The latest development of disaster management platform in Taiwan

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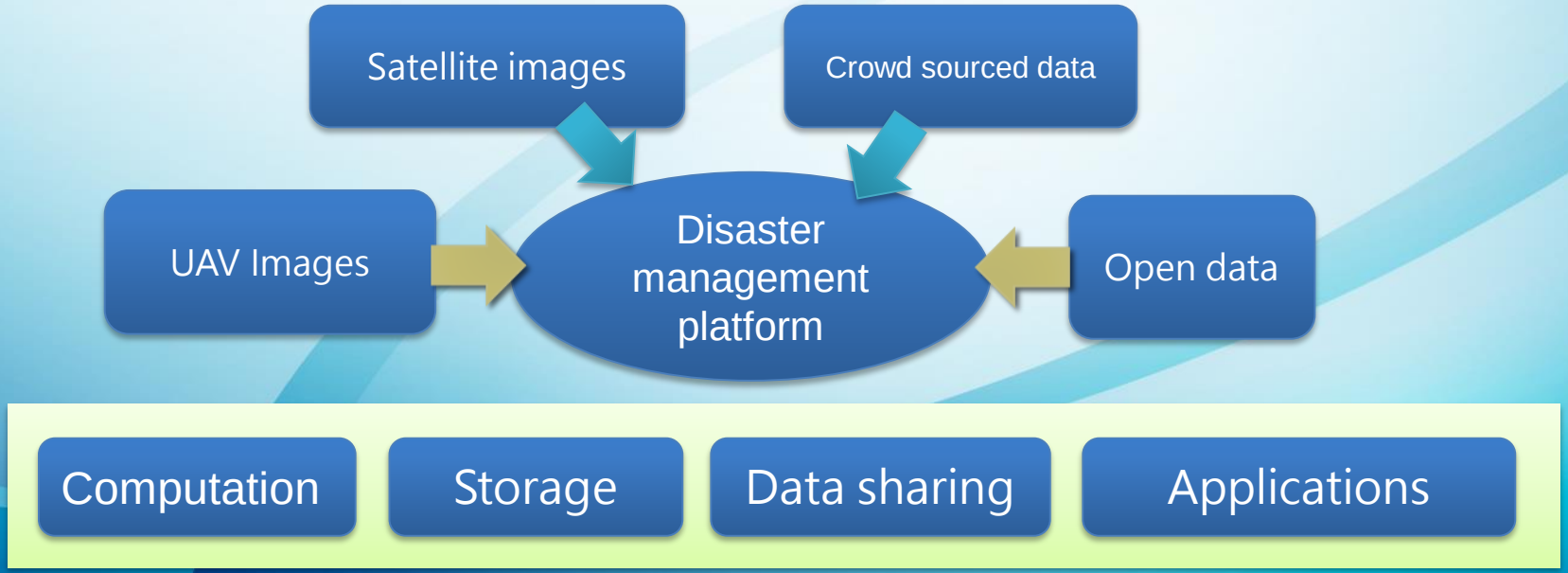
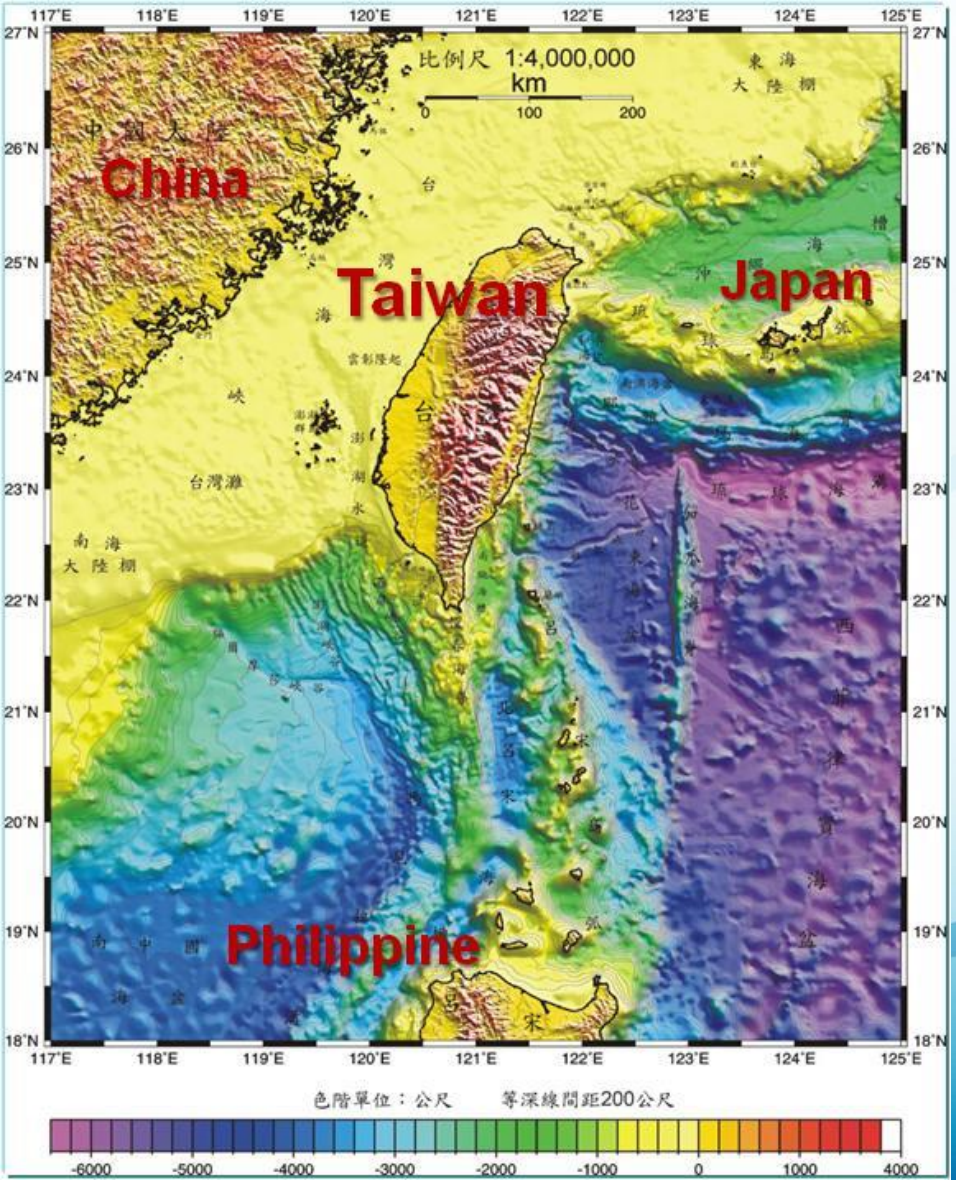
Outline

- Hadoop Use Case: big data computation
- Task satellite anywhere
- Citizen Probe: Crowdsourced data



Basic Information of Taiwan

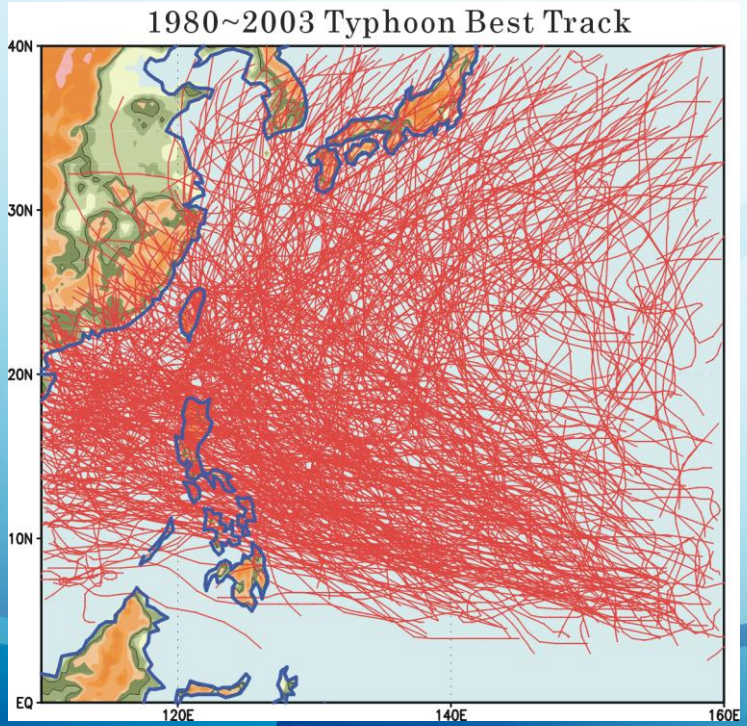


- *Geographic features*
  - *400 km from north to south*
  - *145 km from east to west*
  - *Area: 36,000 Km² **over 70% in slope land***
- *Population (2015)*
  - *23,229,04 in total, **67.70% in urban areas***
  - ***Density: 633/ Km²** , only lower than Bangladesh*
- *Tectonic Conjunctions:*
  - ***Philippine Sea plate***
  - ***Euro-Asia Plate***
- *High risk of tropical cyclones*
  - ***3.6 typhoons/year***

Source: NCDR

Economic Losses of Typhoon in Taiwan

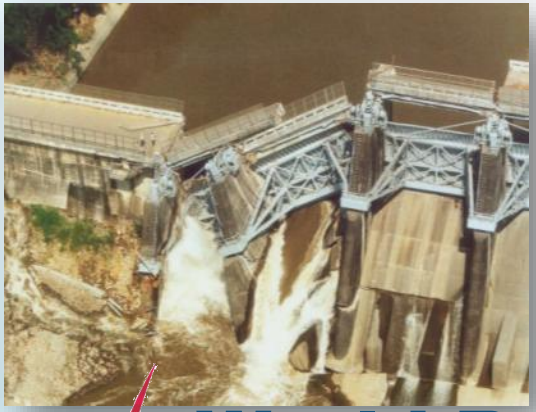
- In average, there are 3.6 typhoons touched down in Taiwan every year
  - In 2001, 8 typhoons attacked Taiwan
  - In 2004, 6 typhoons swept Taiwan
  - In 2005, 3 category-4 typhoons hit Taiwan
  - In 2015, 4 typhoons invades Taiwan



Typhoon	Death	Injure	Agri. Loss ($US M) (A)	Constr. Loss ($US M) (B)	Total ($US M) (A+B)
Chebi	30	124	22.3	0.7	23.0
Trami	5	-	2.2	4.9	7.1
Toraji	214	188	235.7	170.6	406.4
Nari	104	265	126.5	56.7	183.1
Utor	1	6	2.9	7.6	10.5
Total	354	583	389.6	240.5	630.1

Source: NCDR

World Bank: Major Types of Natural Disasters



√ earthquake

√ drought

? volcano

√ typhon

√ flood

√ landslide

Source: NCDR

Taiwan Suffers More than Others

Countries Most Exposed to Multiple Hazards

Three or more hazards (top 15 based on land area)

Country	Percent of Total Area Exposed	Percent of Population Exposed	Max. Number of Hazards
Taiwan	73.1	73.1	4
Costa Rica	36.8	41.1	4
Vanuatu	28.8	20.5	3
Philippines	22.3	36.4	5
Guatemala	21.3	40.8	5
Ecuador	13.9	23.9	5
Chile	12.9	54.0	4
Japan	10.5	15.3	4

Source: World Bank, 2005

Source: NCDR

Hadoop Use Cases

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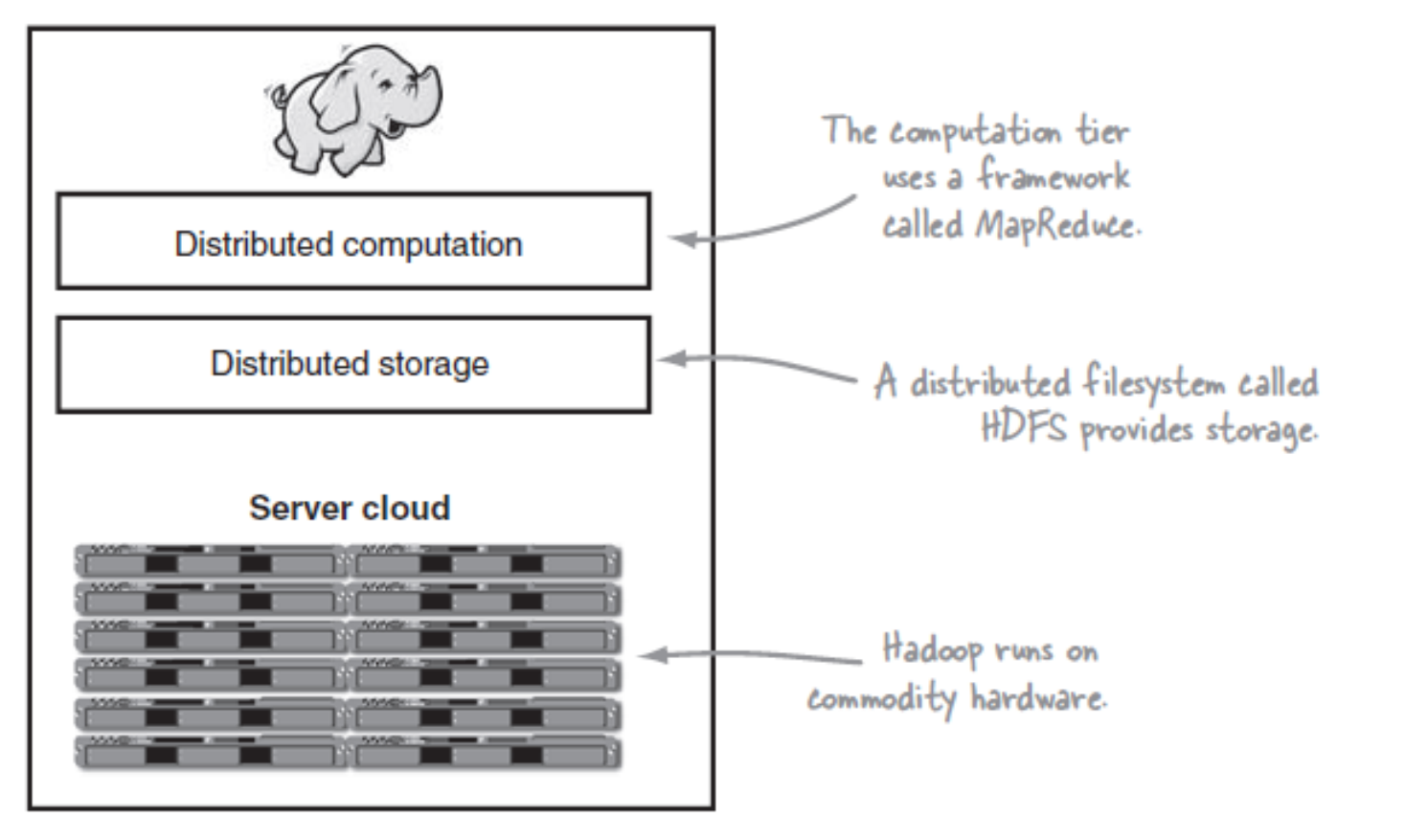
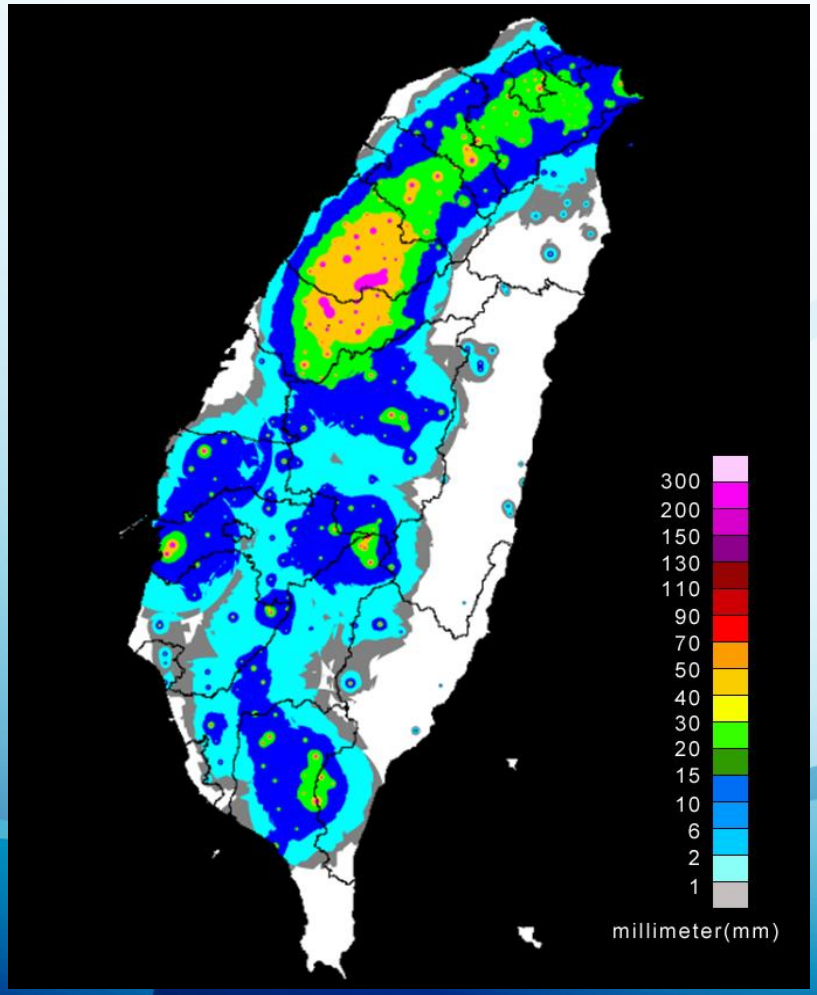
The Hadoop environment



Taiwan rainfall map rendering

1. Rainfall partition operation
2. Continuous range of data obtained



Rainfall Interpolation Application

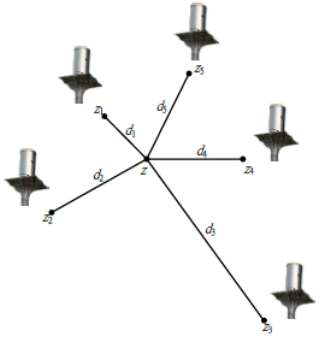


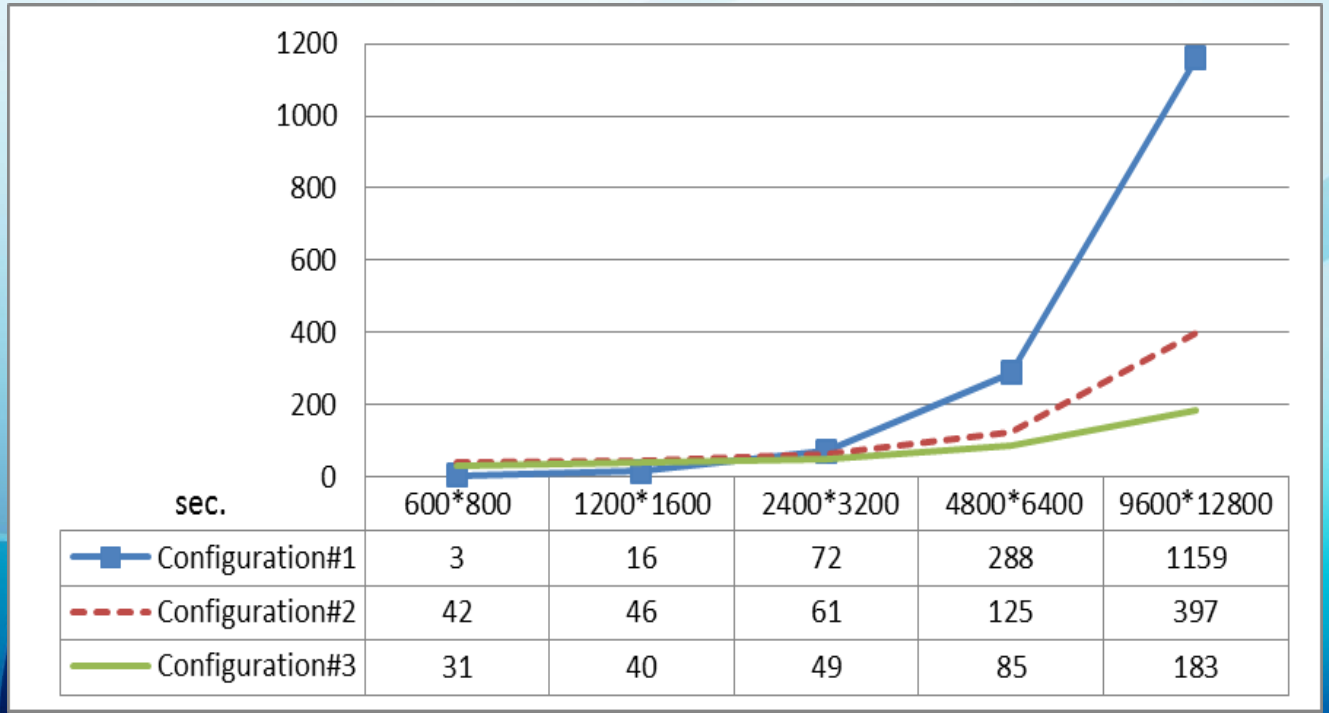
Fig. 8 Example of a Rainfall Interpolation Application

```
//***************
// Interpolation Service Component by IDW
//***************
Input the Evaluate Point, EvaluateP
Find the nearest rainfall stations (within 25 km), NearestSet
Calculate IDW Weight, w

for each p in NearestSet
  begin
    w += 1/ distance(p, EvaluateP)
  end
// Evaluate cell value by IDW
 for each p in NearestSet
  begin
    EvaluateValue += w * (1/distance(p, EvaluateP)) * p.value
  end
```

Fig. 9 Interpolation service pseudocode

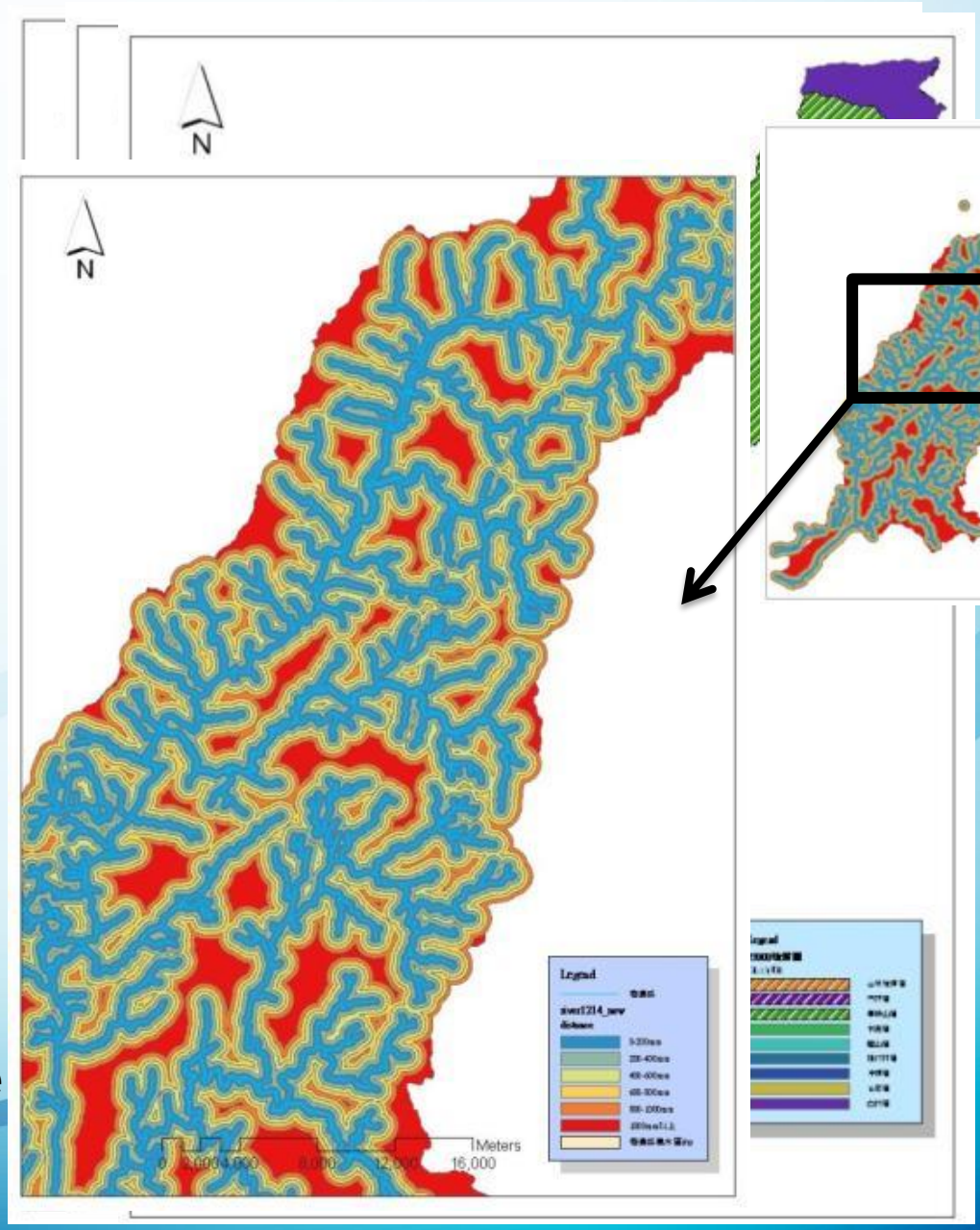
No	Description	CPU	RAM	Virtual Machines	Physical Machines	Software
1	Stand-alone machine	Intel(R) Core(TM) i5-3350P@ 3.10GHz	8G	None	1	Java Runtime Environment
2	Virtual Machines Computing Environment	Intel(R) Core(TM) i7-2600@ 3.40GHz	8G	4 VMs managed by Hyper-V of Server 2008 (One with 2G RAM and three with 1G RAM)	1	hadoop 0.20.205 and Ubuntu Linux 11.10.
3	Distributed Computing Environment	Intel(R) Core(TM) i5-2400@ 3.10GHz	12G or 4G	None	3 (Master with 12G RAM and others with 4G RAM)	hadoop 0.20.205 and Ubuntu Linux 11.10.



sec.	600*800	1200*1600	2400*3200	4800*6400	9600*12800
Configuration#1	3	16	72	288	1159
Configuration#2	42	46	61	125	397
Configuration#3	31	40	49	85	183

Influence of selected factors

- ✓ Slope
- ✓ Height
- ✓ Geological
- ✓ Distance from the river
- ✓ Rainfall



1. Calculate the probability of collapse
2. Partition computing

Task satellite anywhere

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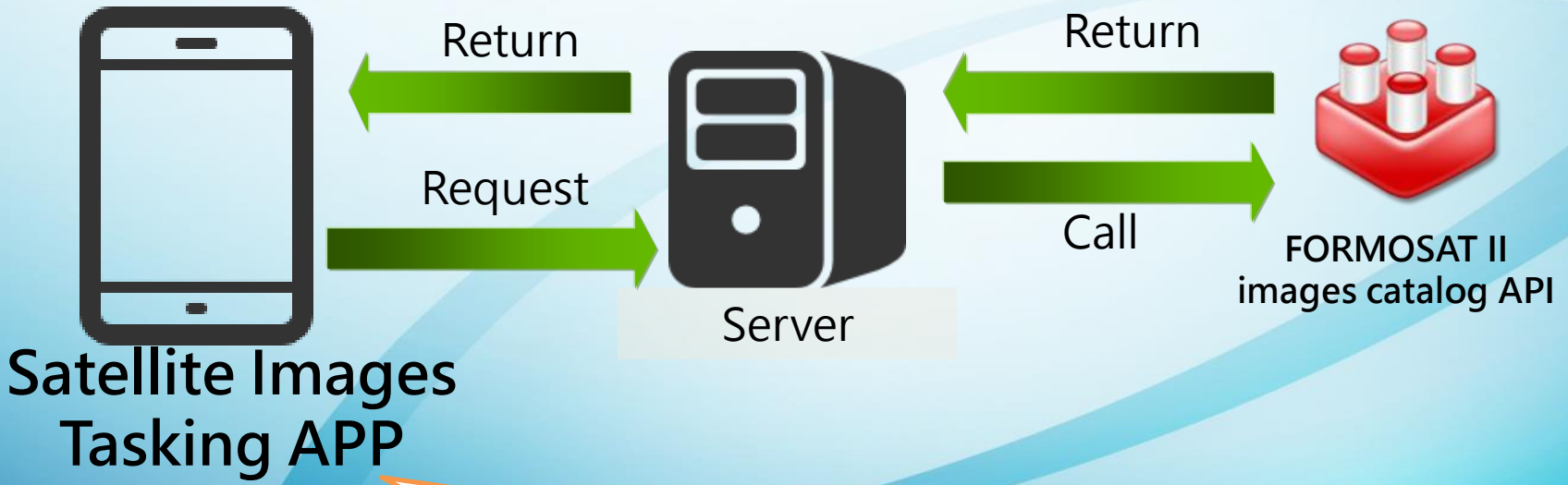
Scenario of tasking anywhere

Emergency of shooting images orders

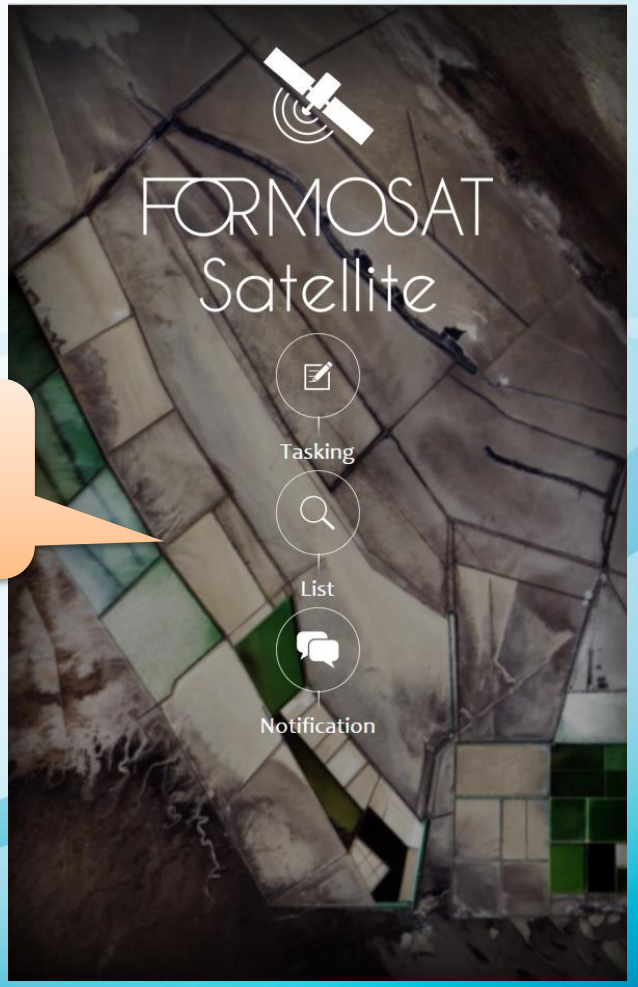


1. Submit tasks (single day or cycle days)
2. Search the status of shooting task

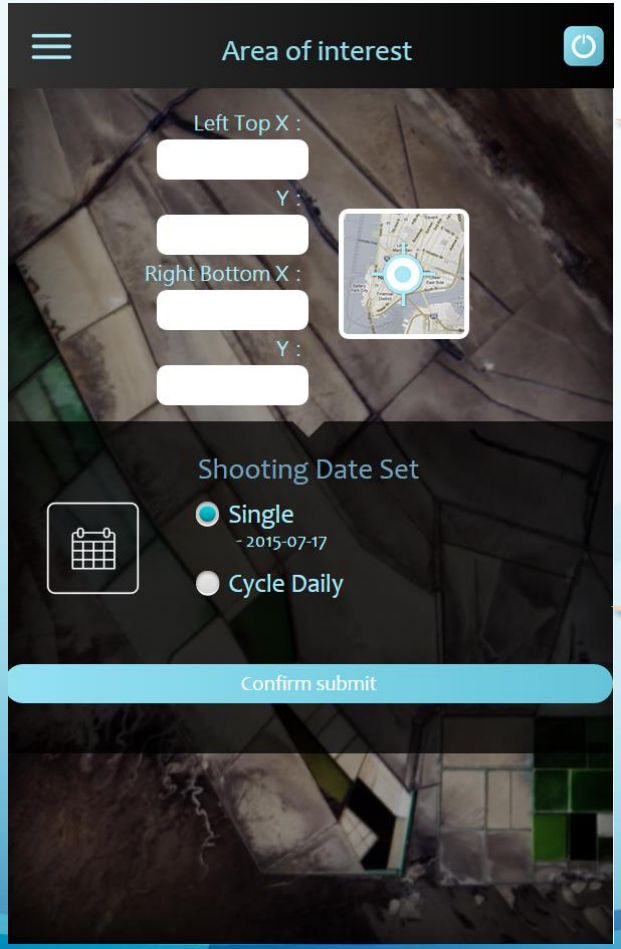
FORMOSAT Satellite Images Tasking APP

Registration and sign-in page

Main page :
1. Submit task
2. Search submitted task
3. Notification



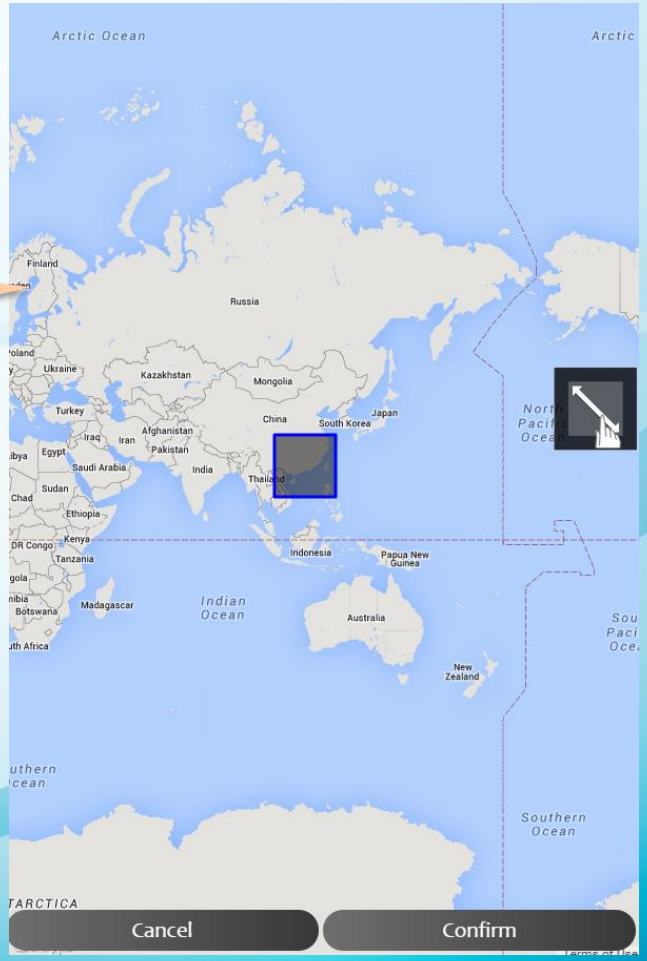
Submit shooting mission



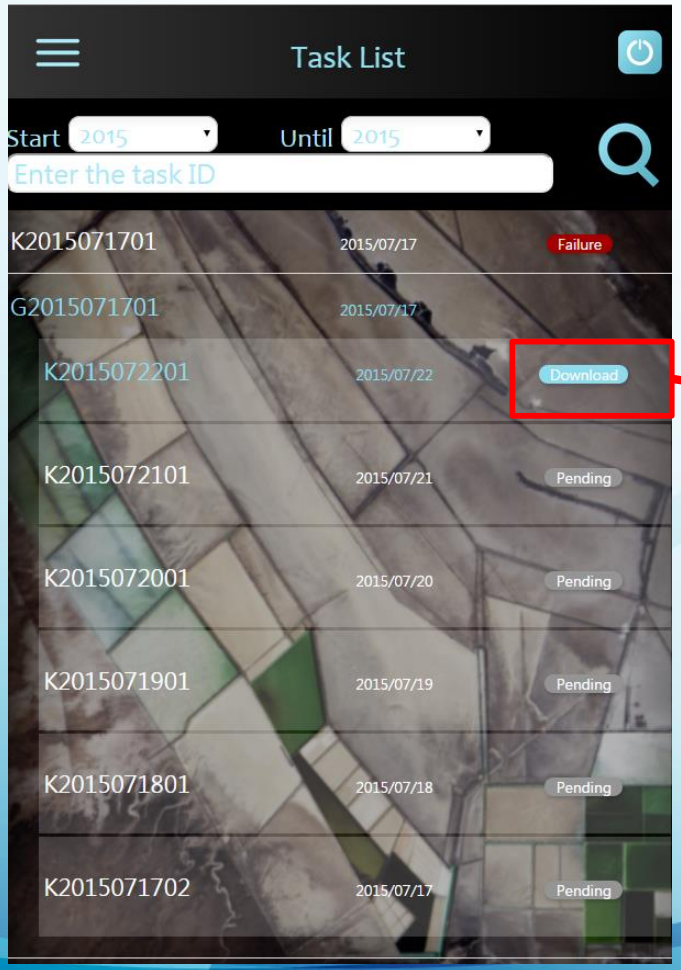
Task by
Area of Interest

Select shooting area

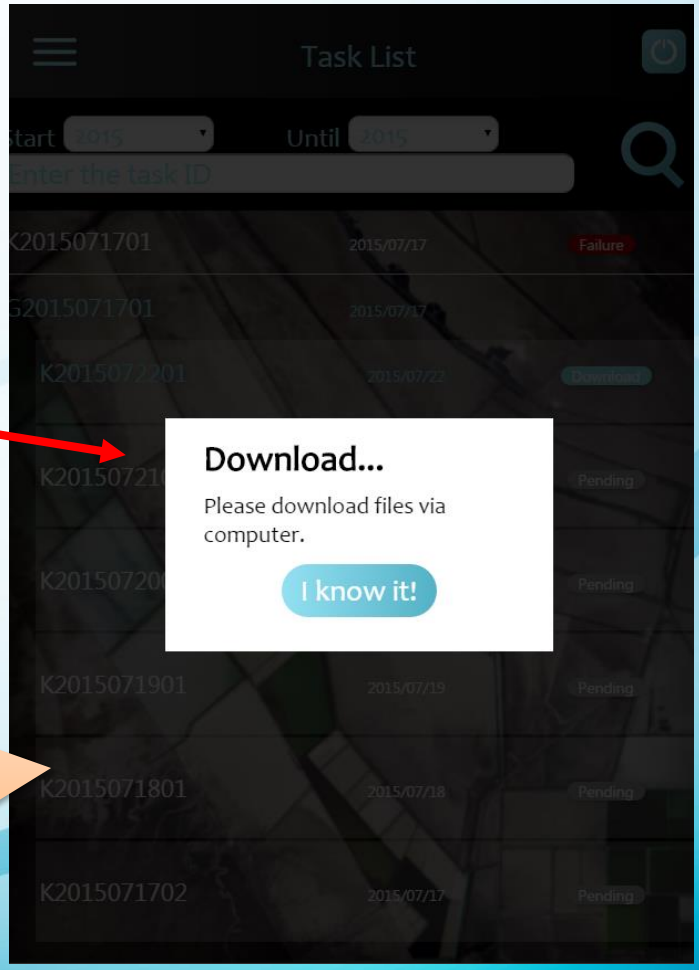
By single day
or cycle daily



Submitted task and search task

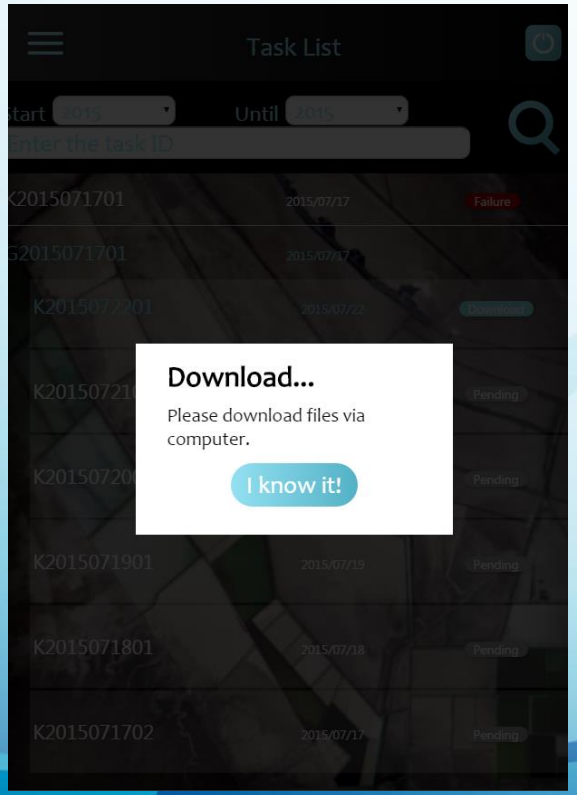


Recommend to download files by desktop

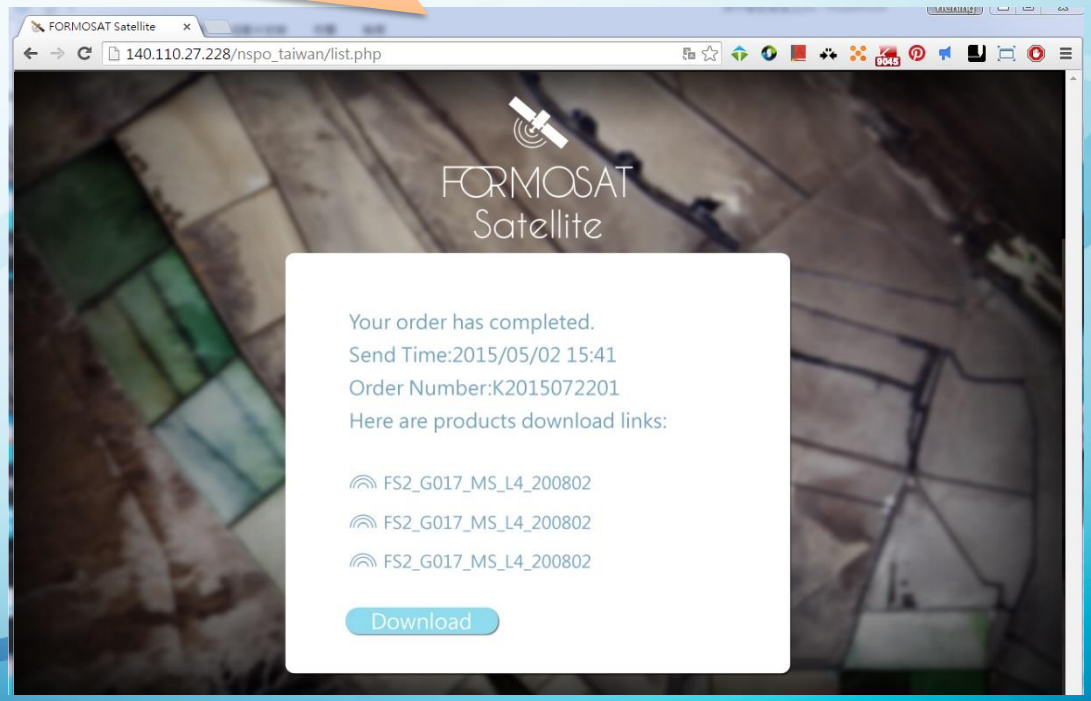


Download products from web

- Due to the limitation of storage in mobile device.
- Users can download L4 images by web sites of desktop.



Download zip files of satellite images in L4 format



Citizen Probe

Crowdsourcing to Build the Disaster Prevention Map of Resilience City

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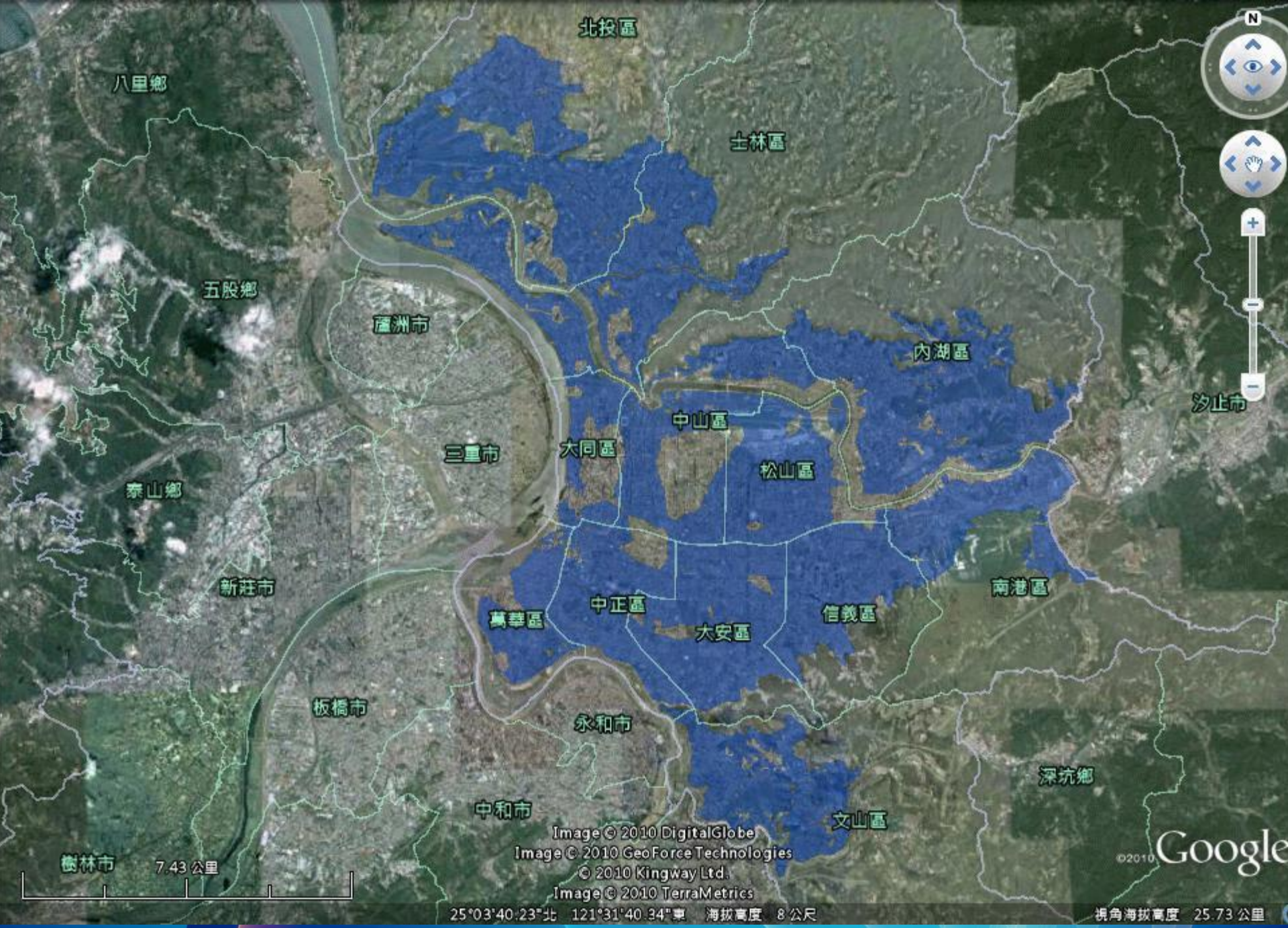
7
ELEVEN


北投區
八里鄉
士林區
五股鄉
蘆洲市
內湖區
汐止市
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大同區
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永和市
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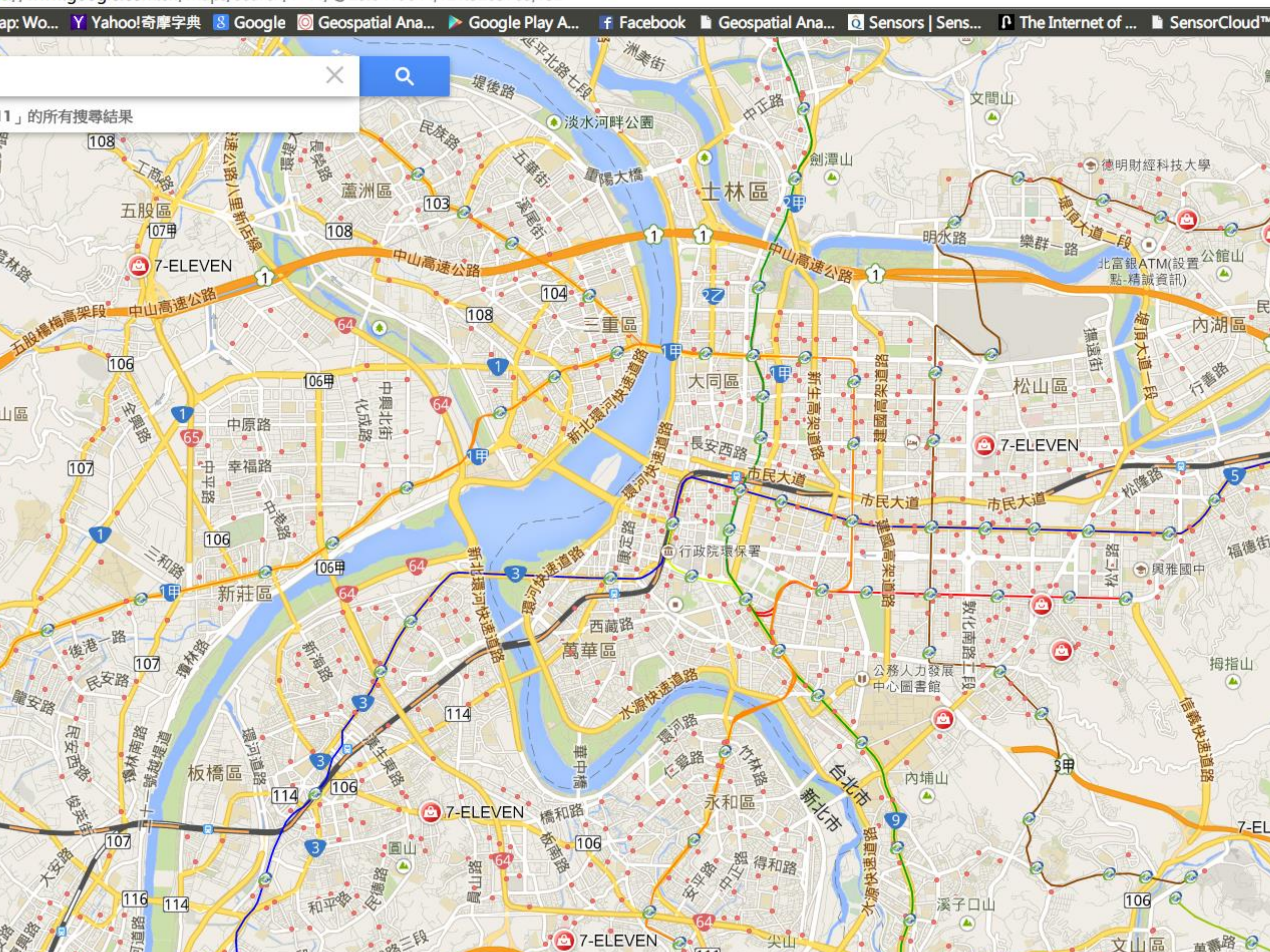
25°03'40.23"北 121°31'40.34"東 海拔高度 8 公尺
視角海拔高度 25.73 公里

- convenience stores
  - 11,000
- Gas stations
  - 2,600
- Government-own cameras
  - 50,000+
- Human volunteers
  - 23,500,000



Yahoo!奇摩字典
Google
Geospatial Ana...
Google Play A...
Facebook
Geospatial Ana...
Sensors | Sens...
The Internet of ...
SensorCloud™
1」的所有搜尋結果
淡水河畔公園
士林區
蘆洲區
五股區
三重區
大同區
松山區
內湖區
新莊區
萬華區
板橋區
永和區
中山高速公路
五股楊梅高架段
7-ELEVEN
劍潭山
文間山
德明財經科技大學
公館山
明水路
樂群二路
堤頂大道二段
北富銀ATM(設置點-精誠資訊)
民族路
重陽大橋
中正路
長安西路
市民大道
行政院環保署
公務人力發展中心圖書館
興雅國中
拇指山
內埔山
溪子口山
西藏路
水源快速道路
環河快速道路
新北環河快速道路
中原路
幸福路
中興北街
化成路
後港一路
民安路
台北市
新北市
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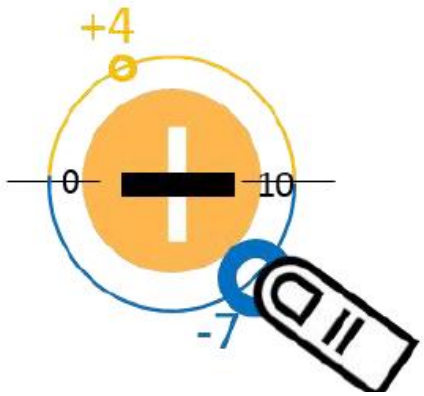
台大醫院站
行政院環保署
中正紀念堂站
大安森林公園站
大安站
忠孝復興站
南京東路站
朱崙街
八德路二段
市民大道
信義路一段
桂林路
山寺站
萬華火車站
蘋果日報

Citizen Probe App (Ongoing Version)

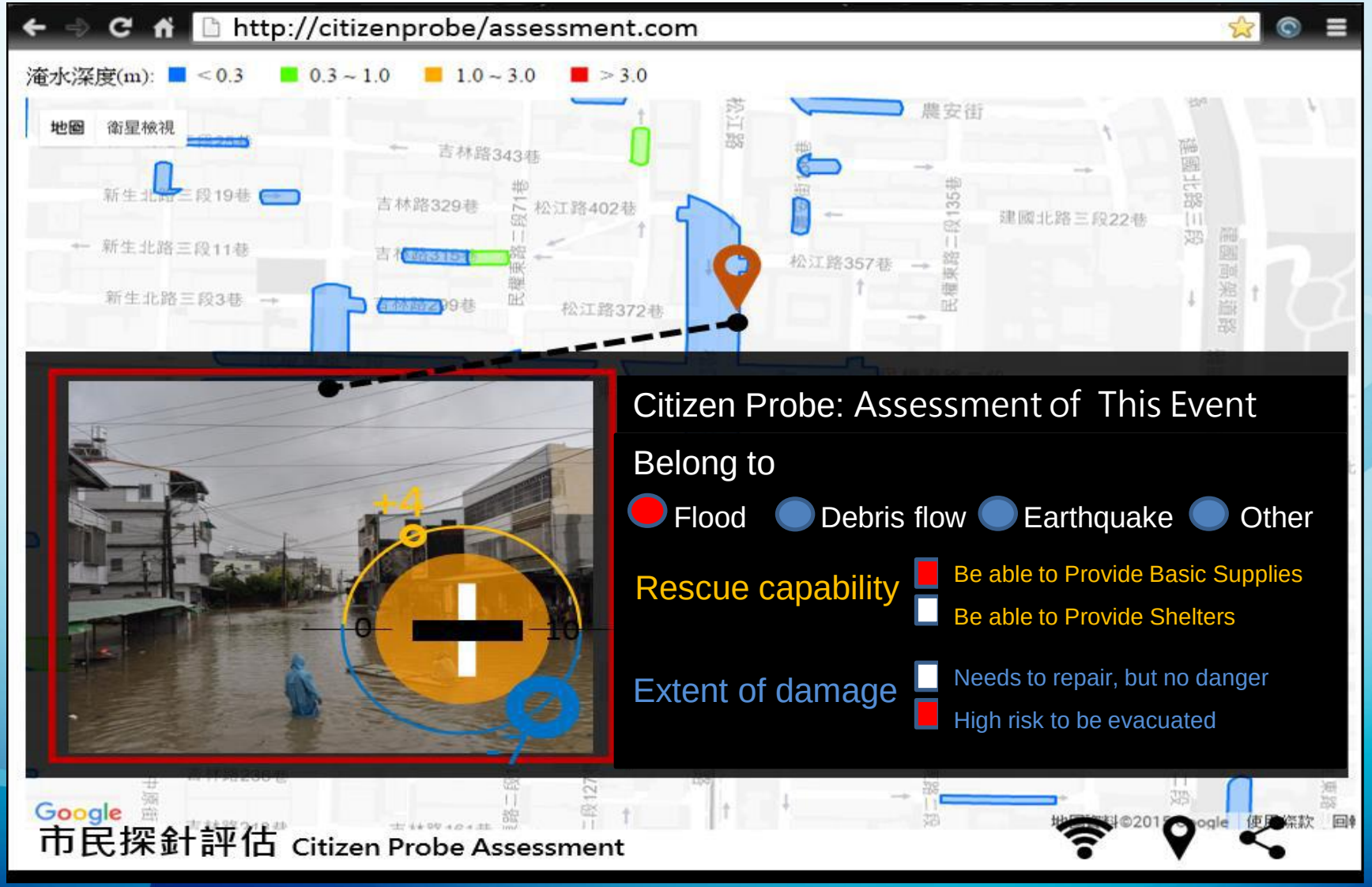
Rescue diffculty



Serverity

From 0 to 10

Assessment of crowd sourced data



Conclusion

- Humanitarian Satellite Images
- Location-based VGI
- Big Data Processing Platform

謝謝

Thank you

Gracias

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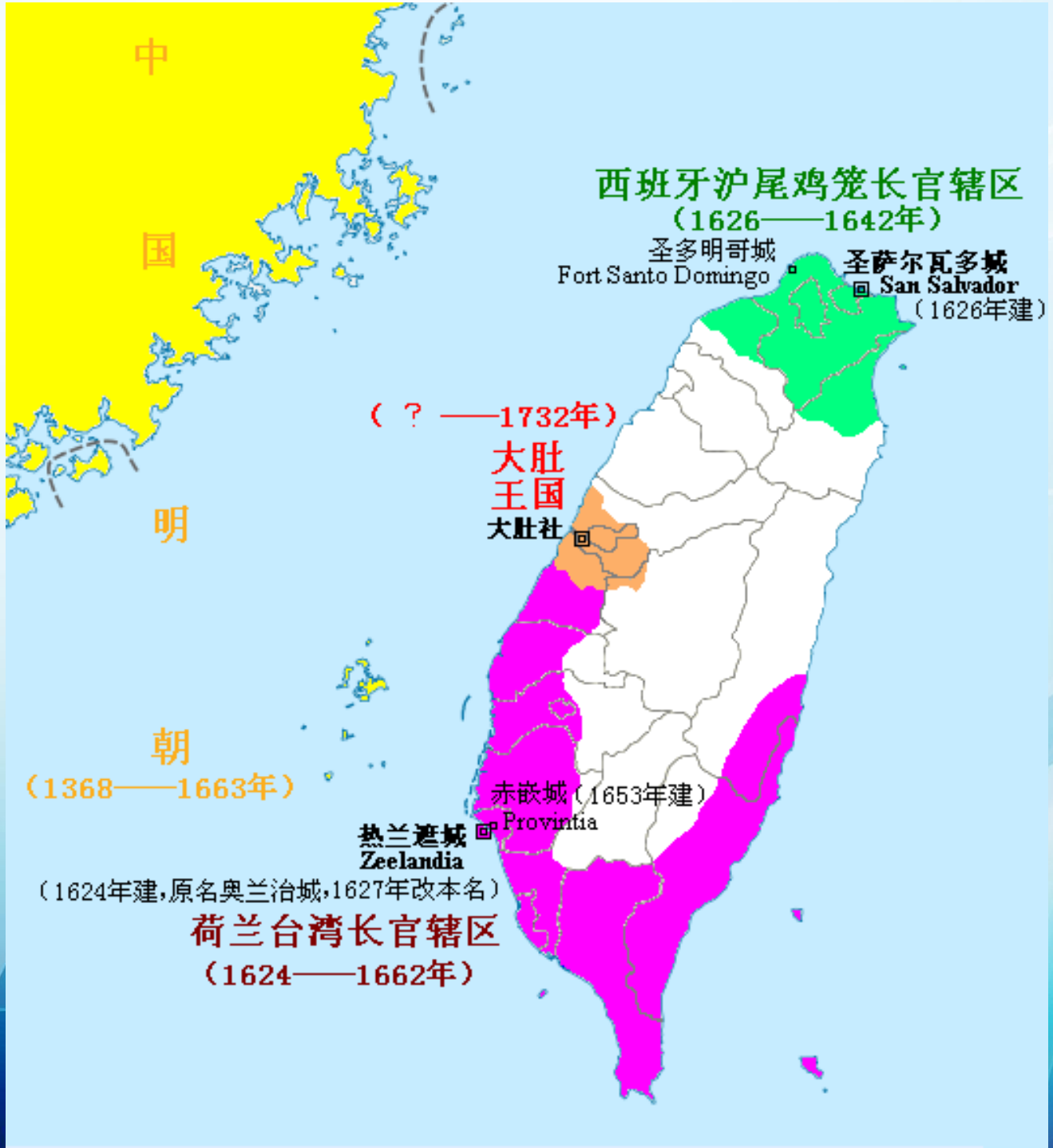
中
国
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朝
（1368——1663年）
西班牙沪尾鸡笼长官辖区
（1626——1642年）
圣多明哥城
Fort Santo Domingo
圣萨尔瓦多城
San Salvador
（1626年建）
（？——1732年）
大肚
王国
大肚社
赤嵌城（1653年建）
Provintia
热兰遮城
Zeelandia
（1624年建，原名奥兰治城，1627年改本名）
荷兰台湾长官辖区
（1624——1662年）