Evacuation Simulation Using Supersomputers

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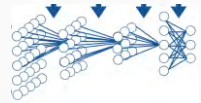
K　10PFLOPS, 2011-2019

Fugaku　442PFLOPS, 2020-



Fugaku NEXT ～2030

x10 performance with accelerator(GPU)

AI oriented with QPU?

Advantage of supercomputer for social simulation and data-mining:

- scalable executions both for capability and capacity
- high data-bandwidth

flexible working bed for future society

Fugaku

RIKEN: organization

History

1917 – 1948 Research Foundation
1948 – 1958 Co. Ltd
1958 – now National Research Center

Transformative Research Innovation Platform of RIKEN platforms (TRIP)
Creation of an innovative research platform that effectively generating new fields of knowledge across research fields by organically linking the cutting-edge platforms

Chief Scientist Laboratories

Cluster for Pioneering Research
Pioneering and creating new fields of science in order to sustain continuous innnovation

- Center for Advanced Intelligence Project
- Interdisciplinary Theoretical and Mathematical Sciences Program
- Center for Integrative Medical Sciences
- Center for Biosystems Dynamics Research
- Center for Brain Science
- Center for Sustainable Resource Science
- Center for Emergent Matter Science
- Center for Quantum Computing
- Center for Advamced Photonics
- Nishina Center for Accelerator-Based Science

Research Infra-structure Centers
Promotion of research and development, improvement, and public utilization of the world' s top-level research infrastructure

Strategic Research Centers
Promotion of strategic R&D to address national and social demands

- Center for Computational Science
- SPring-8 Center
- BioResource Research Center

Information R&D and Strategy Headquarters
Enhancement and implementation of digital research infrastructures for information and data science

- Infrastructure Research and Development Division
- Advanced Data Science Project
- Guardian Robot Project

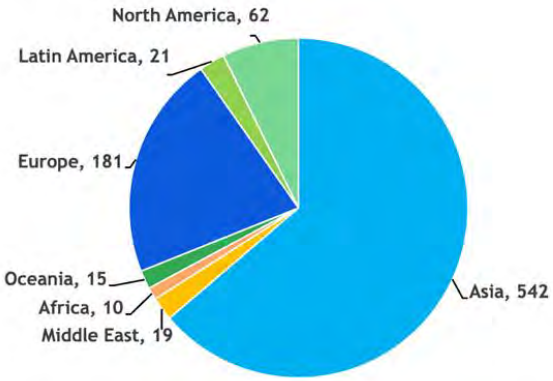
Cluster for Science, Technology and Innovation Hub
Promotion of returning the benefits of research to society by strengthening partnerships with relevant organizations

- Promotion for Drug Discovery and Medical Technology Platforms
- Preventive Medicine & Diagnosis Innovation Program
- Baton Zone Program Industrial Co-creation Program

RIKEN Innovation Co., Ltd.
- Technology licensing
- Start-up support
- Joint research promotion
- Membership-based co-creation

Figures

- Personnel -
Totally 3440
Researchers 2770
(non-Japanese 850)

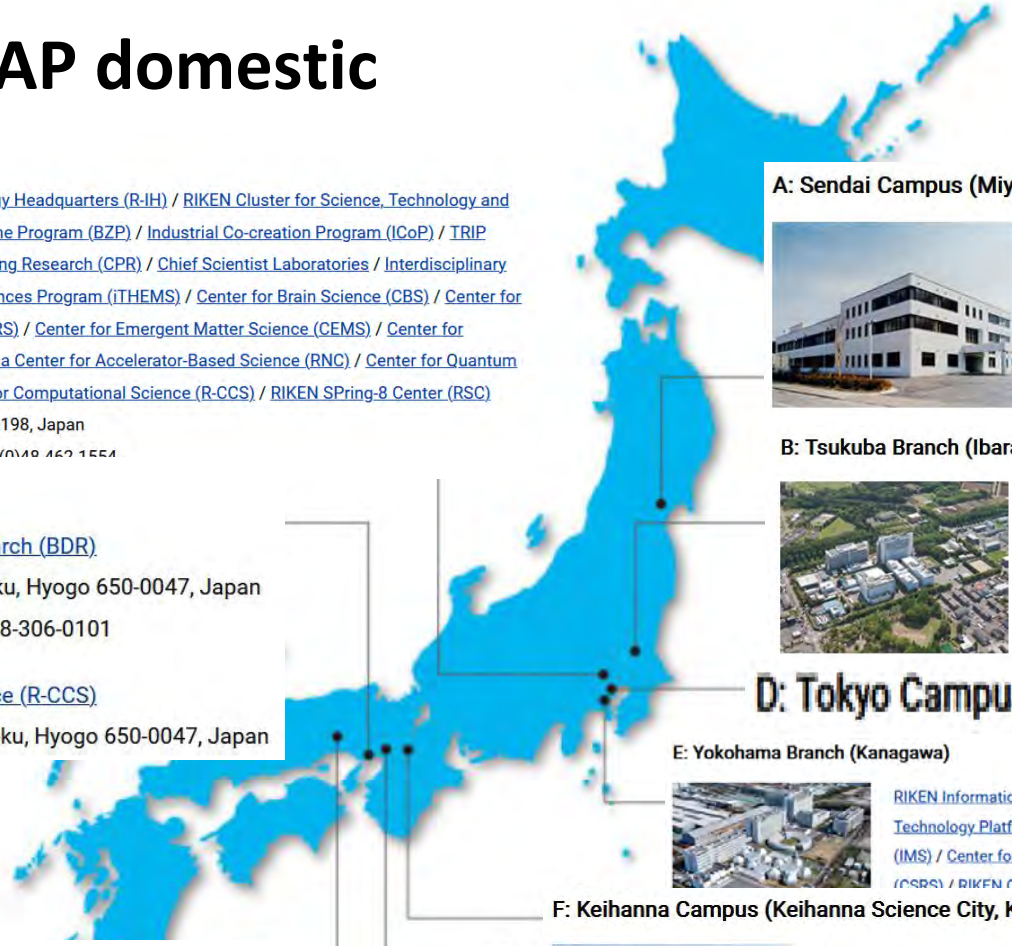


- Budget -
103.89B Yen
≃ 0.67B USD (155 Yen/USD)
(84% from Government)

Fugaku

RIKEN: MAP domestic

RIKEN R-CCS



C: Wako Branch / Headquarters (Saitama)

RIKEN Information R&D and Strategy Headquarters (R-IH) / RIKEN Cluster for Science, Technology and Innovation Hub (RCSTI) / Baton Zone Program (BZP) / Industrial Co-creation Program (ICoP) / TRIP Headquarters / Cluster for Pioneering Research (CPR) / Chief Scientist Laboratories / Interdisciplinary Theoretical and Mathematical Sciences Program (iTHEMS) / Center for Brain Science (CBS) / Center for Sustainable Resource Science (CSRS) / Center for Emergent Matter Science (CEMS) / Center for Advanced Photonics (RAP) / Nishina Center for Accelerator-Based Science (RNC) / Center for Quantum Computing (RQC) / RIKEN Center for Computational Science (R-CCS) / RIKEN SPring-8 Center (RSC)

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A: Sendai Campus (Miyagi)

RIKEN Center for Advanced Photonics (RAP)

519-1399 Aoba, Aramaki, Aoba-ku, Sendai, Miyagi 980-0845, Japan

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B: Tsukuba Branch (Ibaraki)

RIKEN BioResource Research Center (BRC[R]) / Tsukuba Branch

3-1-1 Koyadai, Tsukuba, Ibaraki 305-0074, Japan

Tel: +81-(0)29-836-9111 / Fax: +81-(0)29-836-9109

H: Kobe Branch (Hyogo)

Center for Biosystems Dynamics Research (BDR)

2-2-3, Minatojima-minamimachi, Chuo-ku, Hyogo 650-0047, Japan

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RIKEN Center for Computational Science (R-CCS)

7-1-26 Minatojima-minamimachi, Chuo-ku, Hyogo 650-0047, Japan

D: Tokyo Campus (Chuo-ku, Tokyo)

E: Yokohama Branch (Kanagawa)

RIKEN Information R&D and Strategy Headquarters (R-IH) / Program for Drug Discovery and Medical Technology Platforms (DMP) / Baton Zone Program (BZP) / Center for Integrative Medical Sciences (IMS) / Center for Biosystems Dynamics Research (BDR) / Center for Sustainable Resource Science (CSRS) / RIKEN Center for Computational Science (R-CCS) / Yokohama Campus

agawa 230-0045, Japan

113

F: Keihanna Campus (Keihanna Science City, Kyoto)

G

Center for Advanced Intelligence Project (AIP)

Email: aip-suishin [at] riken.jp

I: Harima Branch (Hyogo)

RIKEN SPring-8 Center (RSC)

1-1-1 Kouto, Sayo-gun Sayo-cho, Hyogo 679-5148, Japan

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G: Osaka Campus (Osaka)

Center for Biosystems Dynamics Research (BDR)

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Osaka Campus (in Japanese)

RIKEN: MAP global

A: Europe Office

Europe Office

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Tel: +32-2-732-7277

C: Beijing Office

Beijing Office

1008, Beijing Fortune Building, No.5, Dong San Huan Bei Lu, Chao Yang District, Beijing, 100004, China

Tel: +86-(0)10-6590-9192 / Fax: +86-(0)10-6590-9897

B: Singapore Office

Singapore Office

61 Biopolis Drive #02-02 Proteos, Singapore 138673

Tel: +65-6478-9940

D: RIKEN BNL Research Center

RIKEN BNL Research Center

Bldg. 510A, Brookhaven National Laboratory, Upton, NY 11973, USA

Tel: +1-631-344-8095 / Fax: +1-631-344-8260

RIKEN R-CCS: Research Teams

Fugaku

RIKEN R-CCS

- Director
- Deputy Directors
- Research Teams
- Operations and Computer Technologies Division
- HPC and AI driven Drug Development Platform Division
- Quantum-HPC Hybrid Platform Division
- AI for Science Platform Division
- Next-Generation HPC Infrastructure Development Division
- Office of the Center Director
  - Office of the Fugaku Society 5.0 Initiative

Science of Computing

Large-scale Parallel Numerical Computing Technology Research Team
Parallel Algorithms
Team Principal
Toshiyuki Imamura

Next Generation High Performance Architecture Research Team
Computer Architecture
Team Principal
Masaaki Kondo

High Performance Big Data Research Team
Big Data Processing Platform
Team Principal
Kento Sato

High Performance Artificial Intelligence Systems Research Team
High Performance Artificial Intelligence Systems
Team Principal
Mohamed Wahib

Supercomputing Performance Research Team
Performance Modelling and Predictions
Team Principal
Jens Domke

Large-Scale Digital Twin Research Team
Digital Twin Platform
Team Principal
Hirozumi Yamaguchi

High Performance Cloud Systems and Secure Software Research Team
Cloud Computing
Team Principal
Atsuko Takefusa

Processor Research Team
Computer Architecture
Team Principal
Kentaro Sano

Science by Computing

Field Theory Research Team
Theory of Elementary Particles
Team Principal
Yasumichi Aoki

Discrete Event Simulation Research Team
Statistical physics
Team Principal
Nobuyasu Ito

Computational Molecular Science Research Team
Quantum chemistry
Team Principal
Takahito Nakajima

Computational Materials Science Research Team
Condensed matter physics
Team Principal
Seiji Yunoki

Computational Biophysics Research Team
Molecular Dynamics
Team Principal
Yuji SUGITA

Computational Climate Science Research Team
Climate modeling
Team Principal
Hirofumi Tomita

Complex Phenomena Unified Simulation Research Team
Fluid Dynamics
Team Principal
Makoto TSUBOKURA

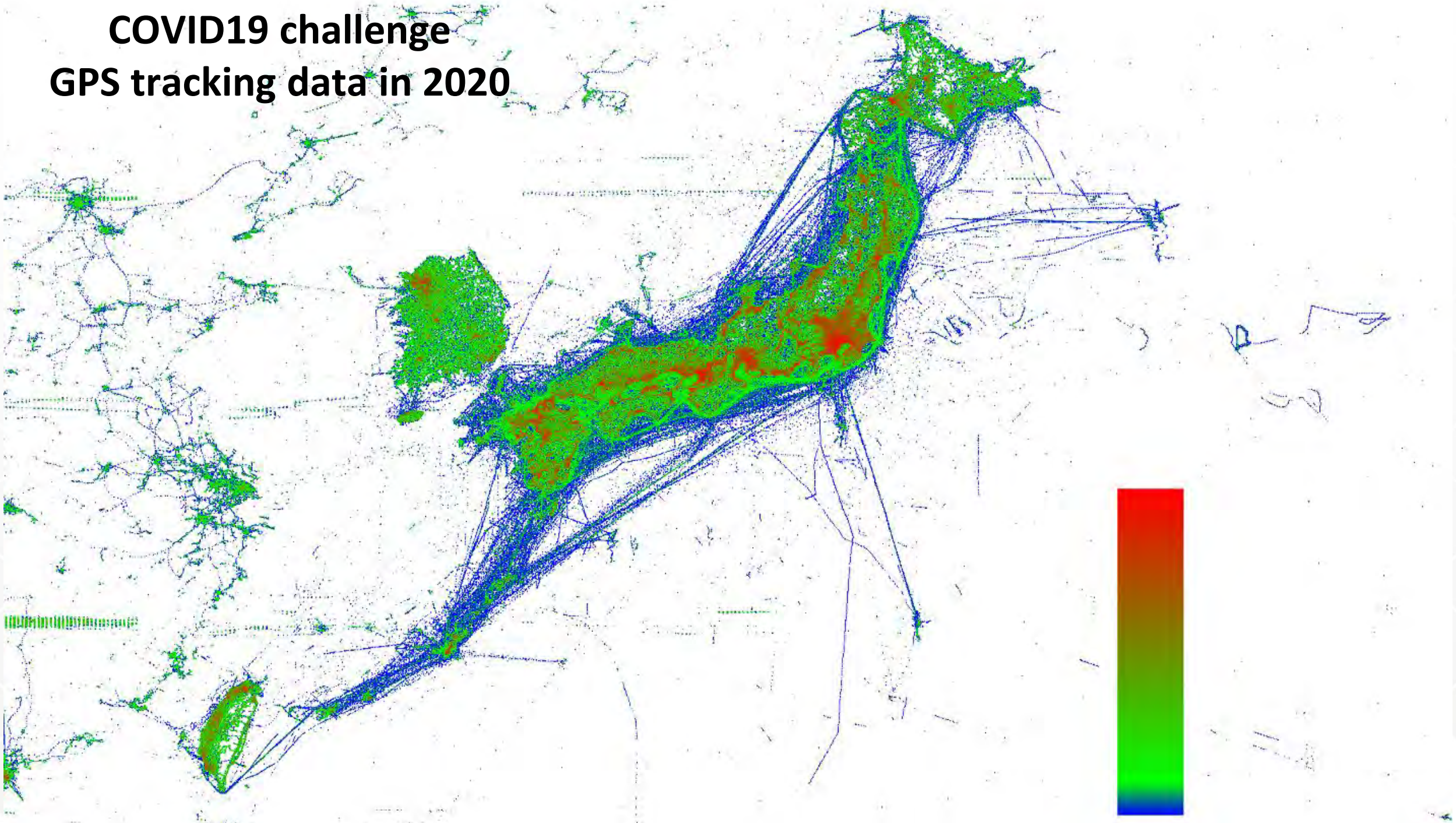
Data Assimilation Research Team
Data Assimilation
Team Principal
Takemasa Miyoshi

Computational Structural Biology Research Team
Modeling
Team Principal
Florence Tama

Computational Disaster Mitigation and Reduction Research Team
Automatic Urban Structure Modeling
Team Principal
Hirofumi Tomita

Digital Materials Science Research Team
First-principles calculation
Team Principal
Shinji Tsuneyuki

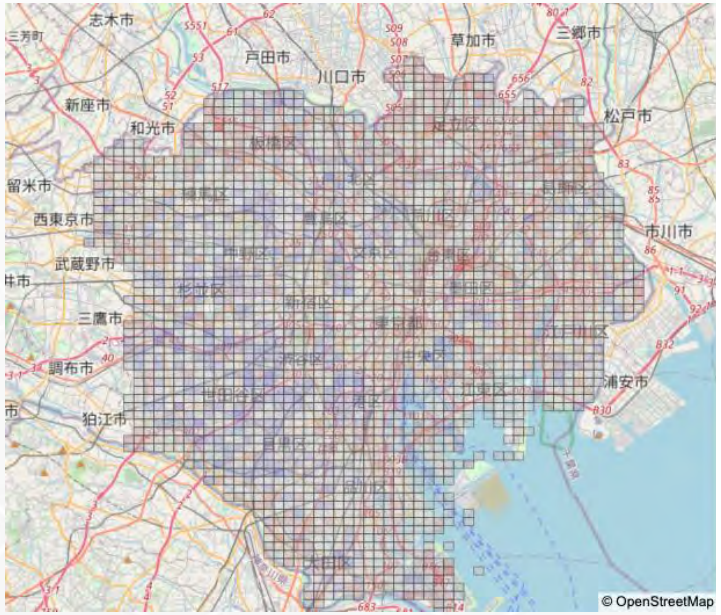
COVID19 challenge
GPS tracking data in 2020



scientific reports vol.15 (2025) p.1081

Check for updates

9th factor



OPEN

Hotspot analysis of COVID-19 infection in Tokyo based on influx patterns

Yu Kimura[1]✉, Tatsunori Seki[1], Keisuke Chujo[1], Toshiki Murata[1]✉, Tomoaki Sakurai[1], Satoshi Miyata[1], Hiroyasu Inoue[2,3] & Nobuyasu Ito[3]

We analyse the relationship between population influx and the effective reproduction number in the 23 wards of Tokyo during the COVID-19 pandemic to estimate hotspots of infection. We identify some patterns of population influx via factor analysis and estimate specific areas as infection-related hotspots by focusing on influx patterns that are highly correlated with the effective reproduction number. As a result, several influx patterns are assumed to be directly related to the subsequent spread of the infection. This analytical method has the potential to detect unknown hotspots related to pandemics in the future.

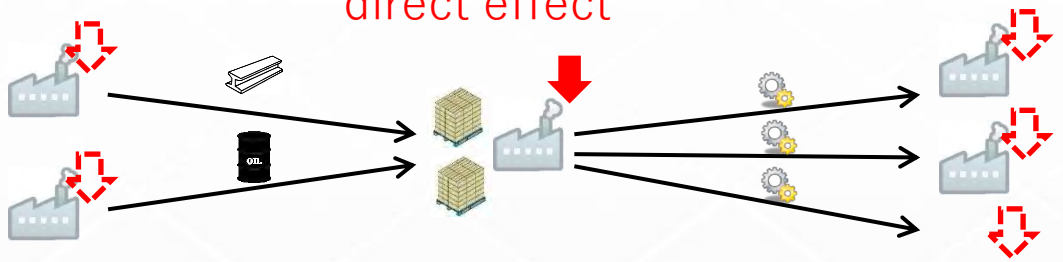
Several years have passed since Coronavirus disease 2019, hereafter referred to as COVID-19, spread worldwide in 2019. Each country has taken measures to prevent the spread of infection, such as travel and commercial restrictions, which have been studied from the viewpoint of their effectiveness[1–4]. According to a paper by Tian et al.[5], the travel ban in Wuhan in January 2020 delayed the arrival of the disease in other cities in China

Y. Kimura et al., “Hotspot analysis of COVID-19 infection in Tokyo based on influx patterns”, Sci. Rep. (2025) 15:1081, https://doi.org/10.1038/s41598-024-82962-y

Impact on macroeconomics

direct effect

indirect effect
demand side

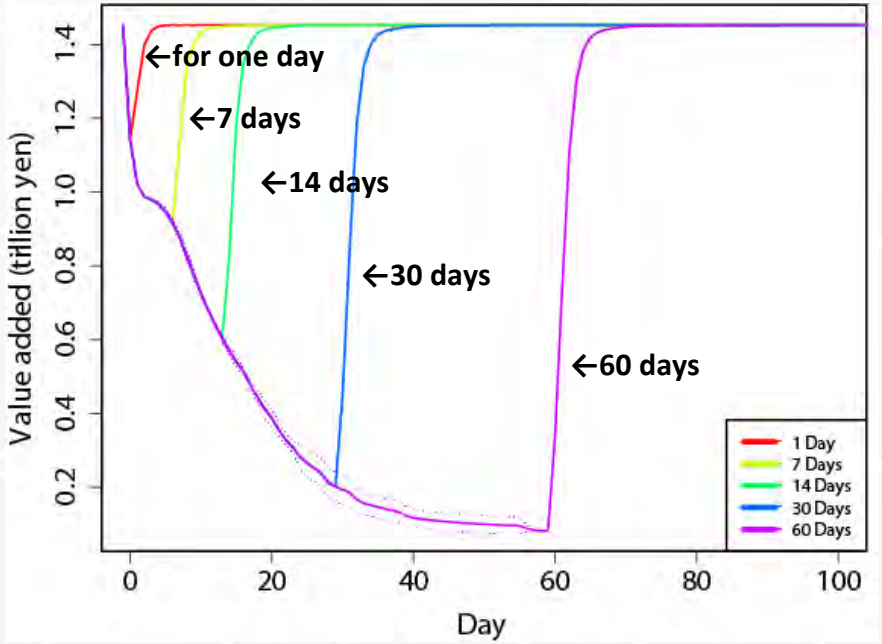


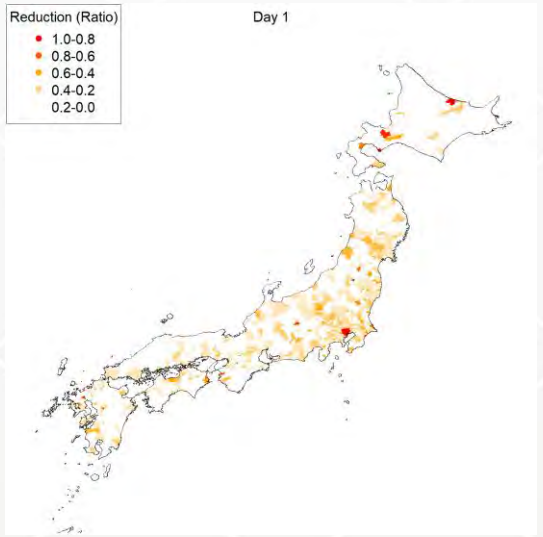
indirect effect
supply side

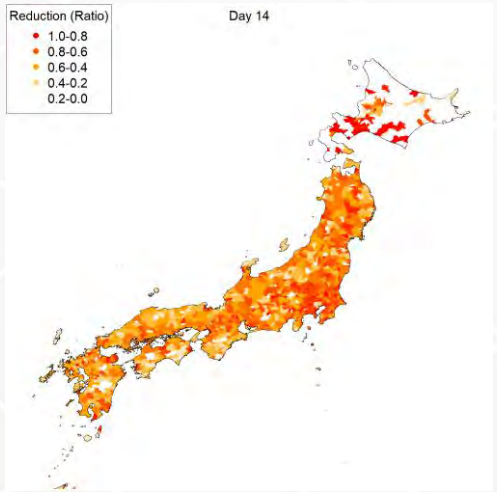
**a model with
1.5～2.0 million nodes**

Minimize economic activities for two months all over Japan
→ estimated GDP from a supply chain model: -7.8%
in reality: -7.8%
(https://www.esri.cao.go.jp/jp/sna/data/data_list/sokuhou/gaiyou/pdf/main_1.pdf)

Minimize in Tokyo Metropolitan area





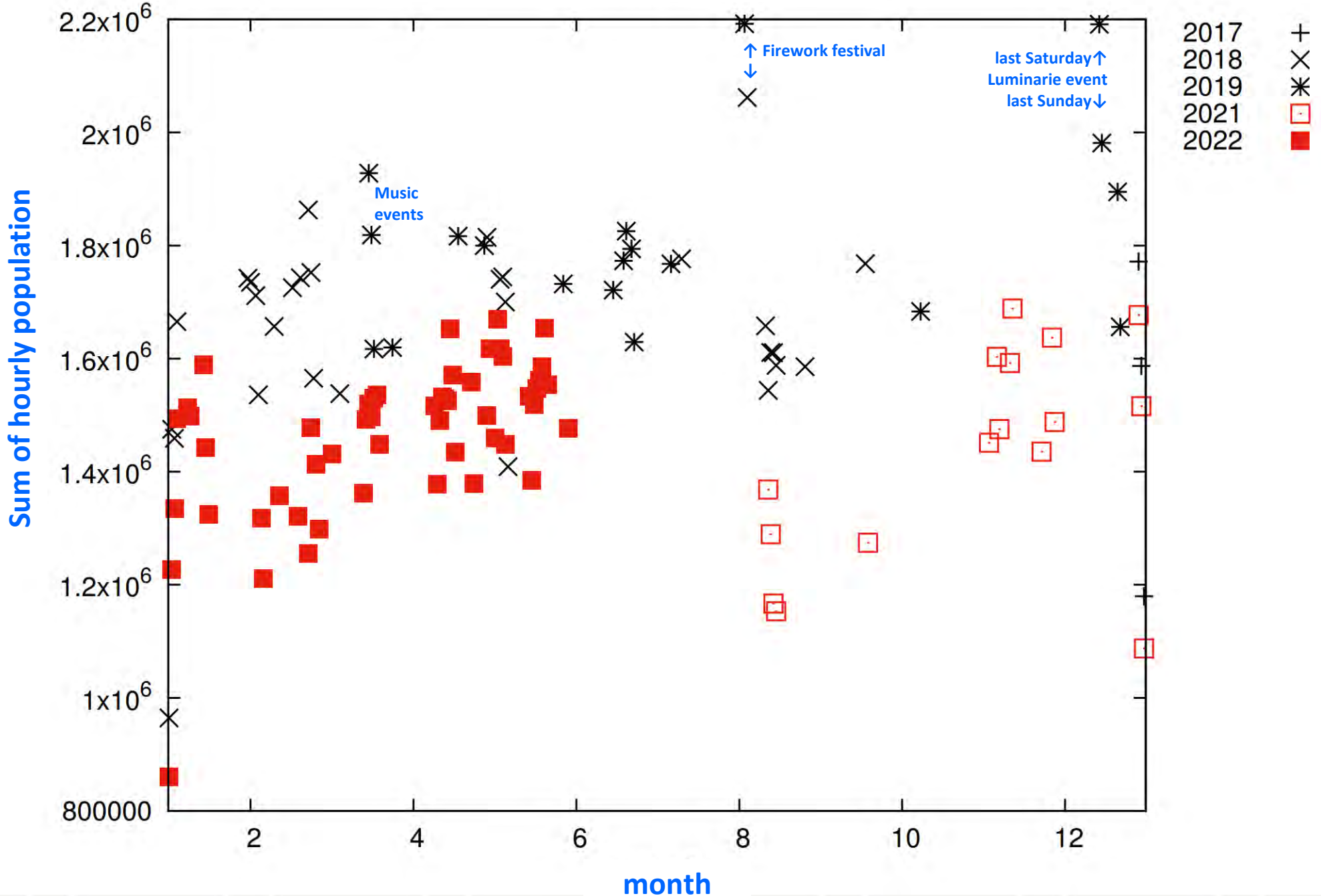


Results by Hiroyasu Inoue and Yasuyuki Todo

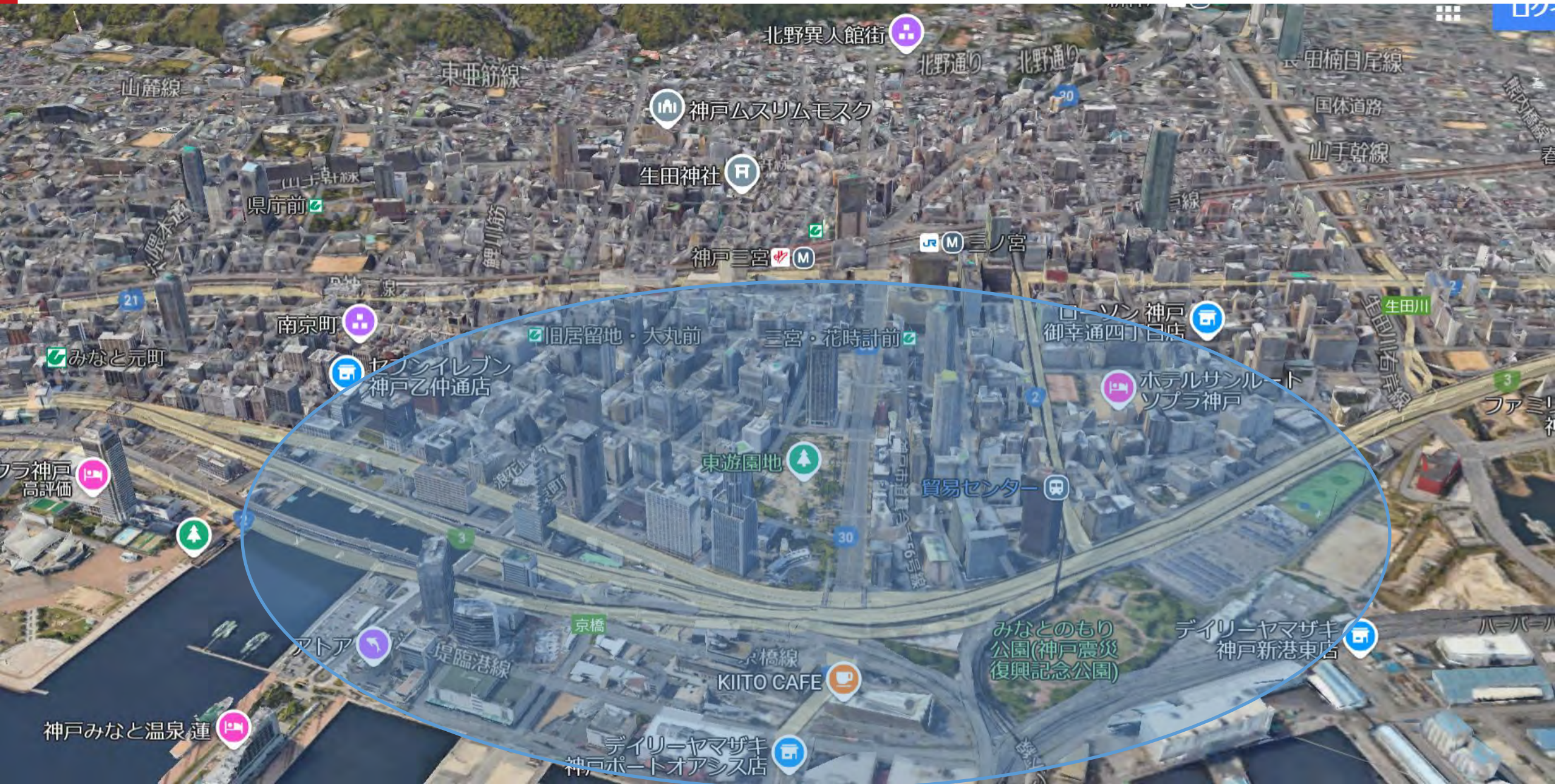
Kobe

with Fernando Cucchietti and Carlos Garcia in Barcelona Supercomputer Center

Daily population in Sannomiya area



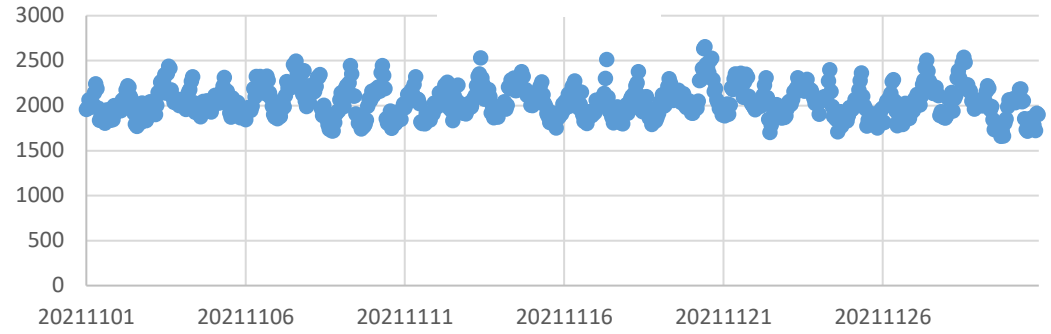
Sannomiya area



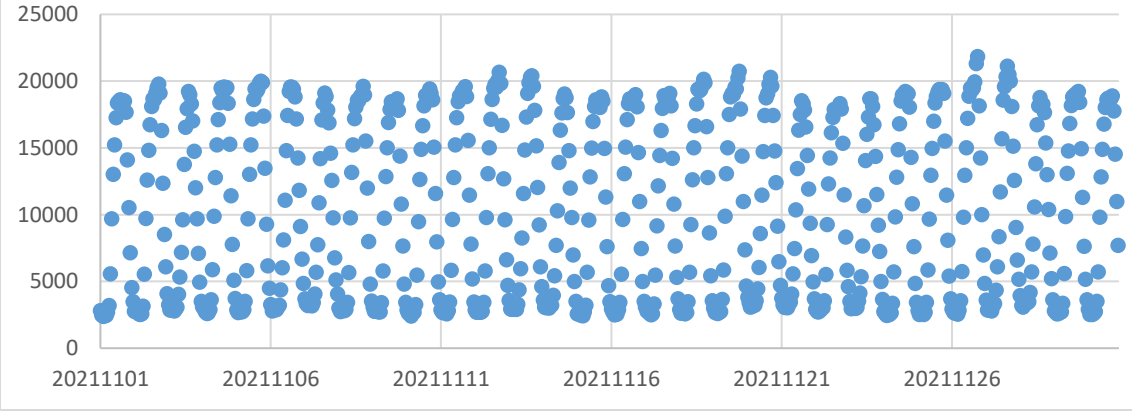
富岳
Fugaku

Sannomiya center
Hourly population in November 2021

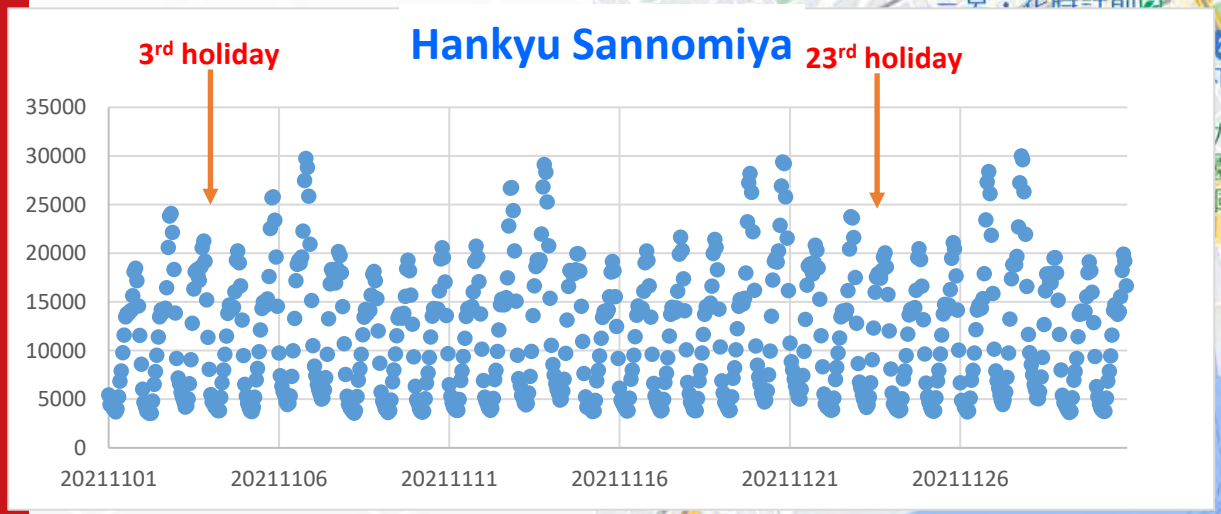
Shin-Kobe



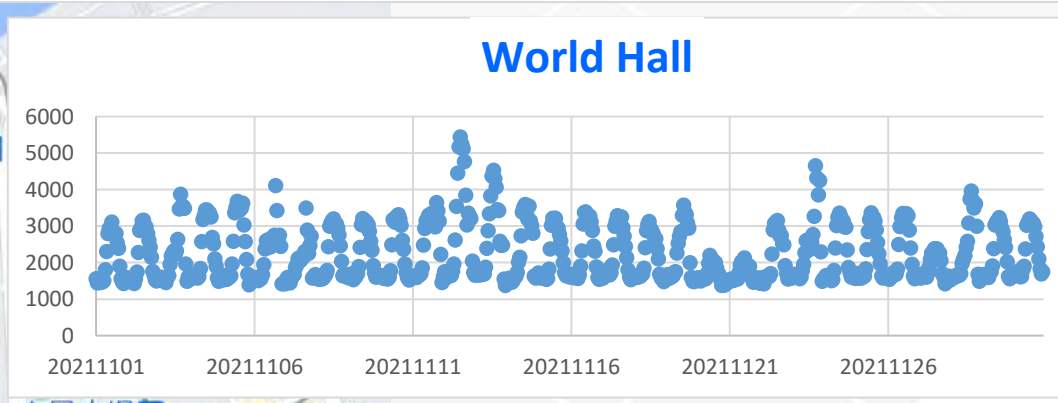
JR Sannomiya



Hankyu Sannomiya



World Hall

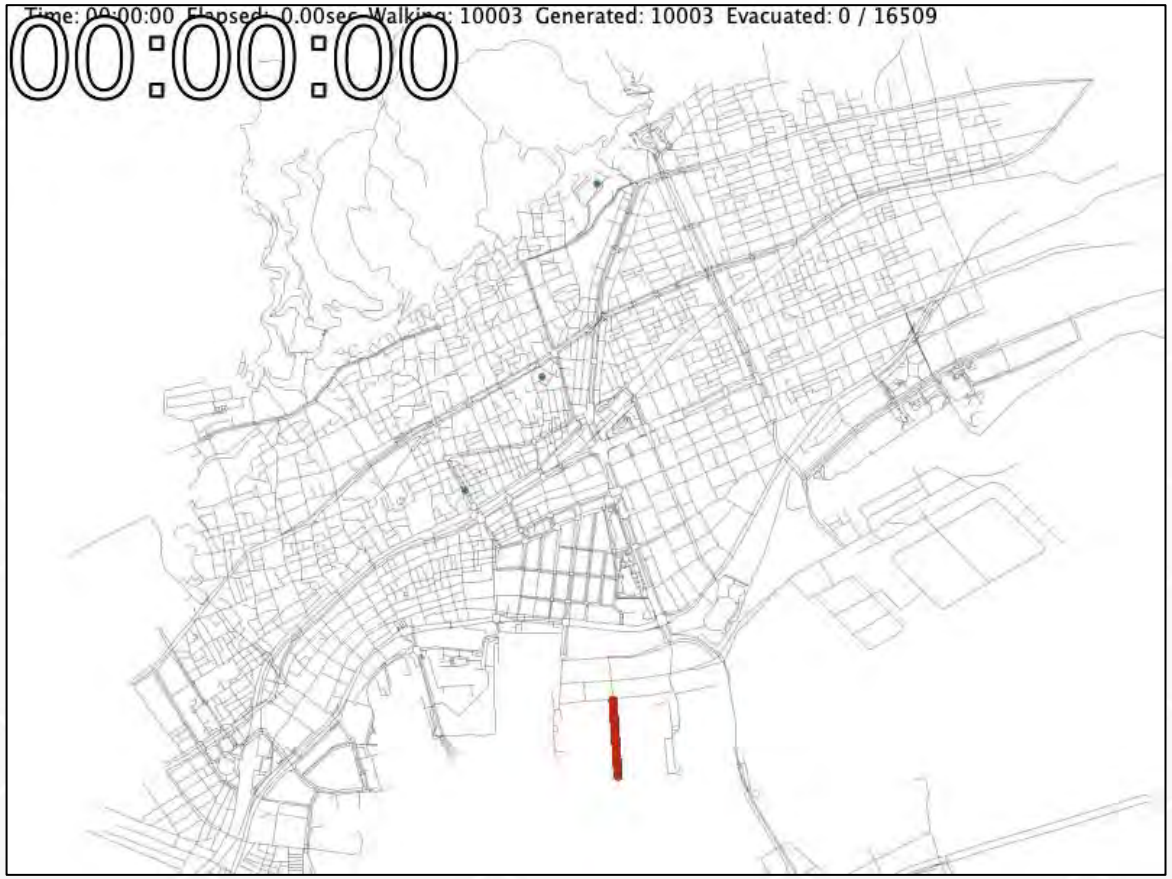


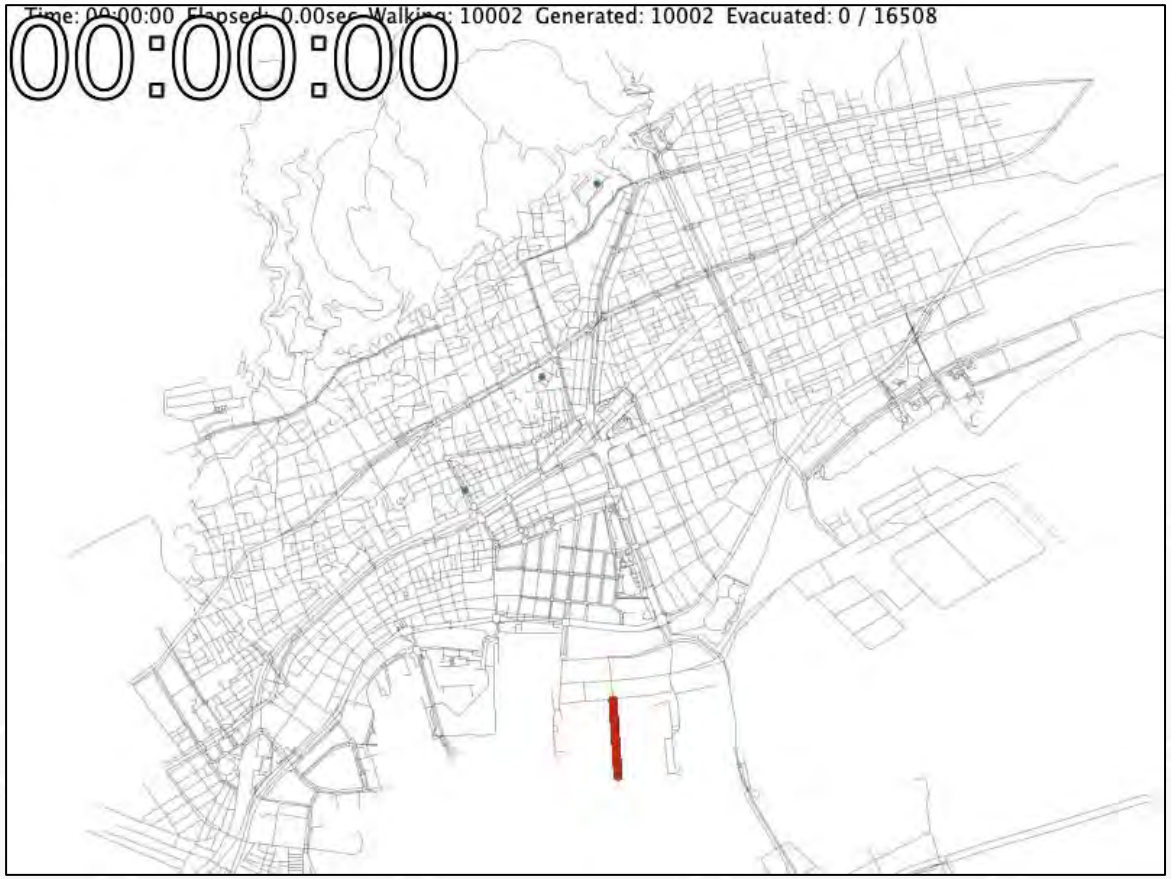
Events in World Hall

2021年11月3日(水・祝)	キュウソネコカミ
2021年11月6日(土)	THE IDOLM@STER
2021年11月6日(日)	THE IDOLM@STER
2021年11月11日(木)	藤井　風
2021年11月12日(金)	藤井　風
2021年11月13日(土)	go!go!vanillas
2021年11月14日(日)	go!go!vanillas
2021年11月23日(火)	マクロスF
2021年11月28日(日)	RIZIN

Kobe earthquake
1995 January 17
5:46 am

East Japan mega earthquake
2011 March 11
14:44

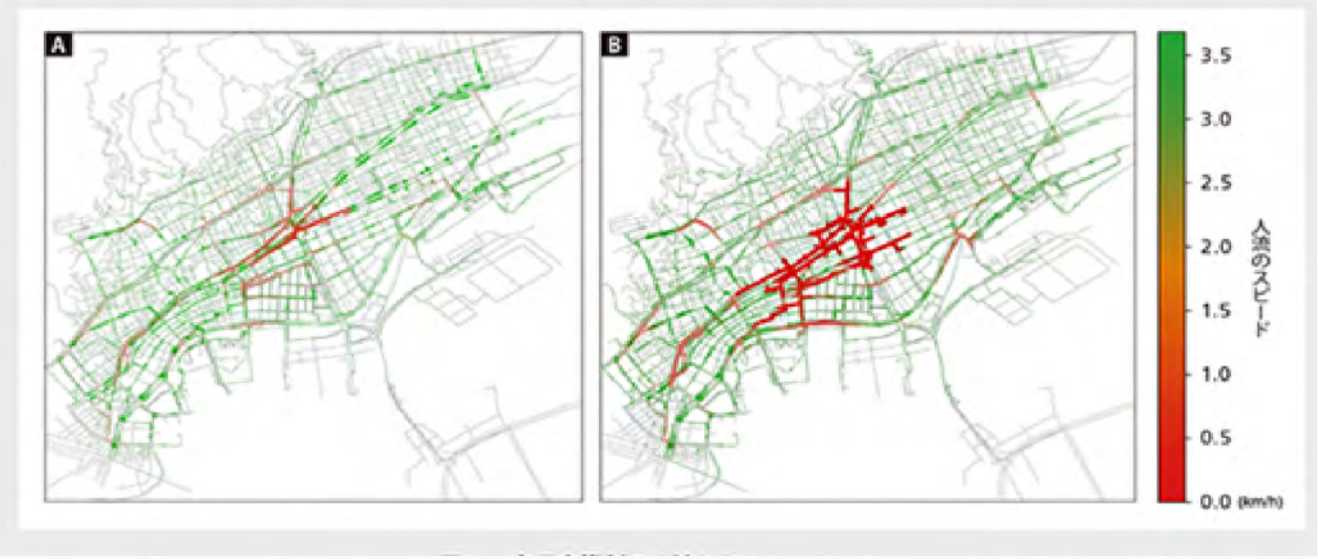




新港第２埠頭から三ノ宮駅への人流シミュレーション
左：最短経路の京町筋のみで誘導した場合
右：フラワーロードへも誘導した場合

Collaboration with Kobe city and NTT Docomo

With and without crowd control



協力：理研数理・JSON・リネア

Harbor land area

Evacuation takes 28 min

例：神戸ガスビル：６階のみが避難所として

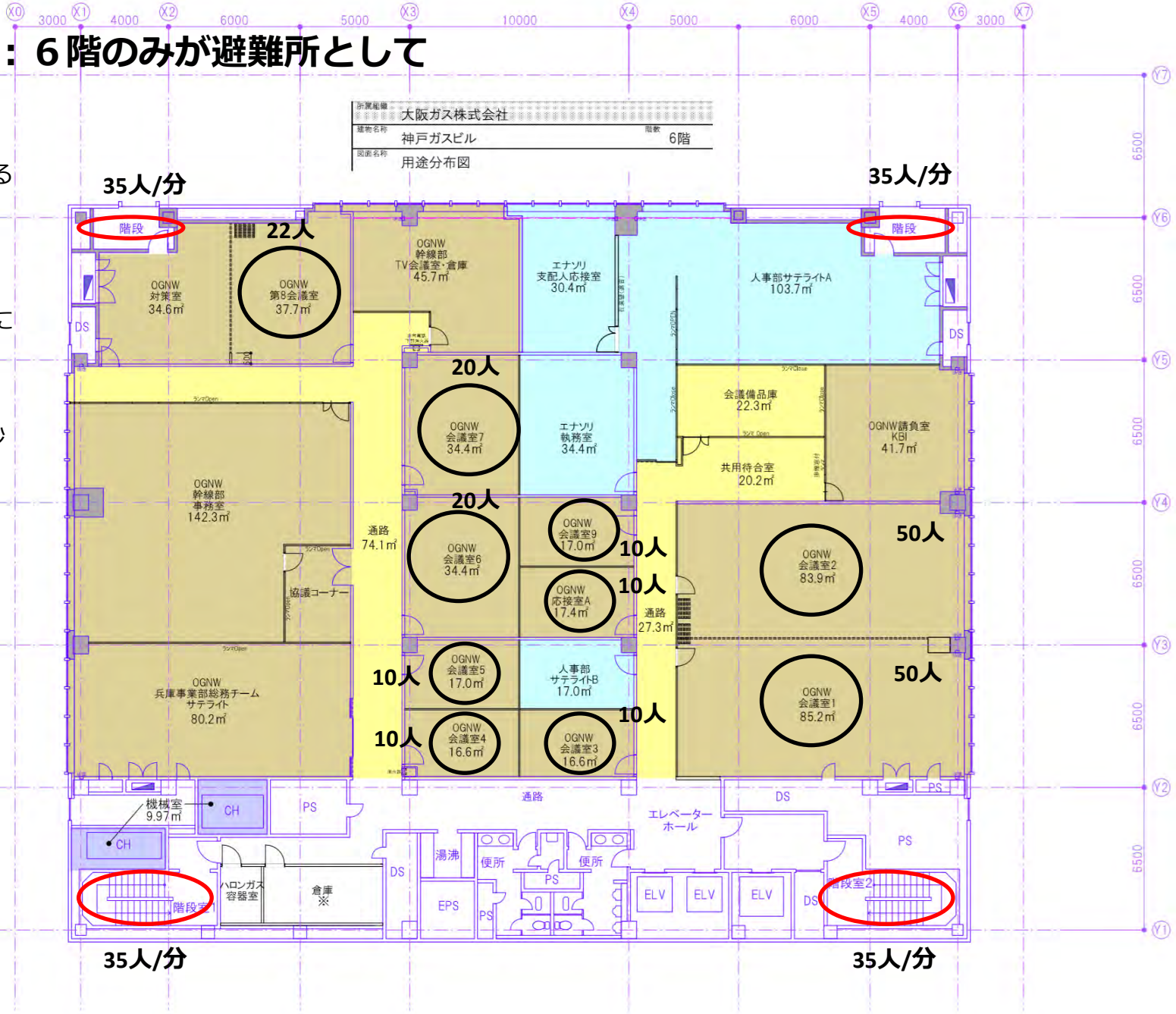
神戸ガスビル６階
１分間に35x4=140人が登り得る
162人が避難し得る

⇓

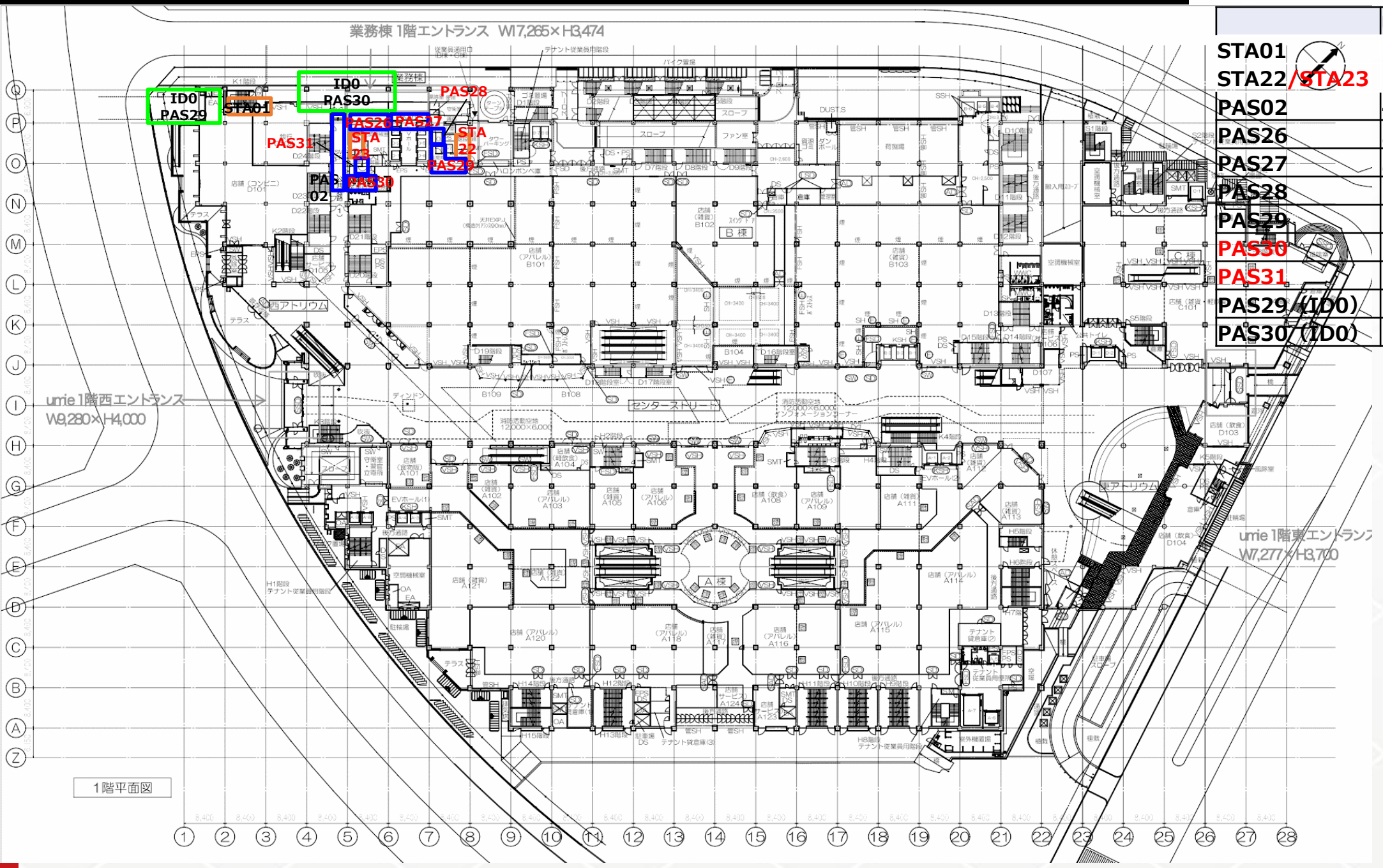
1階の人が6階まで到達するのに
15秒×5=75秒

最初の人が到達してから
162人/140（人/分）＝1分10秒
でフロアが満室

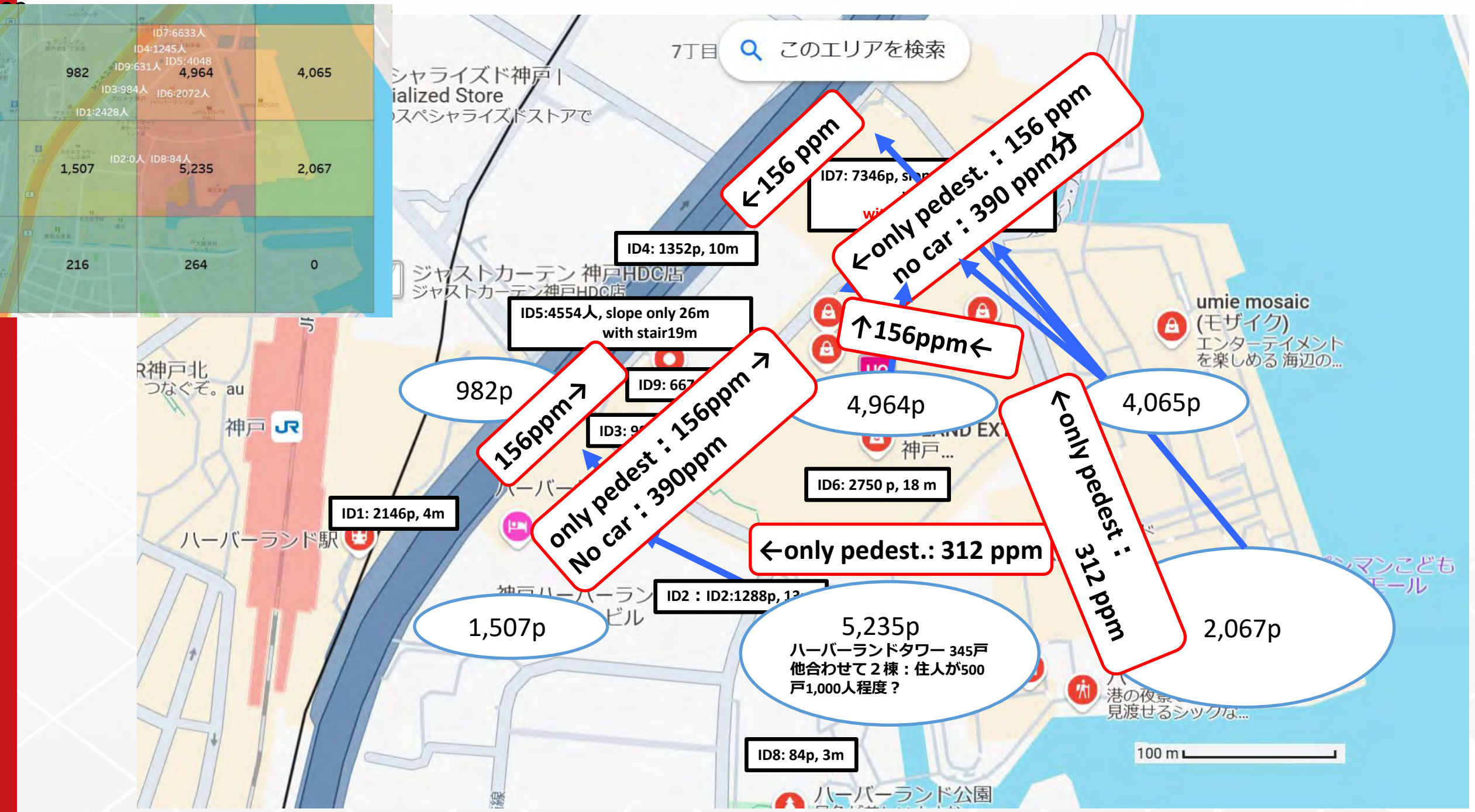
※６階までの動線に
ボトルネックがないとして



ID6　ダイヤニッセイビル 1F



	幅(mm)	長さ (mm)
STA01	1600	11400
STA22/STA23	1600	16800
PAS02	4200	67200
PAS26	3400	8400
PAS27	3400	8400
PAS28	1400	2800
PAS29	1400	11700
PAS30	1800	5200
PAS31	1400	3200
PAS29（ID0）		
PAS30（ID0）		


ID7:6633人
ID4:1245人
ID5:4048
982
ID9:631人
4,964
4,065
ID3:984人
ID6:2072人
ID1:2428人
ID2:0人
ID8:84人
1,507
5,235
2,067
216
264
0
7丁目
このエリアを検索
ID7: 7346p, slope only 26m with stair19m
←156 ppm
←only pedest.：156 ppm
no car：390 ppm分
ID4: 1352p, 10m
ID5:4554人, slope only 26m with stair19m
↑156ppm←
982p
156ppm→
only pedest：156ppm→
No car：390ppm
ID9: 667
ID3: 9
4,964p
4,065p
ID6: 2750 p, 18 m
←only pedest.：
312 ppm
ID1: 2146p, 4m
←only pedest.: 312 ppm
ID2：ID2:1288p, 13
1,507p
5,235p
ハーバーランドタワー 345戸
他合わせて２棟：住人が500戸1,000人程度？
2,067p
ID8: 84p, 3m
umie mosaic
(モザイク)
エンターテイメントを楽しめる 海辺の...
ハーバーランド駅
神戸
JR
R神戸北
つなぐぞ。au
ハーバーランド公園
100 m