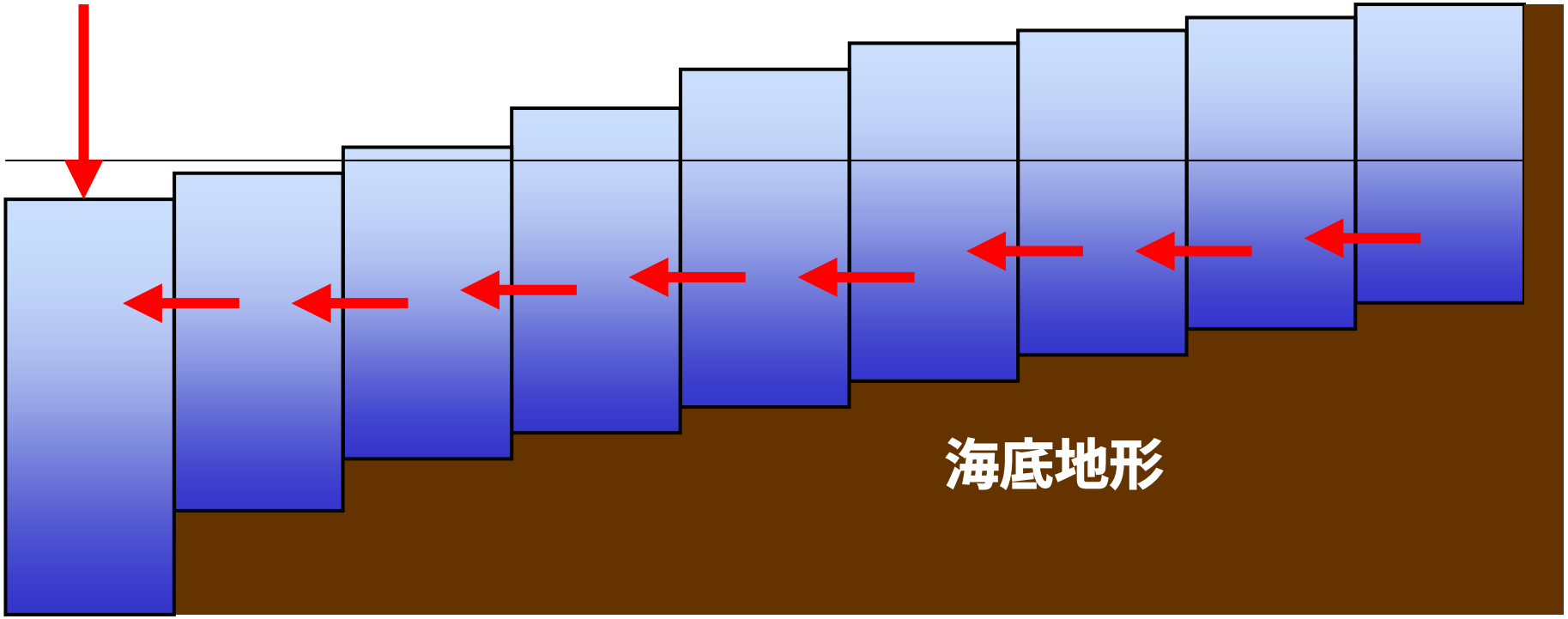
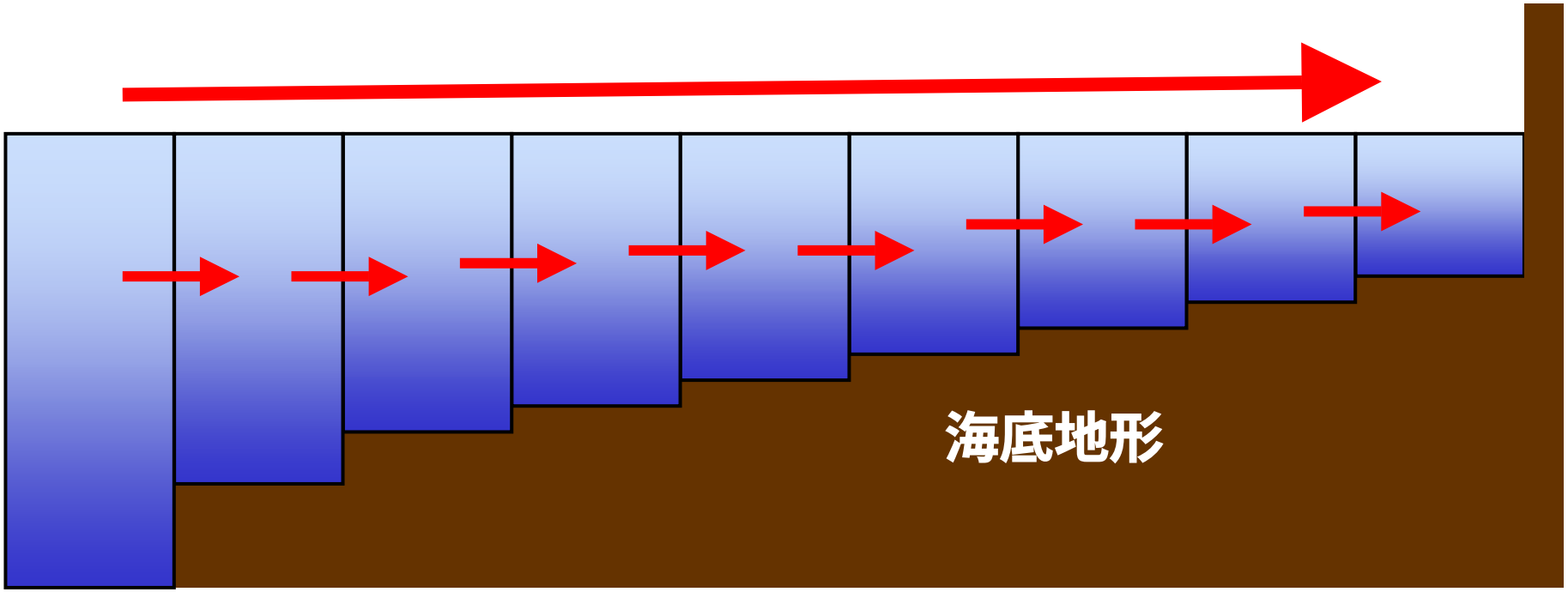


Image of Tidal Current Simulation

潮流シミュレーションイメージ

風による影響も考慮

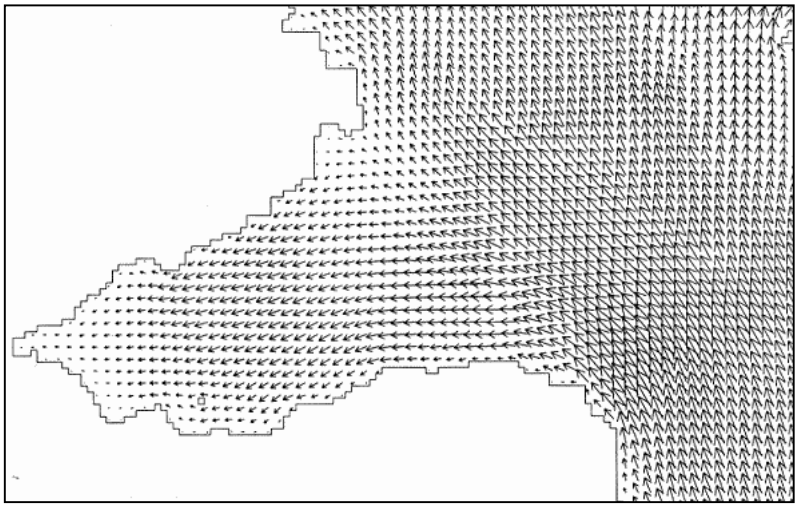
（有明海では潮汐の影響が大きい）



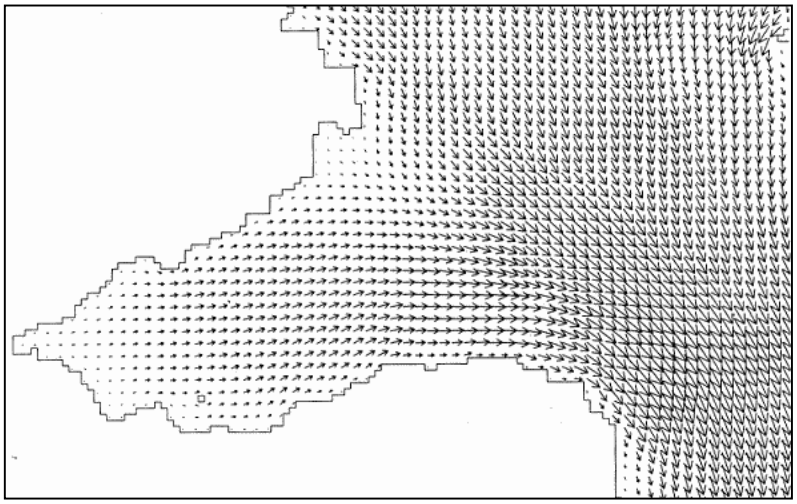
現況再現シミュレーション流況図（大潮時）

工事前

上げ潮最強時

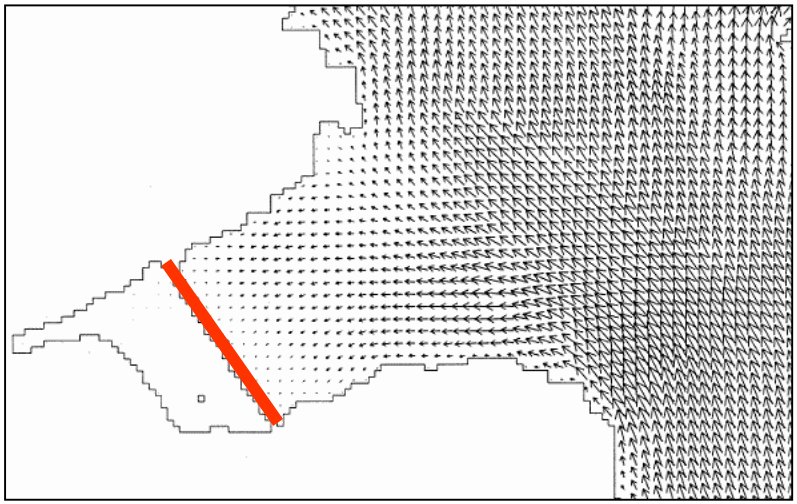


下げ潮最強時

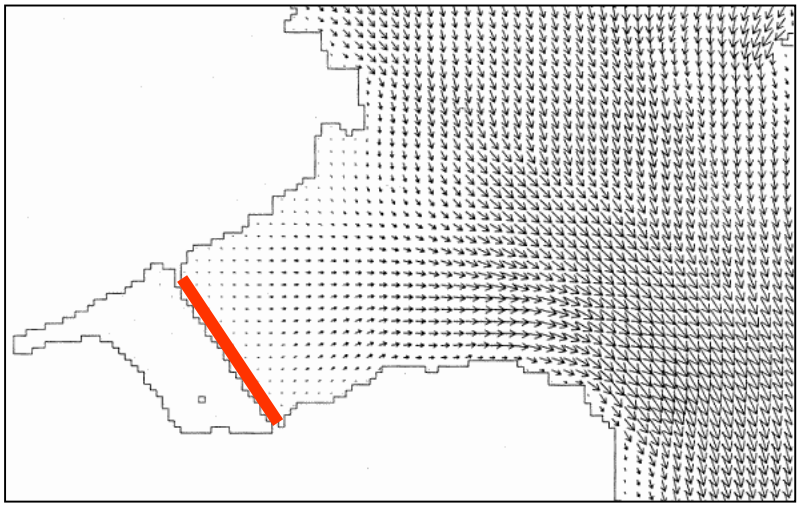


閉め切り後

上げ潮最強時

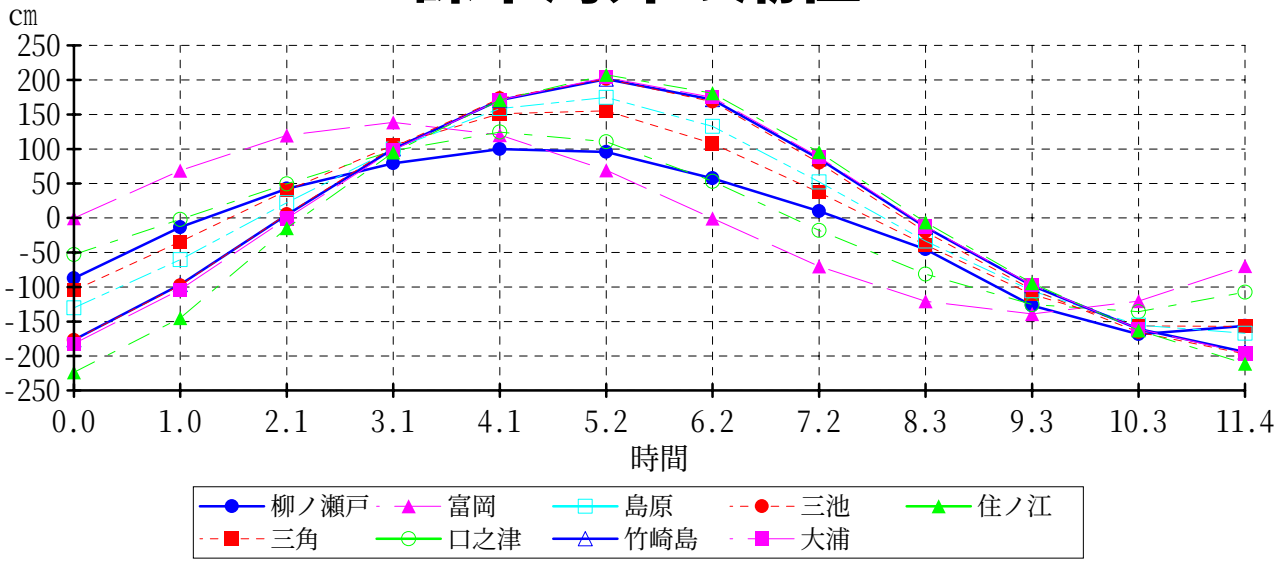


下げ潮最強時

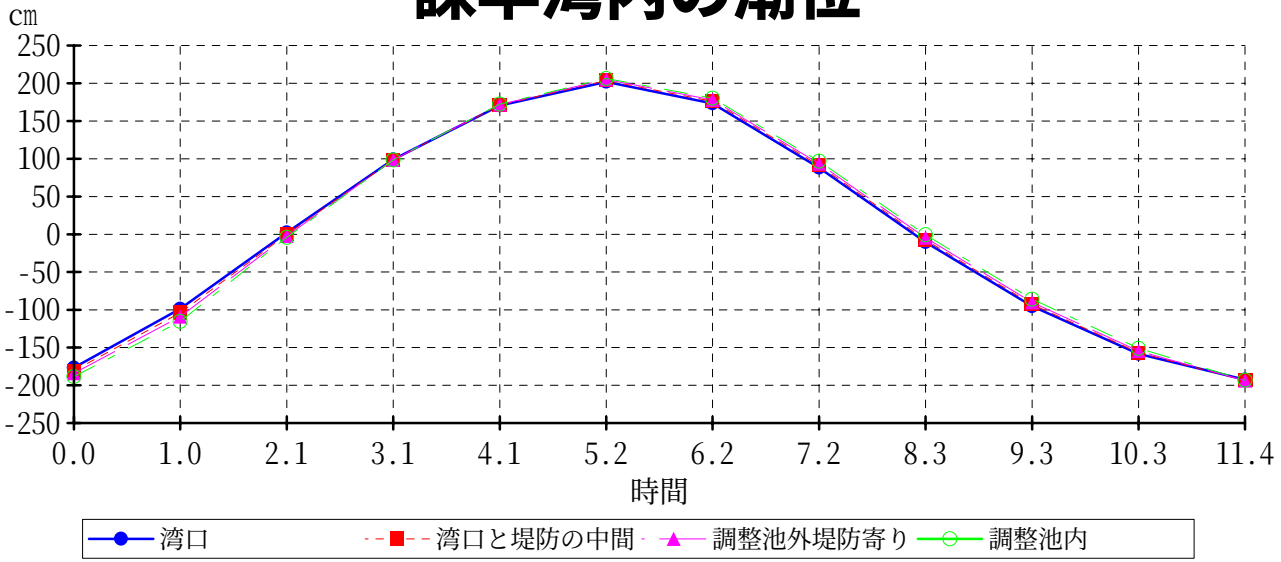


潮位変化の現況再現シミュレーション

諫早湾外の潮位



諫早湾内の潮位



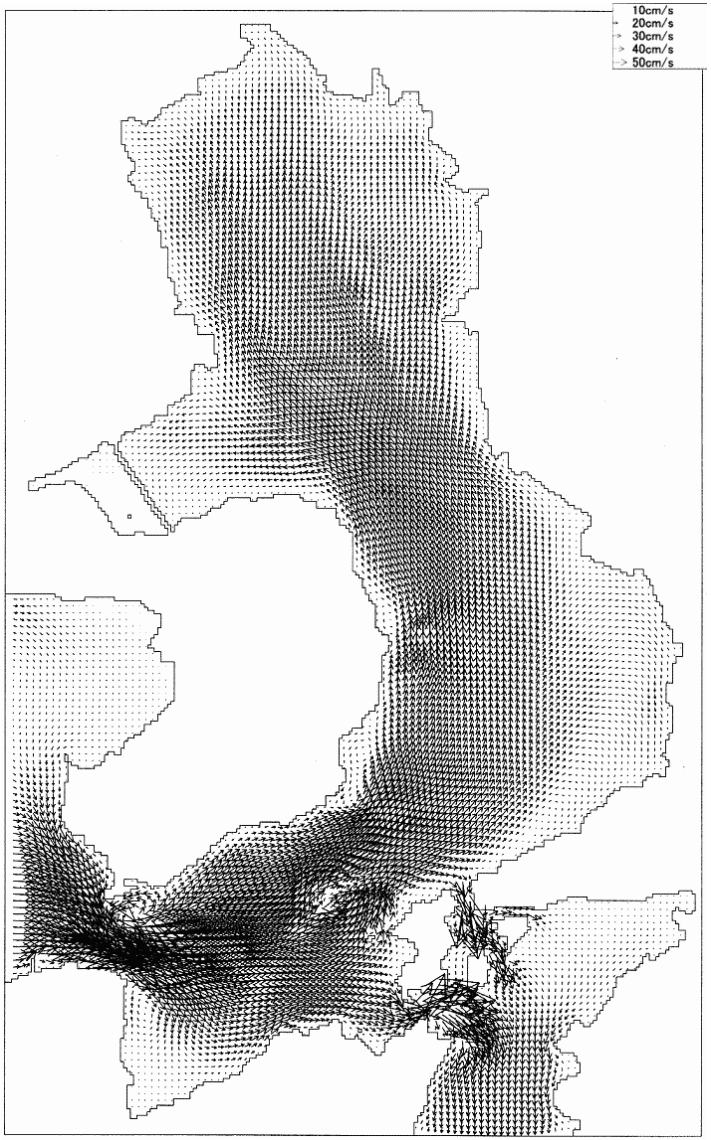
Tidal Current Simulation

Phase 3:
Simulation Results

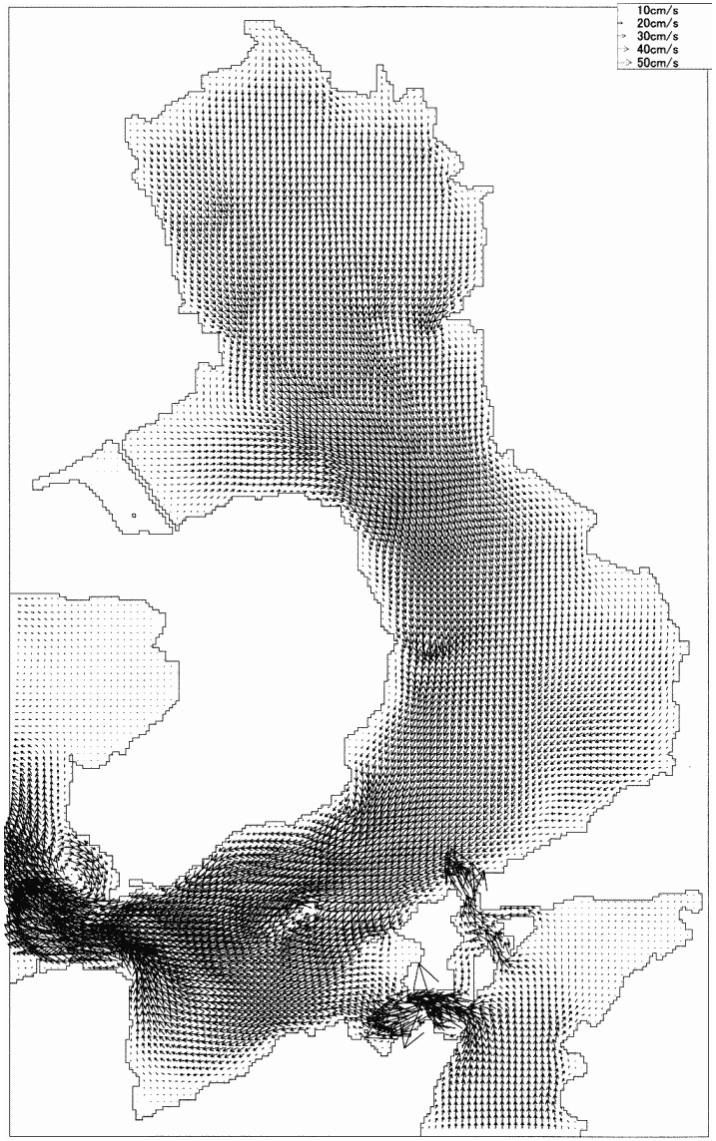
Whole Simulation of Ariake Sea After Shut Down

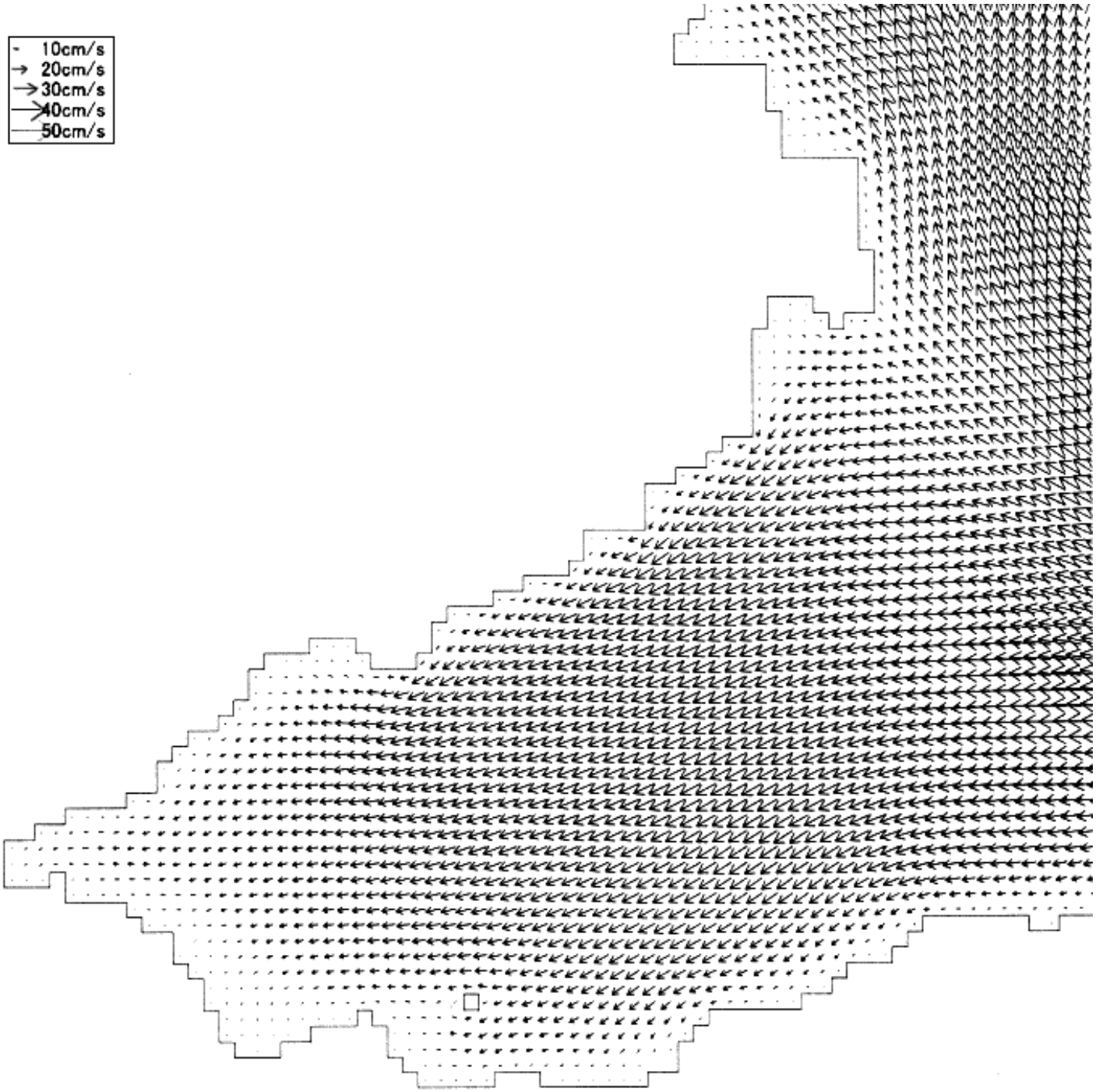
完全閉め切り後（中潮）

（満潮）



（干潮）





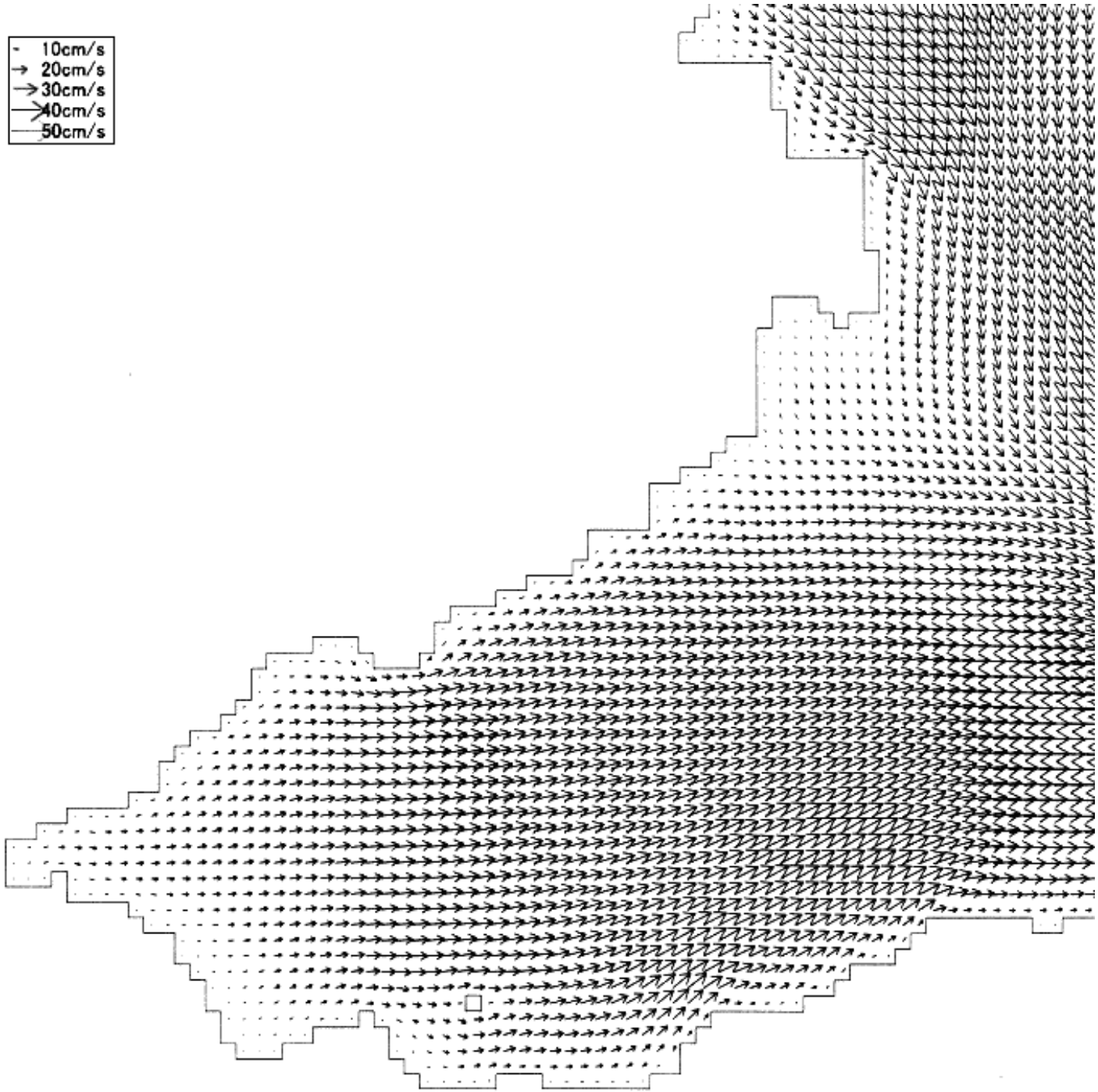
CASE1：

諫早干拓工事前

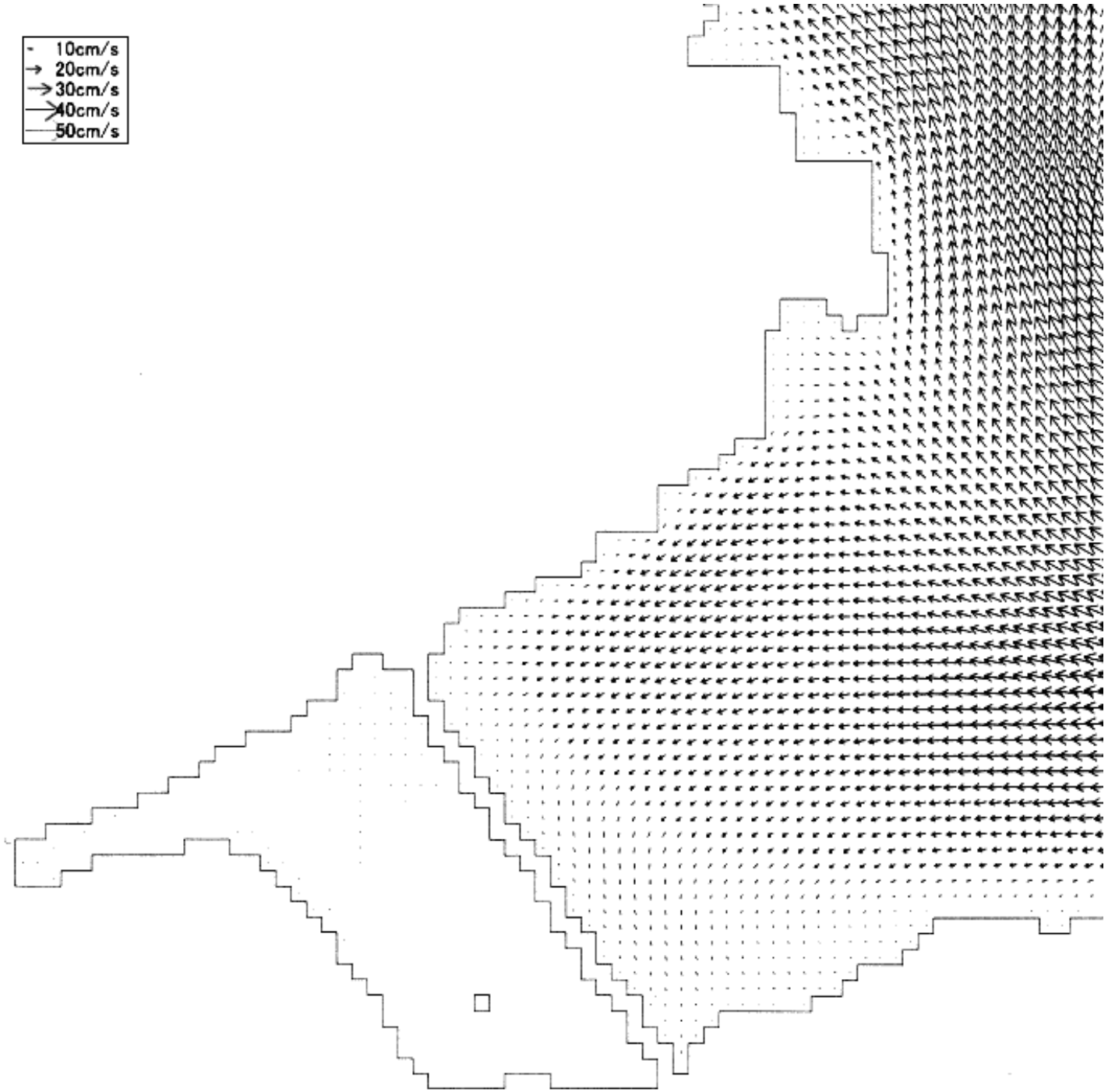
（中潮満潮）

Before

Shut Down



ケース1：
諫早干拓工事前
(中潮干潮)

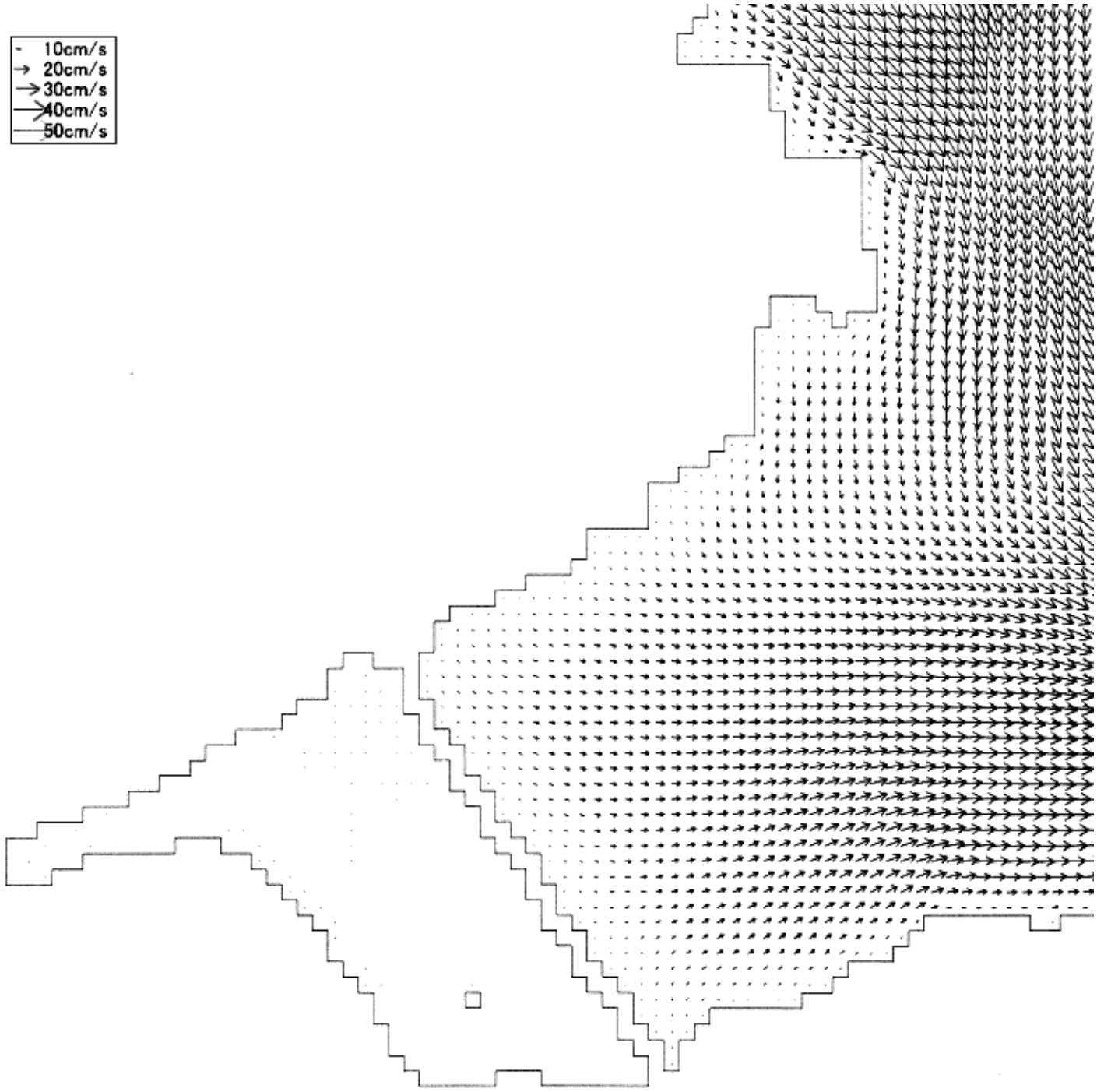


Case２：

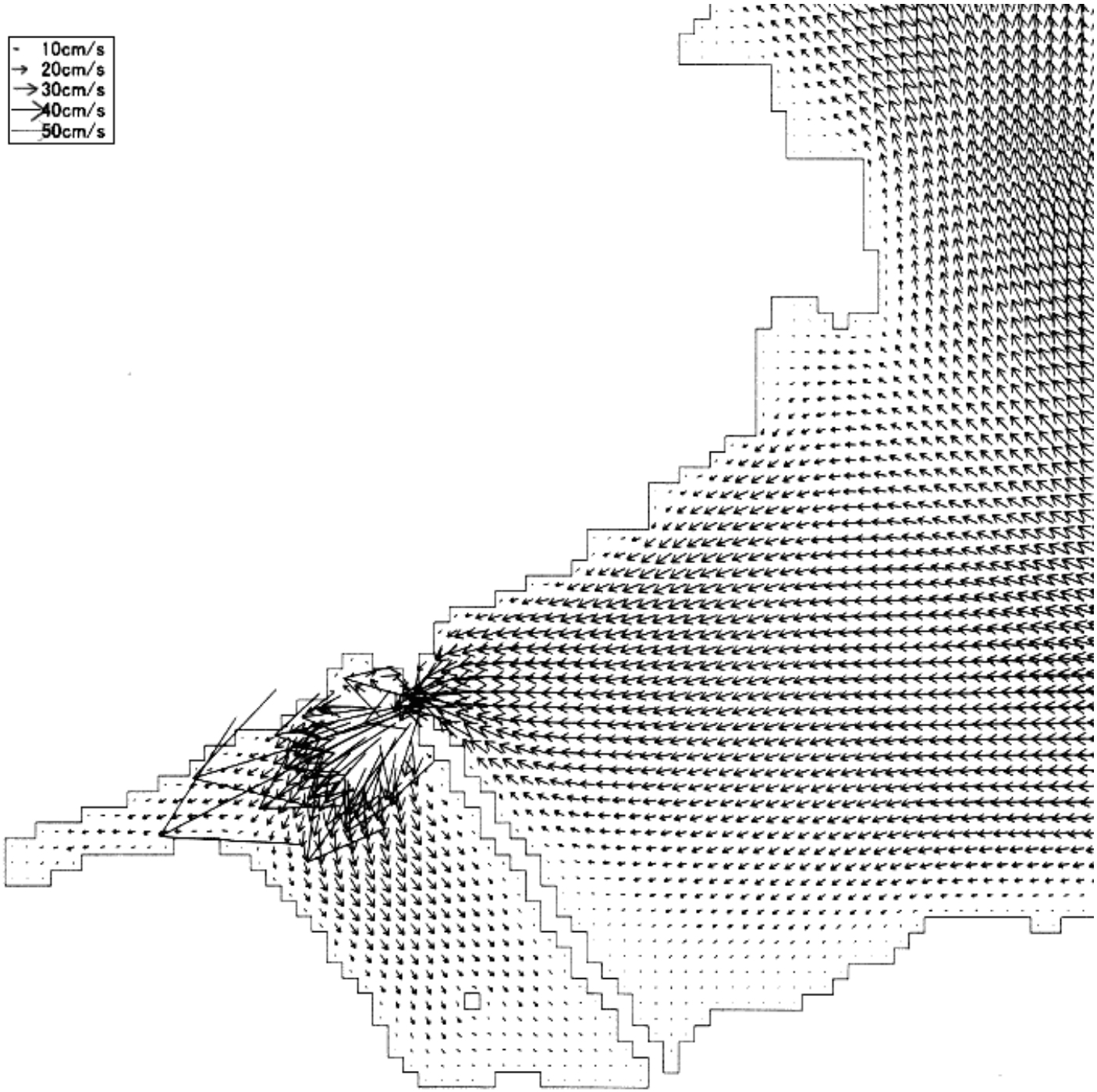
完全閉め切り後

（中潮満潮）

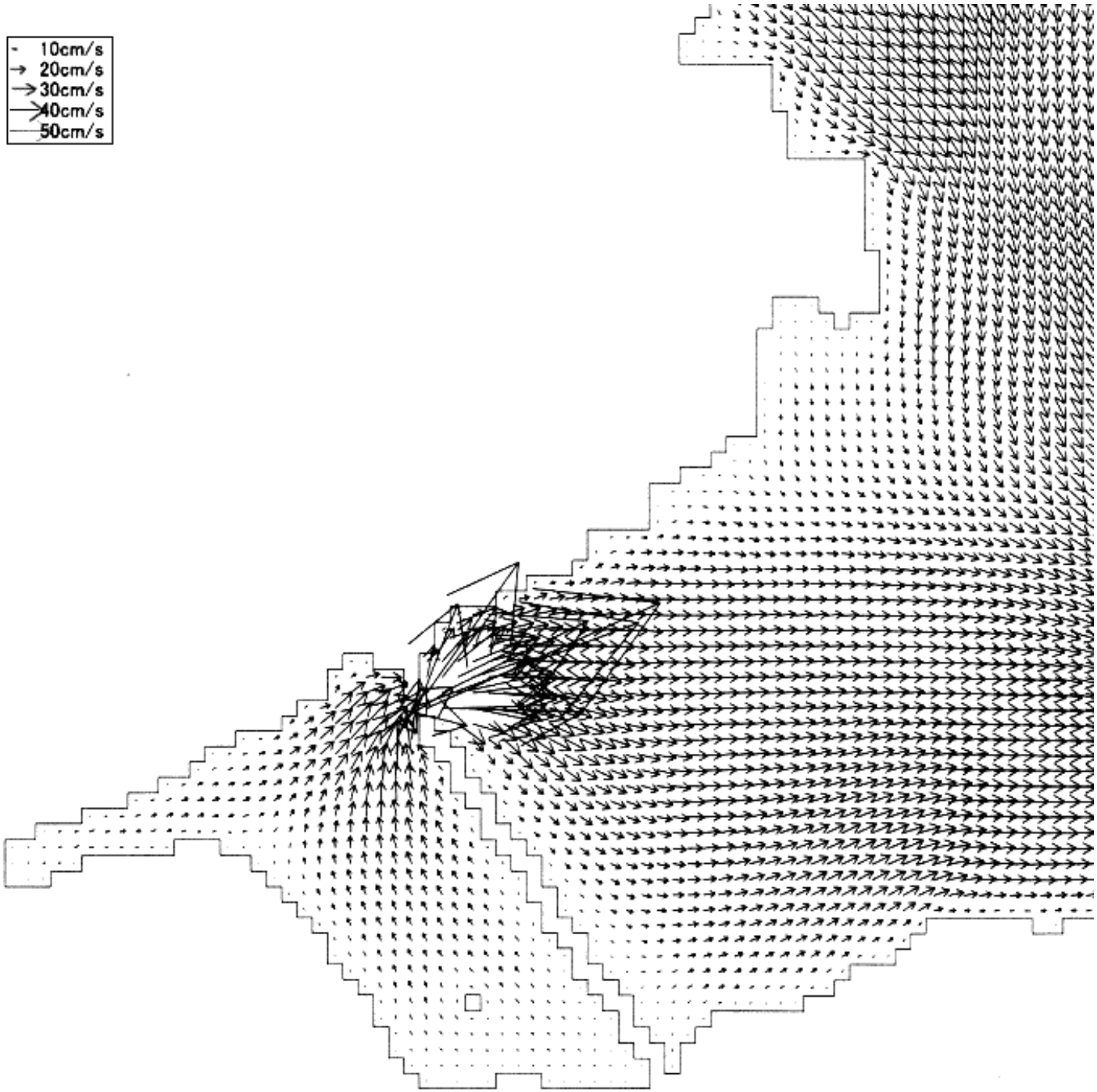
Afer Shut Down



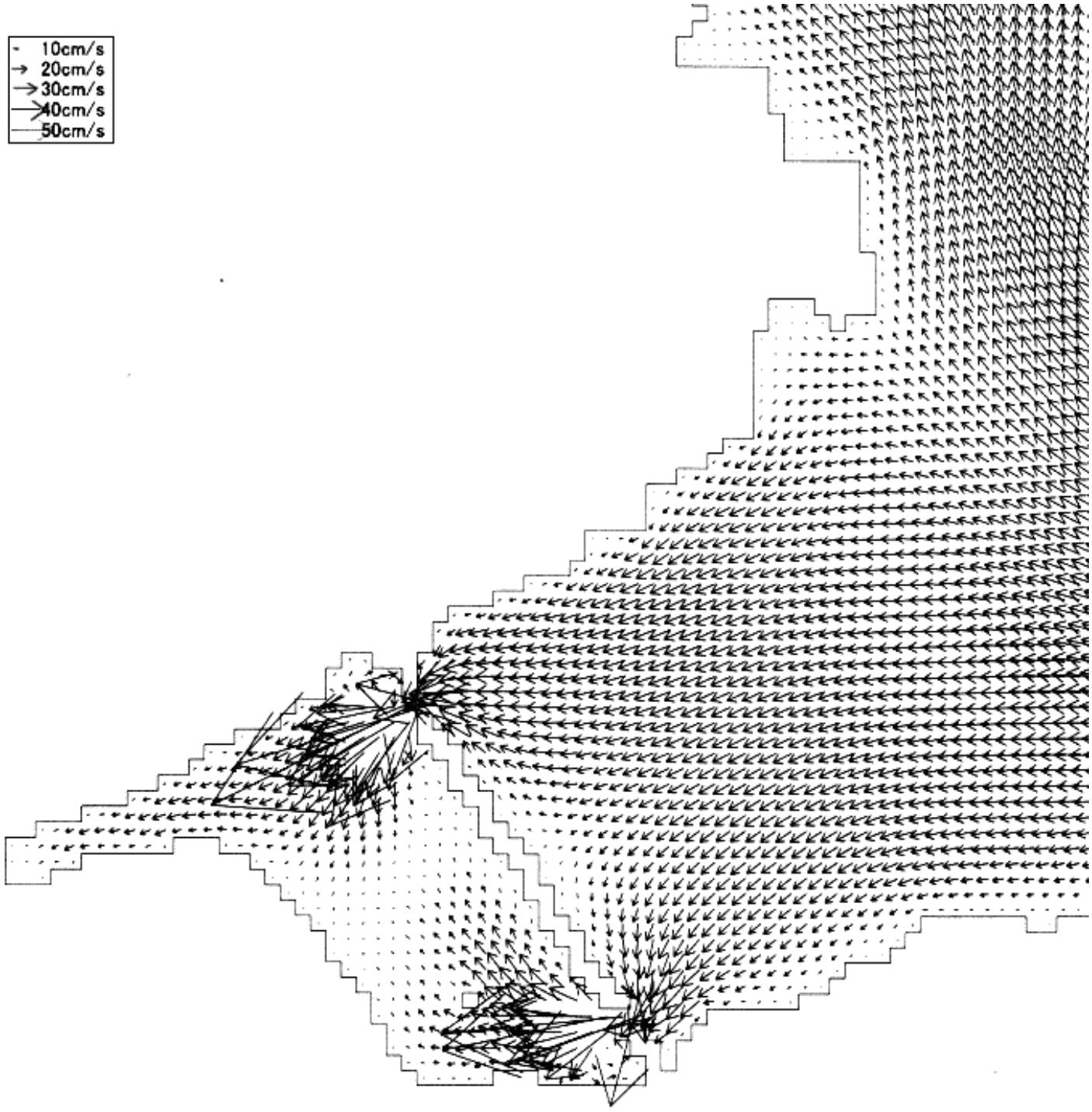
ケース2：
完全閉め切り後
(中潮干潮)



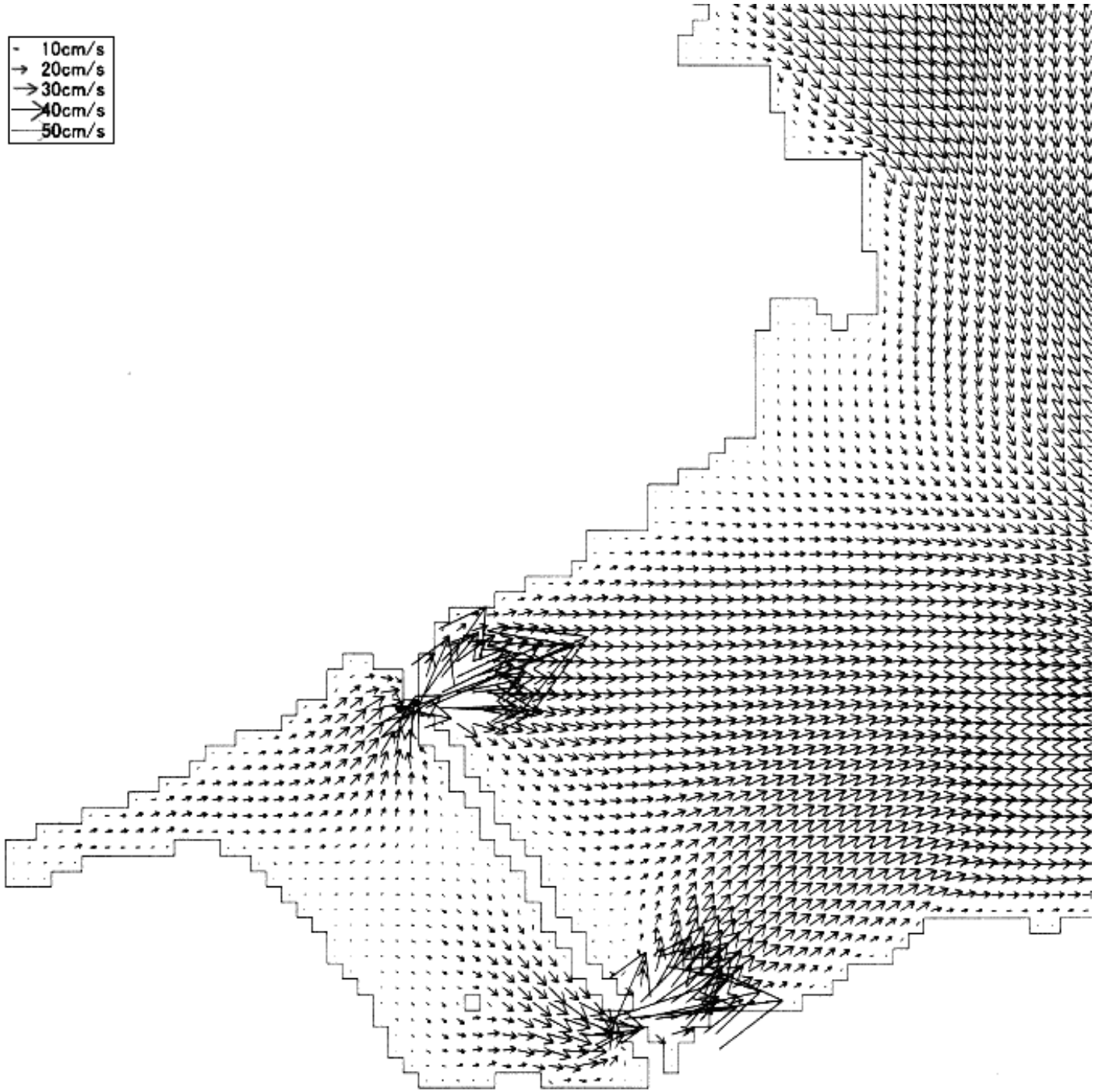
Case３－１：
水門1つ開放
（中潮満潮）
North Gate
Open



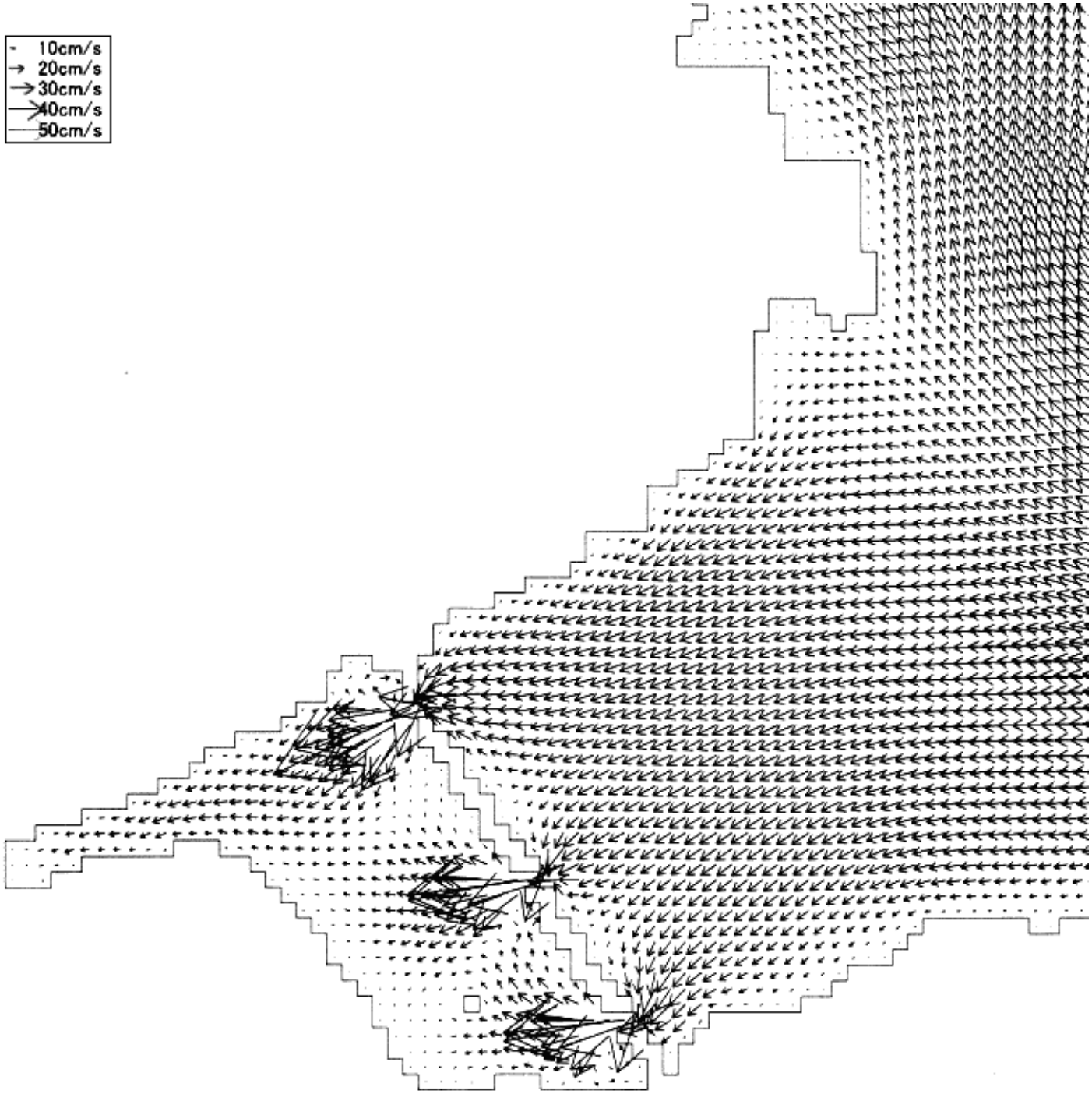
ケース3－1：水門1つ開放（中潮干潮）



Case ３－２：
水門２つ開放
（中潮満潮）
2Gates Open



ケース3－2：水門2つ開放（中潮干潮）

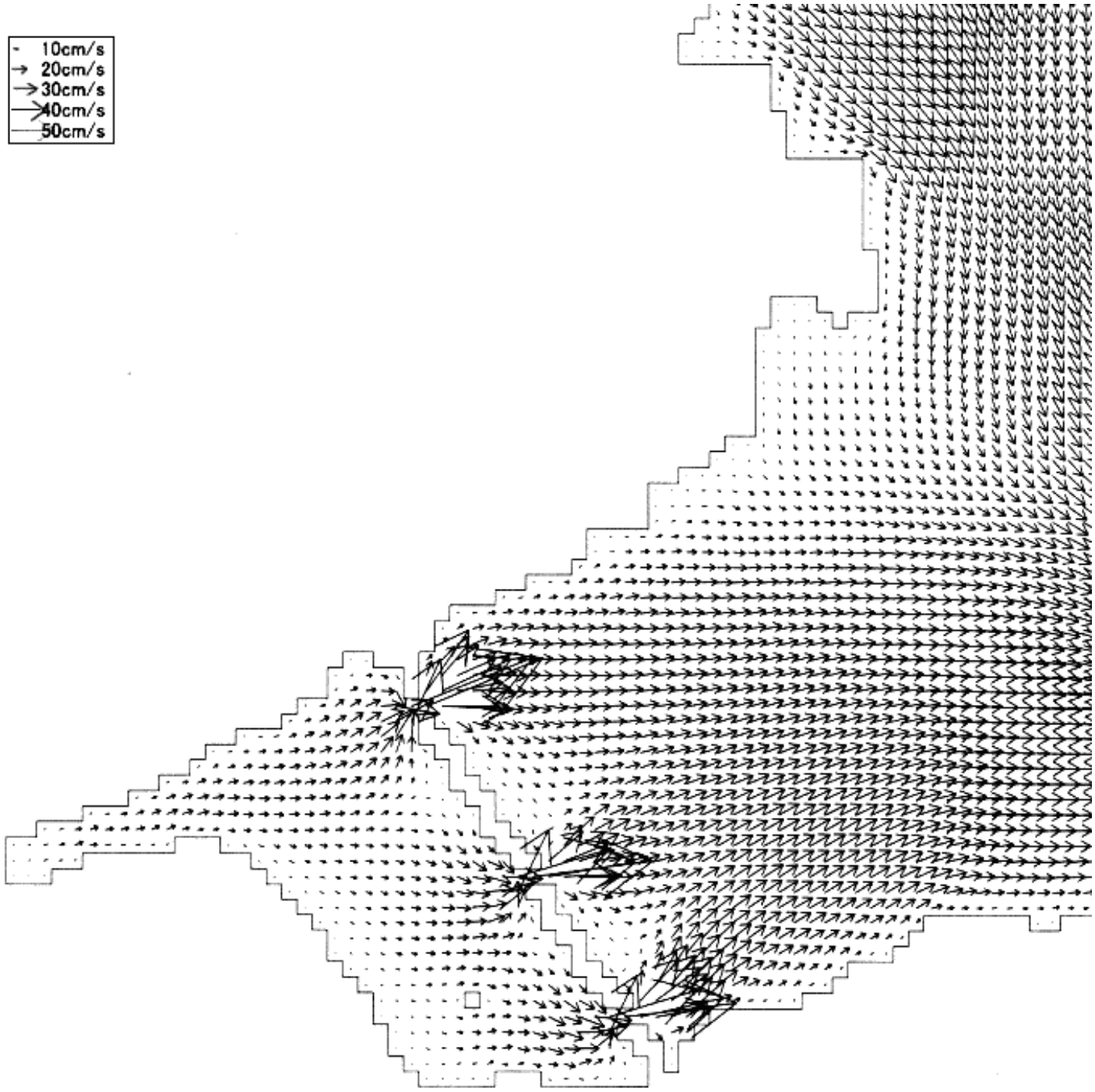


Case３－３：

水門３つ開放

（中潮満潮）

3Gates Open



ケース3－3：水門3つ開放（中潮干潮）

Tidal Current Simulation

Phase 4:
Evaluation of the Results

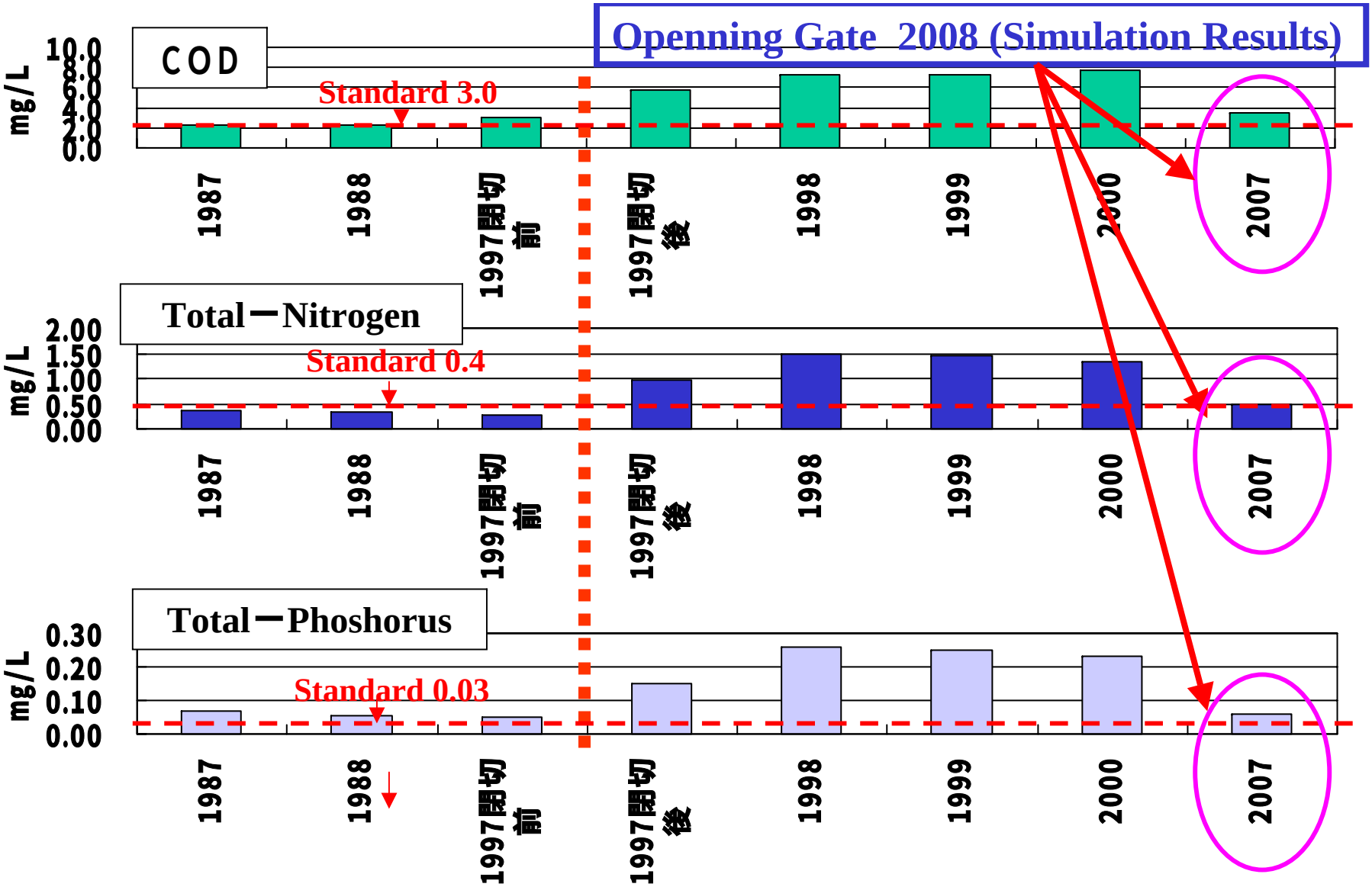
Conclusion

By summing up, as a results of our simulation,
it became clear that the tidal current recovered to the status of before constructing the tidal bank (shut down of the Bay) by opening the 2 water gates.

This means there were some possibility of water quality improvement from physical point of view as well as improving the eutrophication of the Bay area.

However, it is quite difficult to recover the healthy and nutritious ecosystem of the mud flat (tideland) once lost by the dam construction by just opening the water gates.

Further, it is also uncertain that the fishery will be recovered fully by the opening of the water gates, because the condition of oxygen-deficient at the bottom of the Bay will not be physically improved.



Trend and Change of Water quality for the 3 Pollutants after the opnning gates of ISAHAYA Bay tidal bank

Article of

Asahi Shimbun

(Asahi Press)

朝日新聞　西部本社

2001年3月13日

2001年(平成13年)3月13日　火曜日　42907号　(日刊)

水門開放で「潮流戻る」

諫早湾を民間研究所が解析

長崎県・諫早湾の国営干拓事業で湾を閉め切る潮受け堤防の水門開放の影響について、東京の民間研究所、環境総合研究所（青山貞一所長）が、開放すると諫早湾内の潮流が閉め切り前にかなり近い状態に戻ると推定するシミュレーション結果を出した。有明海のノリ不作と干拓事業との因果関係が指摘される中、開放の影響をどうとらえるかは焦点の一つだ。（38面に関係記事）

同干拓事業では、全長約七キロの堤防に対して南北二カ所にある水門は計二百五十mで、「これだけの長さを開けても、海全体には大した変化は現れない」と開放に否定的な見方がある。

同研究所は、農水省と長崎県が公開している有明海や諫早湾の潮流などのデータを基に、水門を開放した場合の流速と流れの方向をコンピューター解析した。

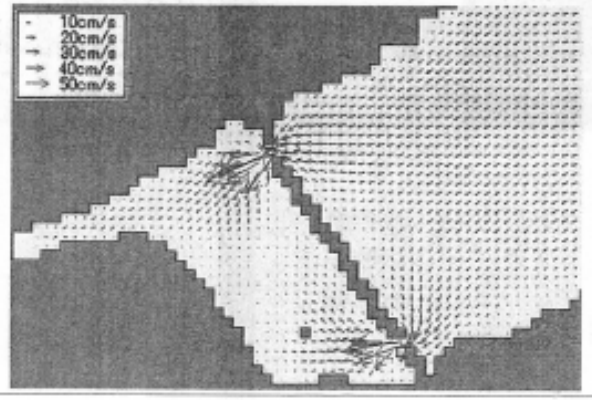
工事が始まる前の湾内全域十二カ所の平均流速を一〇〇％とすると、閉め切り後の満潮時の流速は、大潮、小潮のいずれも、十二カ所平均で四〇％前後にまで落ちている。

これを大潮の満潮時に、北部の水門のみを一つだけ開けると六七％、水門を二つとも開けると八八％まで戻る。小潮の満潮時では、水門一つだと八九％、二つだと一〇一％と、閉め切り前と同じになる。

いずれもゲートを全開にしたと仮定しているため、水門付近の流速が速くなる。この場合、渦が巻き上げられることを付近の養殖者が嫌うなどの調整をすれば、流速を抑えることは可能だという。

ただ、堤防中央部付近のよどみは残ったままなので、堤防中央部にもう二つ水門を設ければ、閉め切り前の状態にほぼ近づくという。

これについて農水省農村振興局は「現在、開放の技術的課題を整理している段階で、なんとも評価はできない」としている。



諫早湾干拓の水門開放シミュレーション。5つの水門を開けた場合（環境総合研究所提供）

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■Finally the Local Court Direct
2 Gates Open Immediately on the Judegment

It is obvious that the further counter measures for environmental quality improvement should be taken by the Ministry.

Under these circumstances,
the SAGA Local Court gave a ruling that the water gates of the tidal bank should be opened immediately on the judgement of 28 June 2008

謝辞

Many Thank for listning my Presentaion!

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