



# **Divergence/Convergence Field and its Effect on Accumulation of Sea Surface Marine Litter in Suruga Bay, Japan**

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# *Introduction*

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Accumulation of marine debris on the sea surface ----



A remarkable front observed in the Upper Gulf of Thailand in Oct. 2004

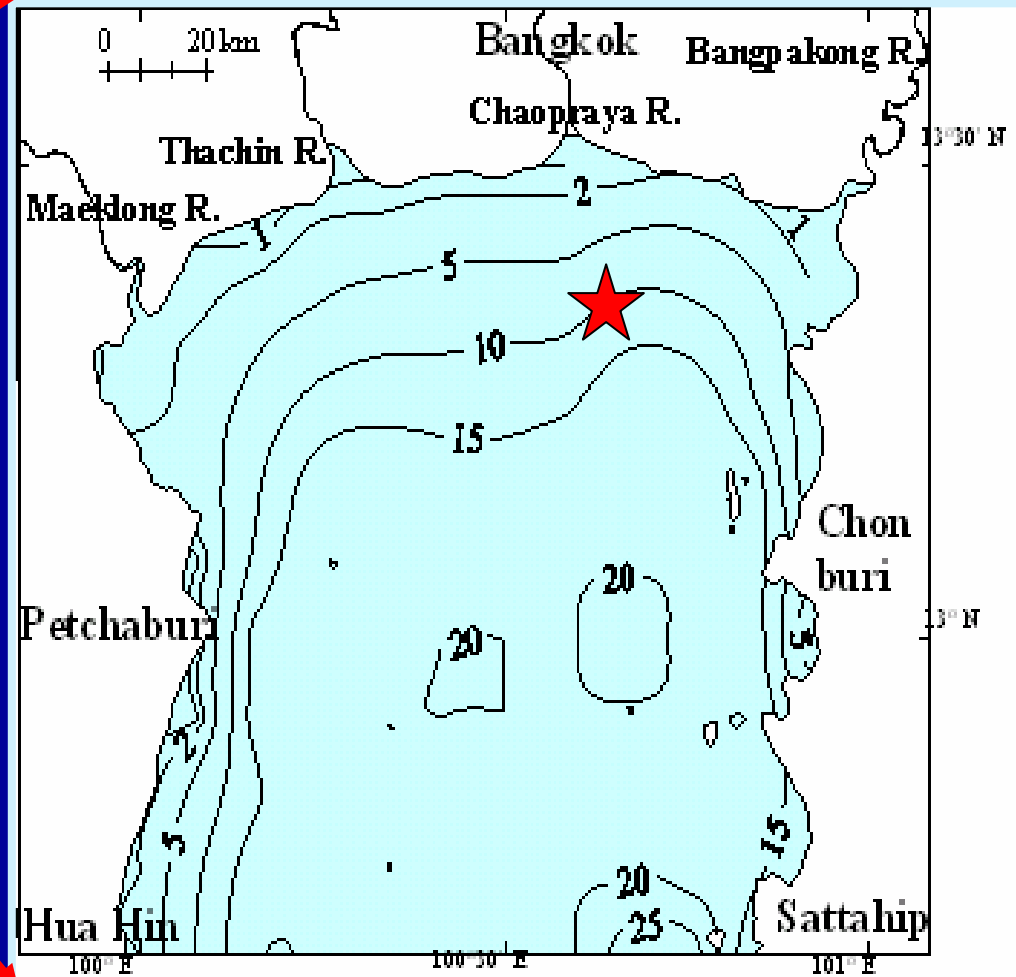
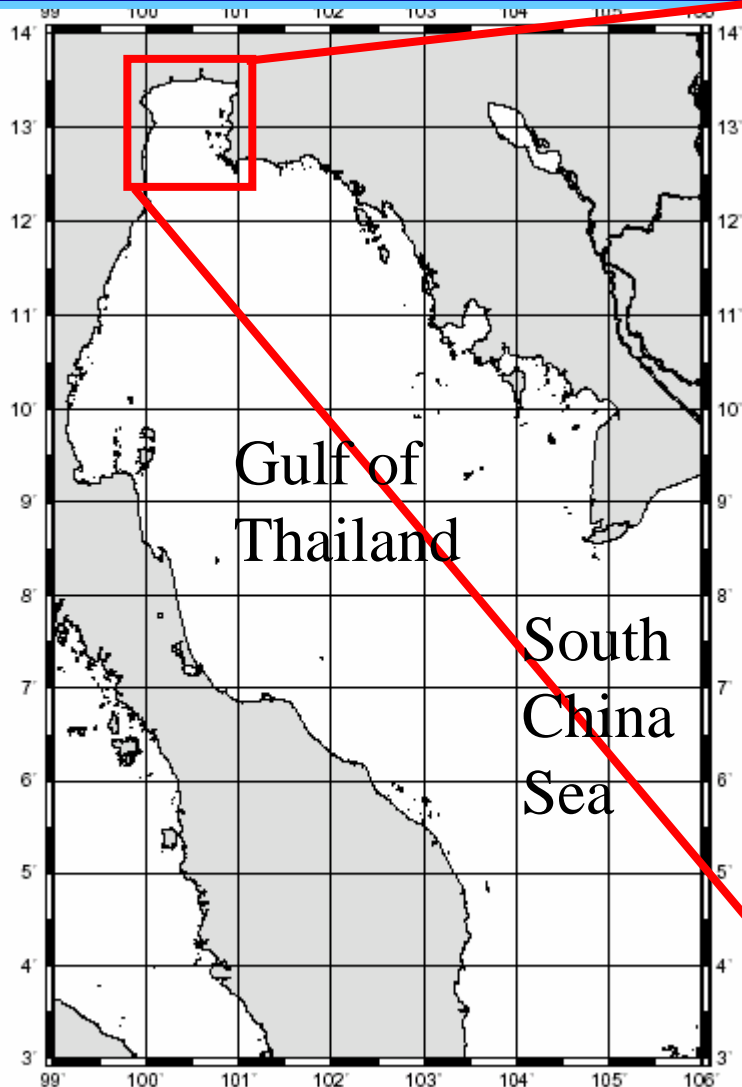


Marine debris were accumulated along the front.



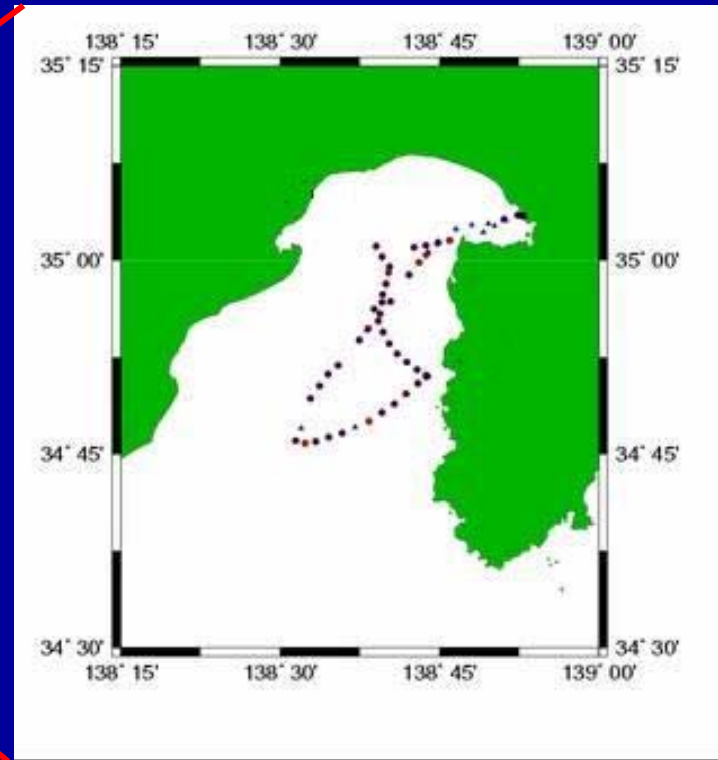
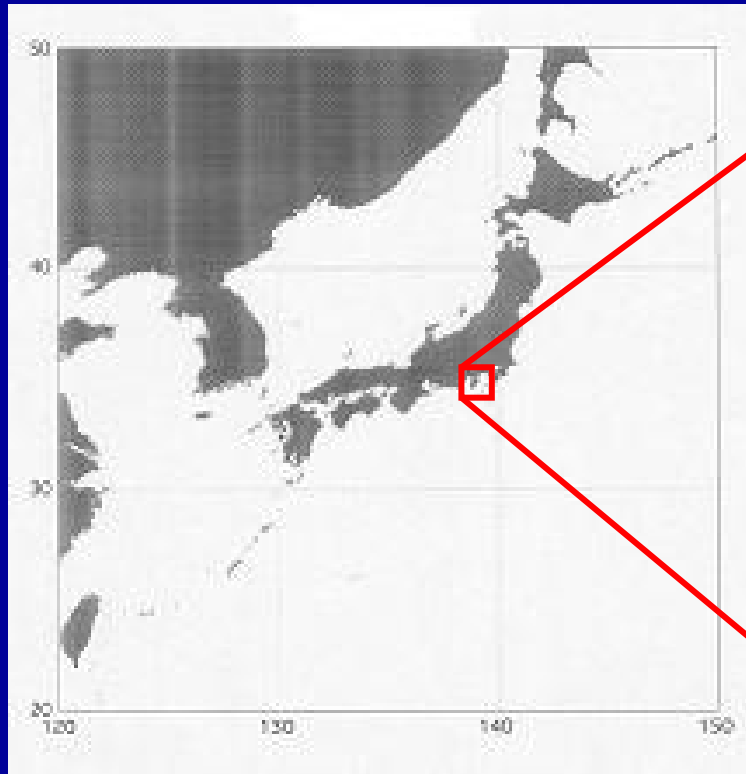
R/V Kasetart I

# Location



Upper Gulf of Thailand

# *Observations in Suruga Bay, Japan*



# Observations in Suruga Bay, Japan

## 1. GPS tracked drifters

➡ Divergence/convergence field

## 2. Visual observation

➡ Marine debris on the sea surface



*Izu-maru*, fishing boat

# Mobile GPS

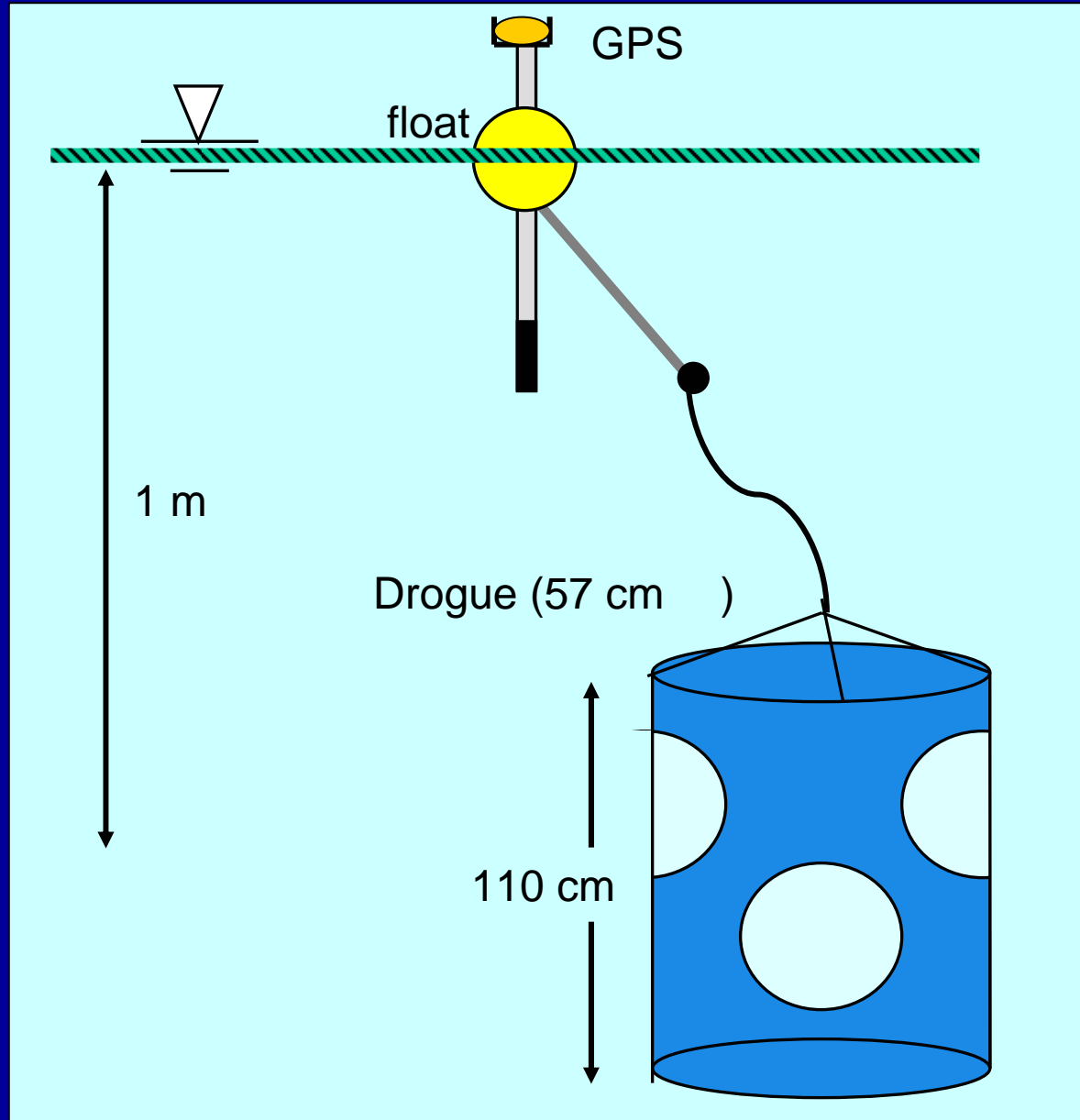


GPS location data are transmitted through mobile phone network.

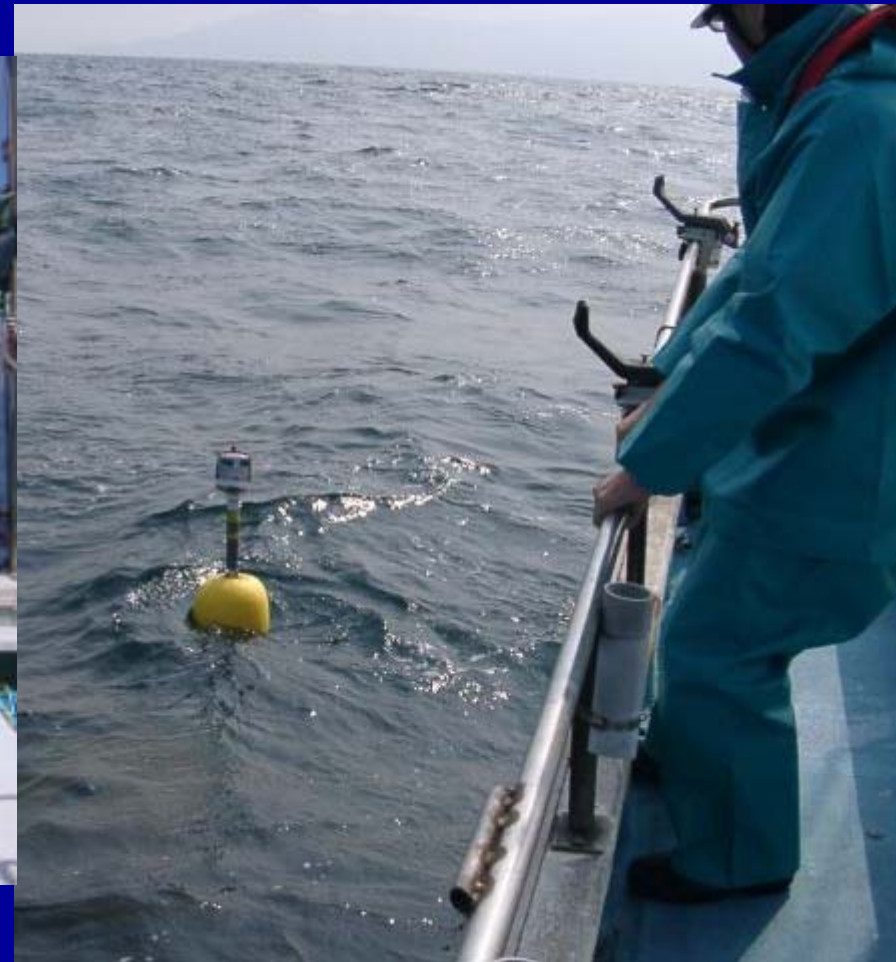
Interval of location : 5 -60 min.

Duration : 36 hrs (5 min.)

7 days (60 min.)

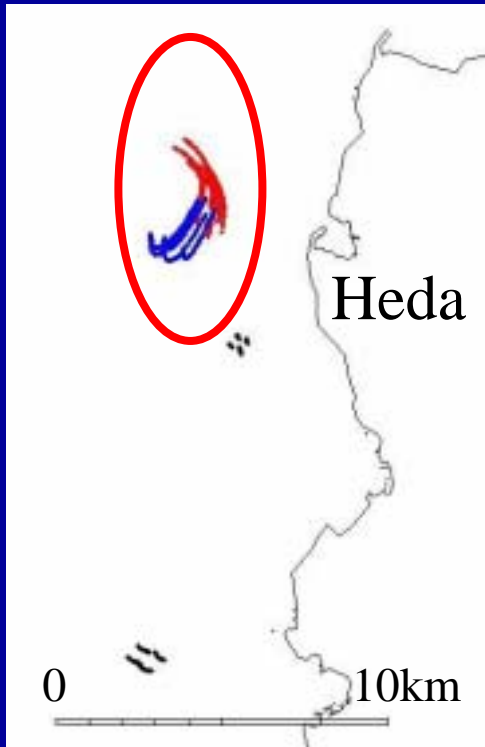


# Drifter experiment in Suruga Bay



Exp.	Date	Buoys	Horizontal Scale (m)
1	Feb. 25, 2005	5	150
2	Mar. 11, 2005	7	300
3	Mar. 19, 2005	6	300
4	Apr. 18, 2005	9	1,500
5	May 20, 2005	5	300
6	Jun 23-25, 2005	11	500
7	Jul. 22, 2005	12	300
8	Aug. 20, 2005	12	300
9	Sep. 22, 2005	12	200-1,000

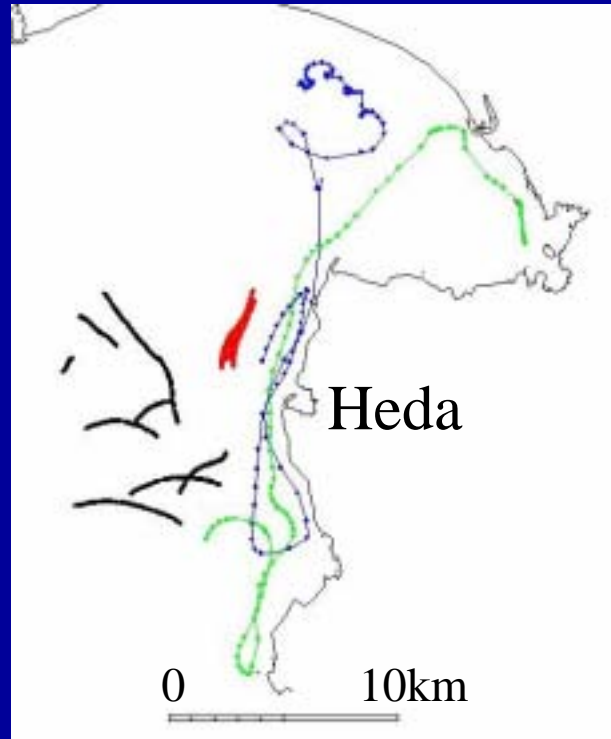
# Trajectories of drifters



Black : Feb. 25, 2005

Red : Mar. 11, 2005

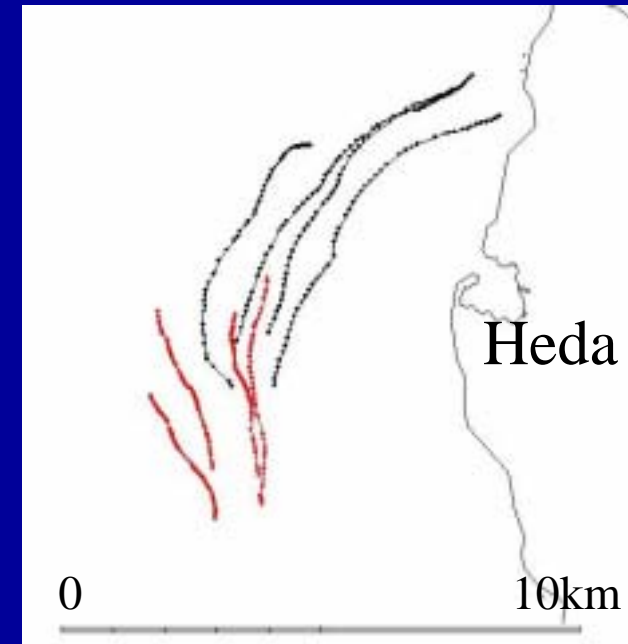
Blue : Mar. 19, 2005



Black : Apr. 18, 2005

Red : May 20, 2005

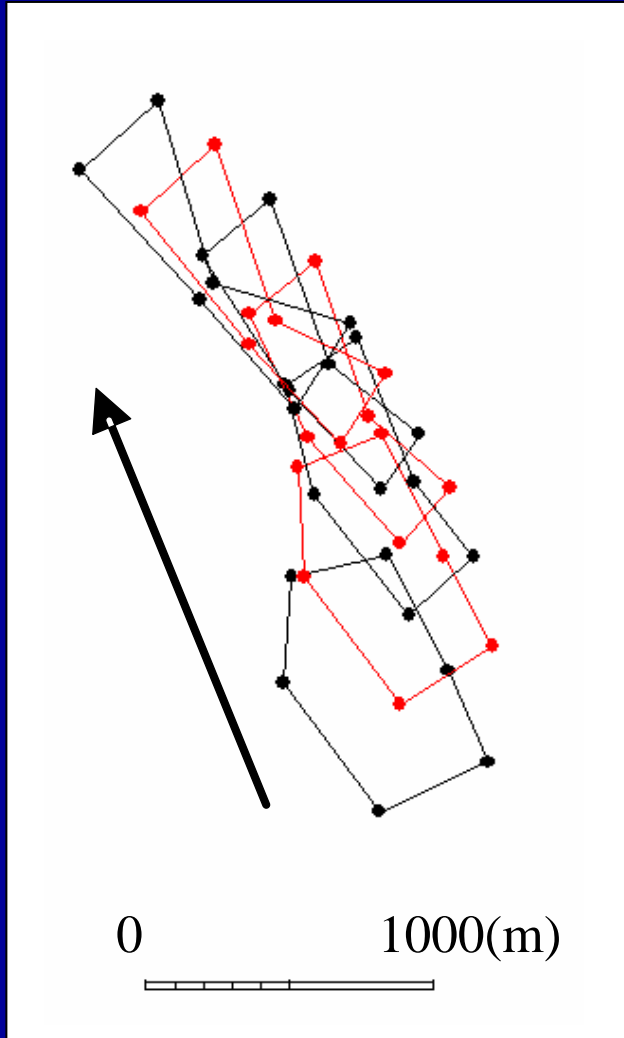
Blue/Green : Jun. 23-25, 2005



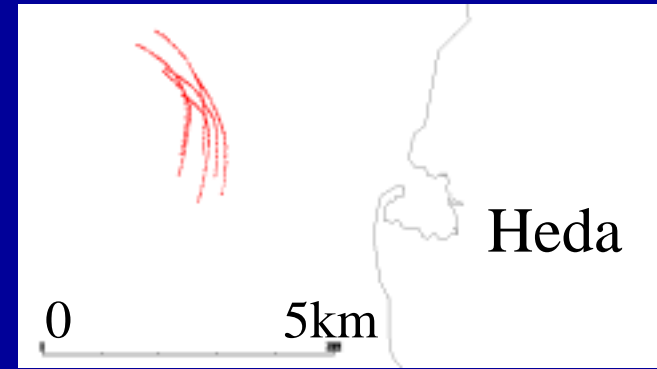
Black : Jul. 22, 2005

Red : Aug. 20, 2005

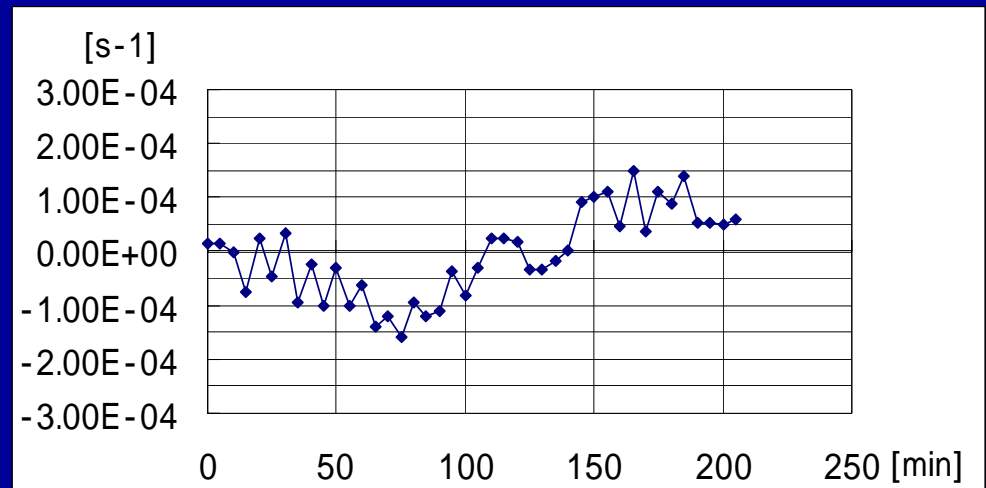
# Exp. on March 11, 2005



Deformation of polygon

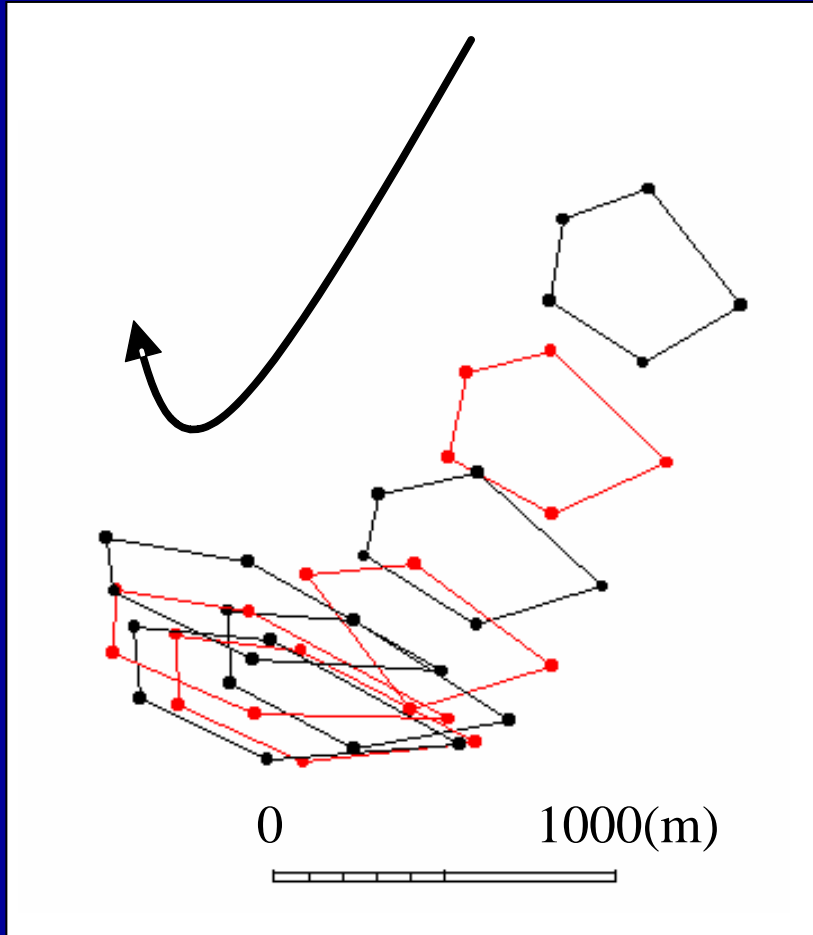


trajectories

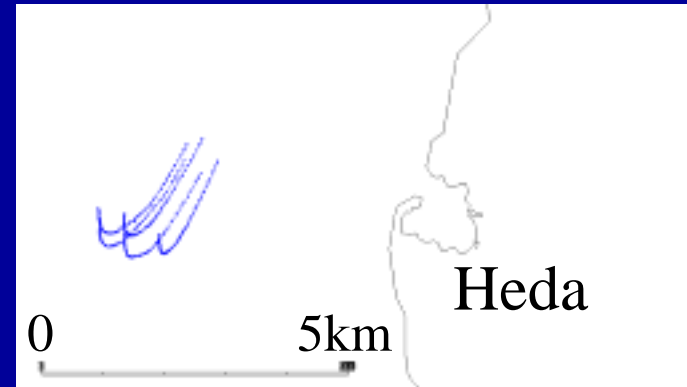


Time series of divergence/convergence  
(positive: divergent)

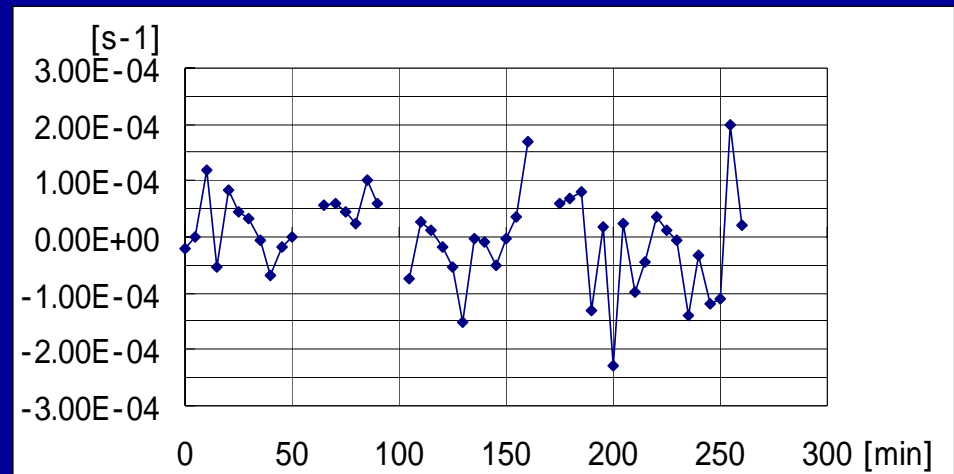
# Exp. on March 19, 2005



Deformation of polygon

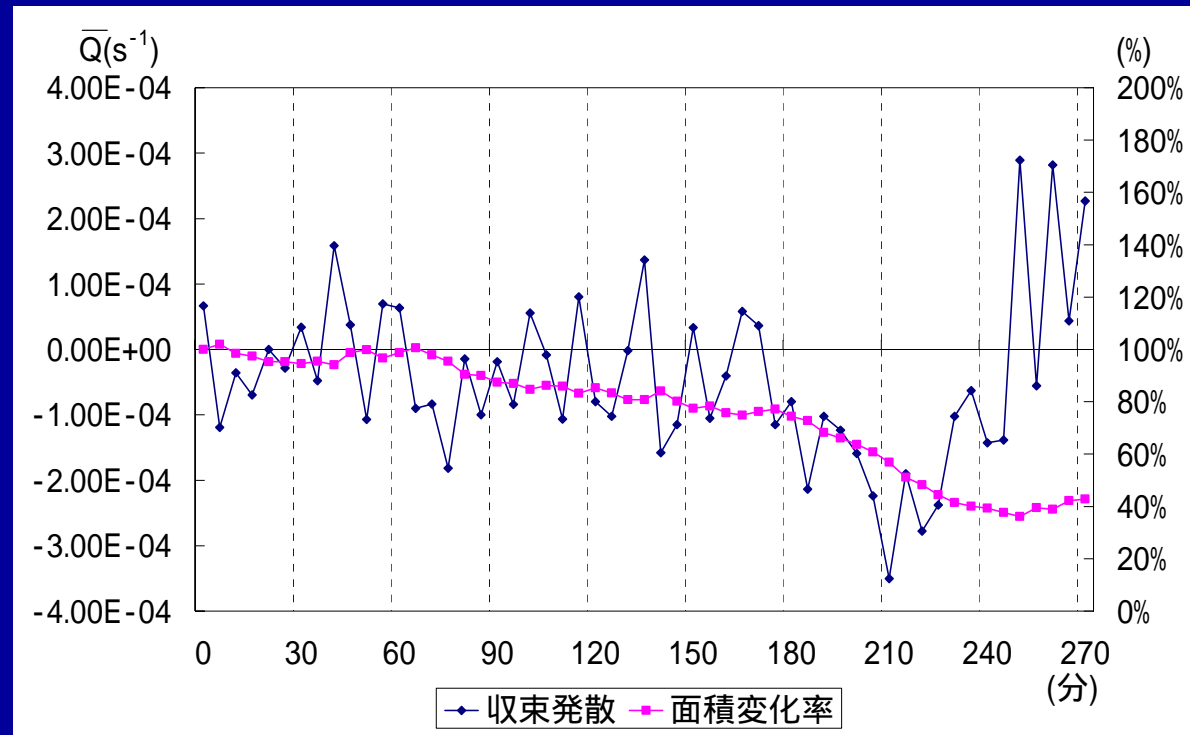
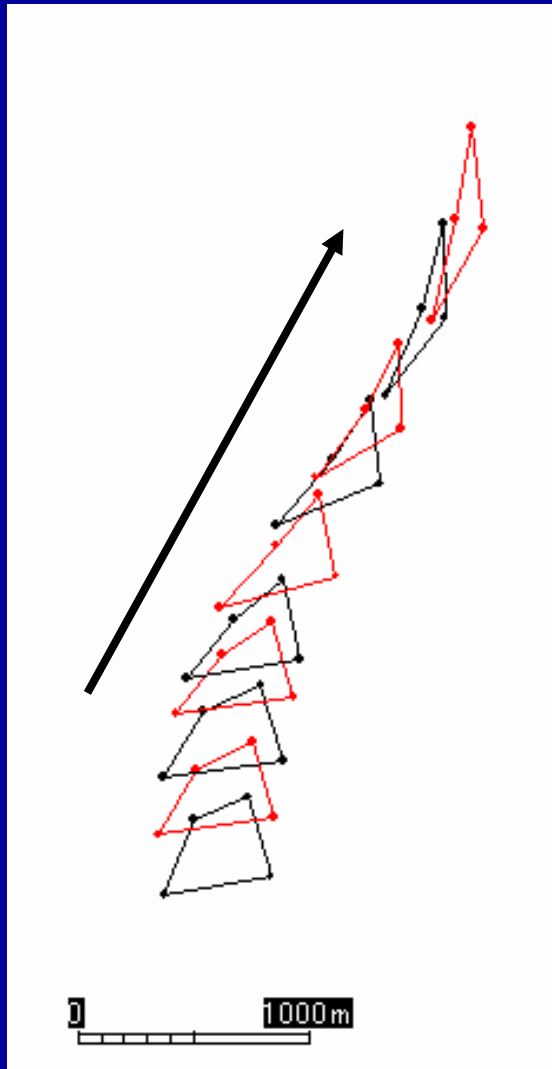


trajectories



Time series of divergence/convergence  
(positive: divergent)

# Exp. on May 20, 2005

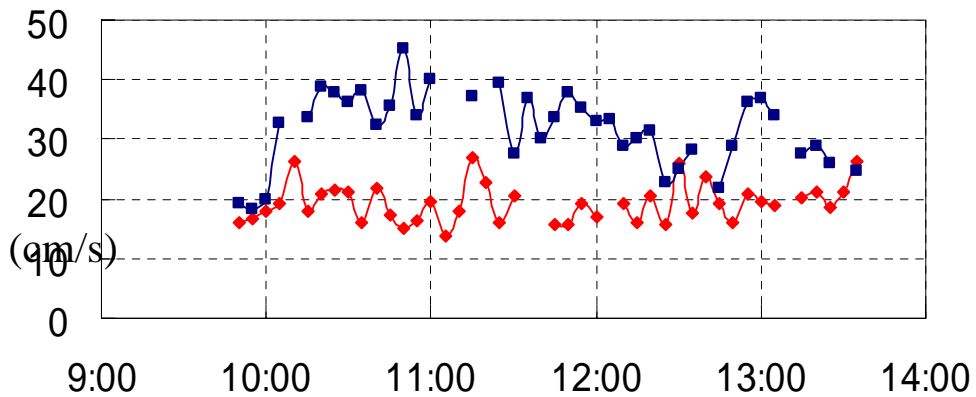


Deformation of polygon

Time series of divergence/convergence  
(positive: divergent)

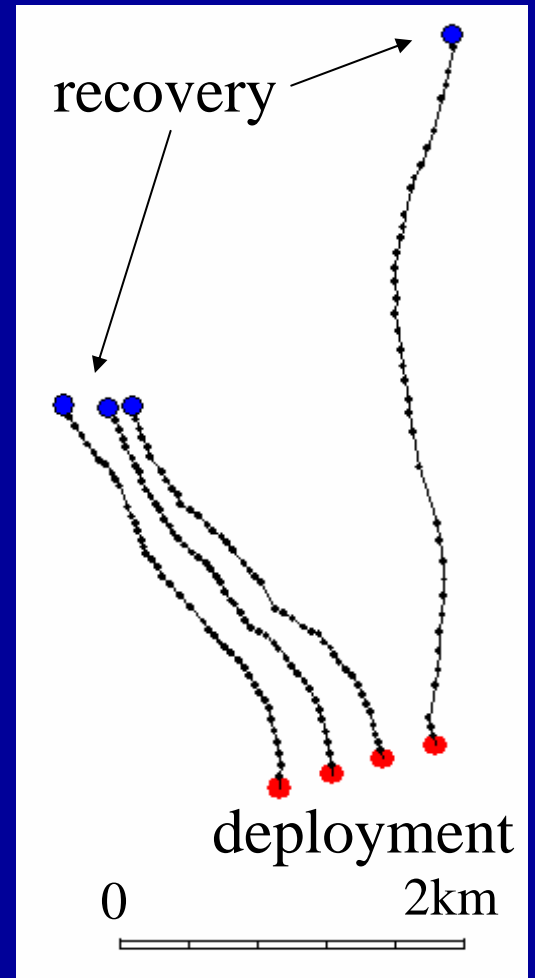






Red : drifting speed of drogued buoys

Blue: drifting speed of a buoy undrogued



## *Concluding summary*

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We see a qualitative correlation between the convergence field estimated by buoy experiments and accumulation of marine debris in the eastern side of Suruga Bay. This suggests that there are convergence zones off Heda Port where floating particles including marine debris are accumulated due to the convergent current field.

Northward current was dominant within 5 km off Heda Port during almost all of our experiments, usually showing convergence in zonal (east-west) and divergence (or stretching) motions in meridional direction, respectively.

This study presents preliminary results of field observations in Suruga Bay that are focusing upon the relation between the surface current structure and accumulation process of marine debris. Further experiments and observations are required to understand the behavior of floating marine debris on the sea surface, and mechanism of convergent structure of the current system in the region of interest.

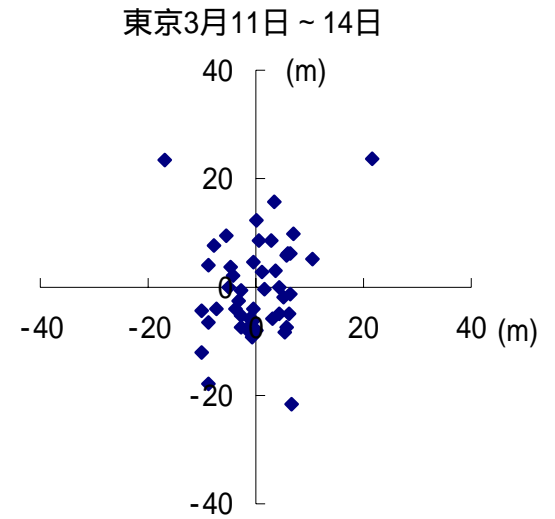
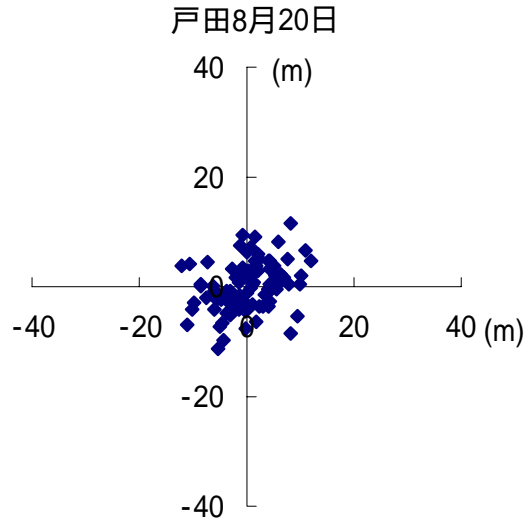
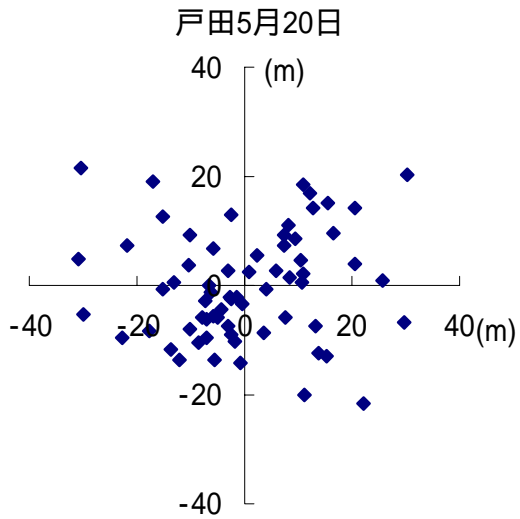
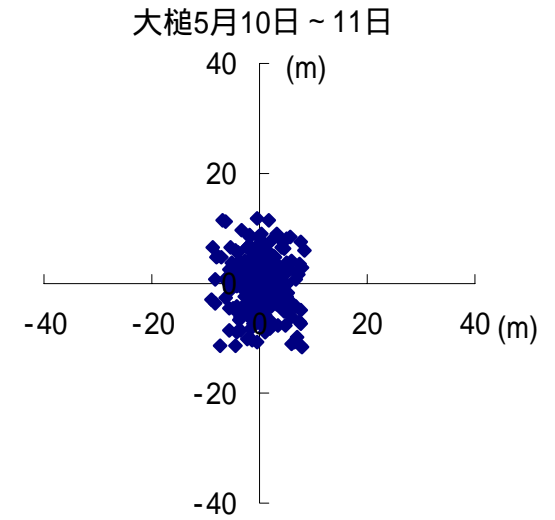
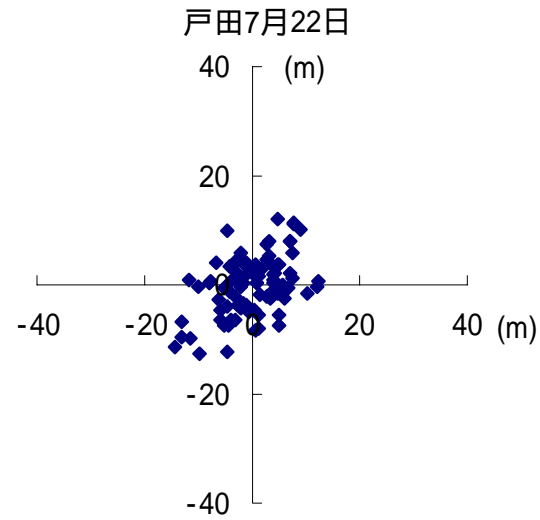
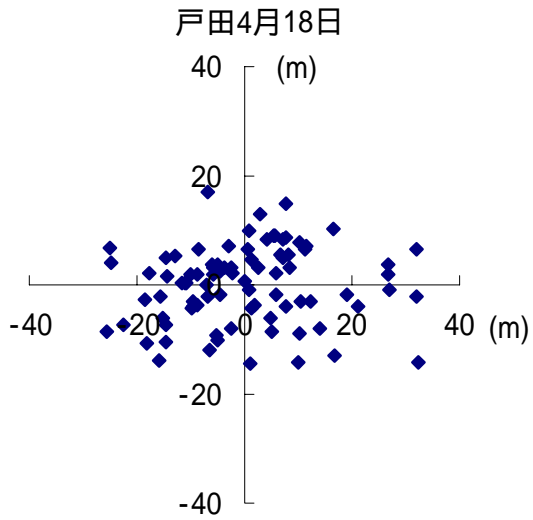
*Thank you*

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*First International Workshop on Marine Litter in the Northwest Pacific Region,  
Toyama, Japan, 14 and 15 November 2005*



# Error estimation of GPS positioning



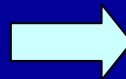
		SD of GPS positioning (m)		
		zonal ( x)	Meridional( y)	distance
Mar. 2005	Tokyo	6.6	9.0	11.2
Apr. 2005	Heda	13.2	7.0	15.0
May 2005	Heda	13.7	10.0	17.0
May 2005	Otsuchi	3.4	4.7	5.8
Jul. 2005	Heda	5.7	5.3	7.8
Aug. 2005	Heda	5.2	4.3	6.8

Table. Standard deviations of GPS positioning

### Accuracy of positioning

East-west : 3.4 ~ 13.7m

North-south : 4.3 ~ 10.0m



### Accuracy of velocity

East-west : 1.1 ~ 4.6 cm/s

North-south : 1.4 ~ 3.3 cm/s

# 装置の概要 (GPS携帯端末)



図 GPS携帯端末

分解能:  $1/100$ 秒 = 約30cm

データ取得間隔: 5, 10, 15, 20, 30, 60分

電池持続時間:

5分間隔: 約36時間

1時間間隔: 約6日と20時間

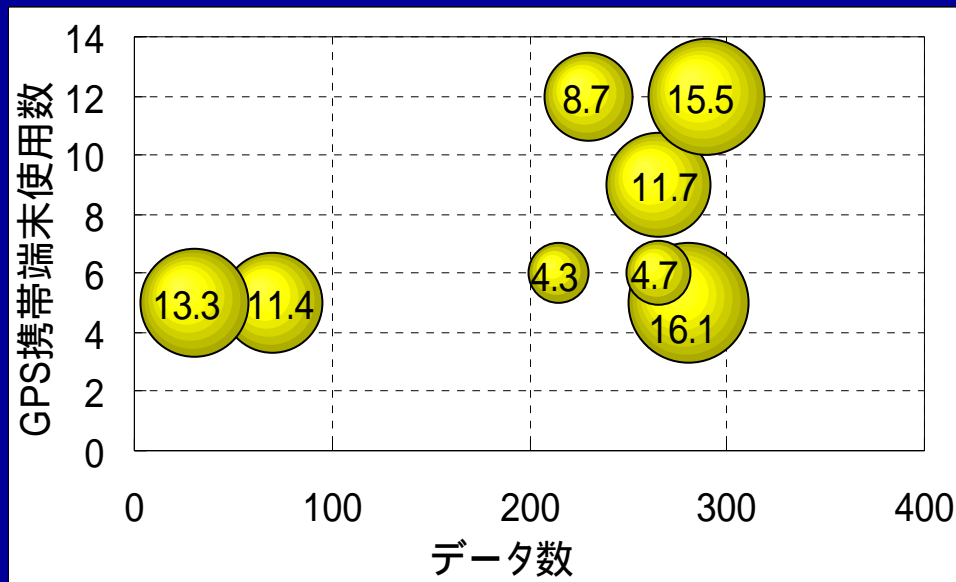


図 データ欠損率

円中の数字がデータ欠損率(%)

データ欠損率は

4 ~ 16%程度

# 装置の概要 (GPS携帯端末)

	GPS携帯端末
長所	<p>リアルタイムでデータが得られる</p> <p>好きな時間に所在地を知ることが出来る</p> <p>遠隔地から監視可能</p> <p>(携帯電話で操作可能)</p> <p>亡失してもデータは残る</p> <p>アンテナが多少ずれていても測位可能</p> <p>小型・軽量・比較的安価</p>
短所	<p>ドコモ圏外では使用不可</p> <p>(予備実験が不可欠)</p> <p>グループ毎でしか設定が出来ない</p>

表 GPS携帯端末の長所と短所