

# Combination of HPC and high-speed data transfer technologies for big-data processing systems



## Overview

### Background

With the rapid growth in the information and communication technologies, large volumes of data from computing resources in datacenters and Internet of Things (IoT) sensors are collected and processed in real time. High-speed infrastructure networks play an important role to support the real-time operations, and a high-speed file transfer tool is needed to fully utilize the network bandwidth. In addition, artificial intelligence (AI) enables to improve disaster mitigation applications by quickly processing large volumes of complex and fragmented data.

### Objective

We conduct three case studies to demonstrate large-scale data processing and large-scale information systems. The first is extraction of meteorological information from Himawari-8 satellite data using AI and visualization on tiled display wall (TDW). The second is concurrent processing system for high-speed data transfer and visualization of genomic information. The third is information extraction of visual IoT data using deep learning.

## Extraction of Meteorological Information Using AI

### Himawari-8 real-time web

- Provides Himawari-8 satellite sensed images in real time and with full resolution
- Mirror sites: Thailand and Philippines

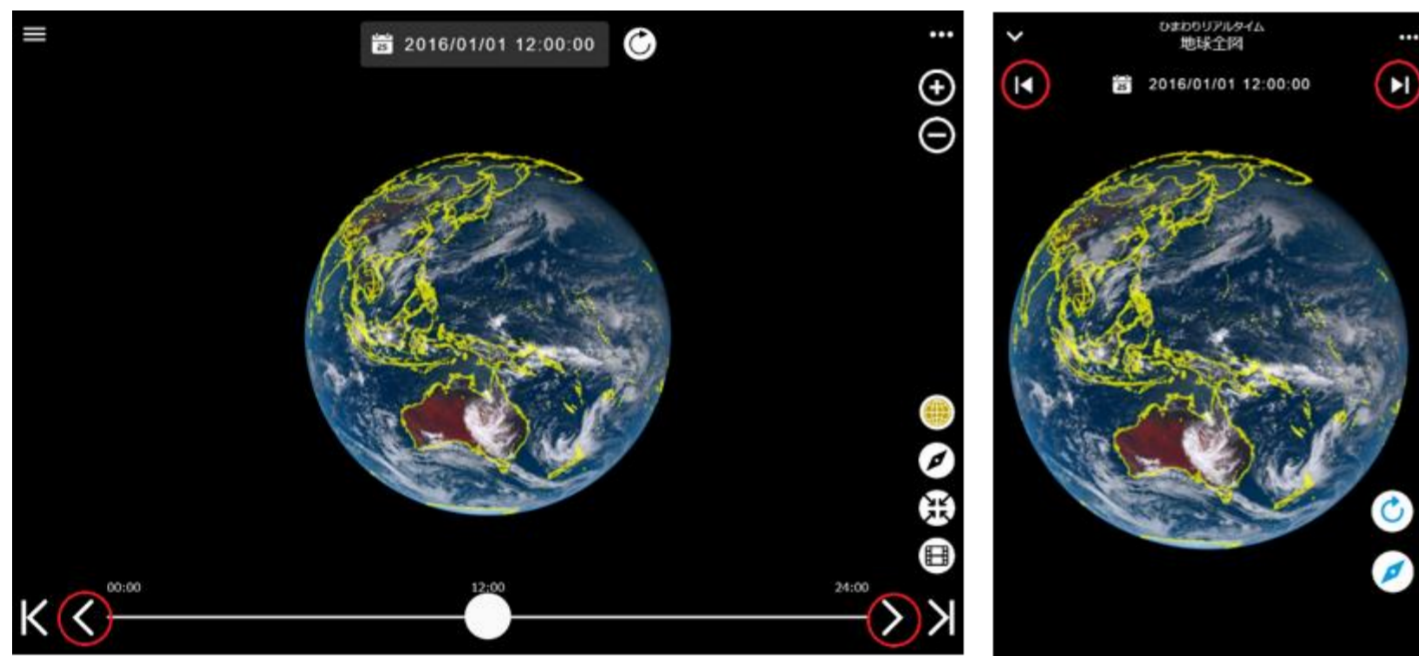


Fig. 1 Himawari-8 real-time web (<https://himawari.asia/>)

### Amaterass web

- Provides ground weather data (e.g. solar radiation) in real time

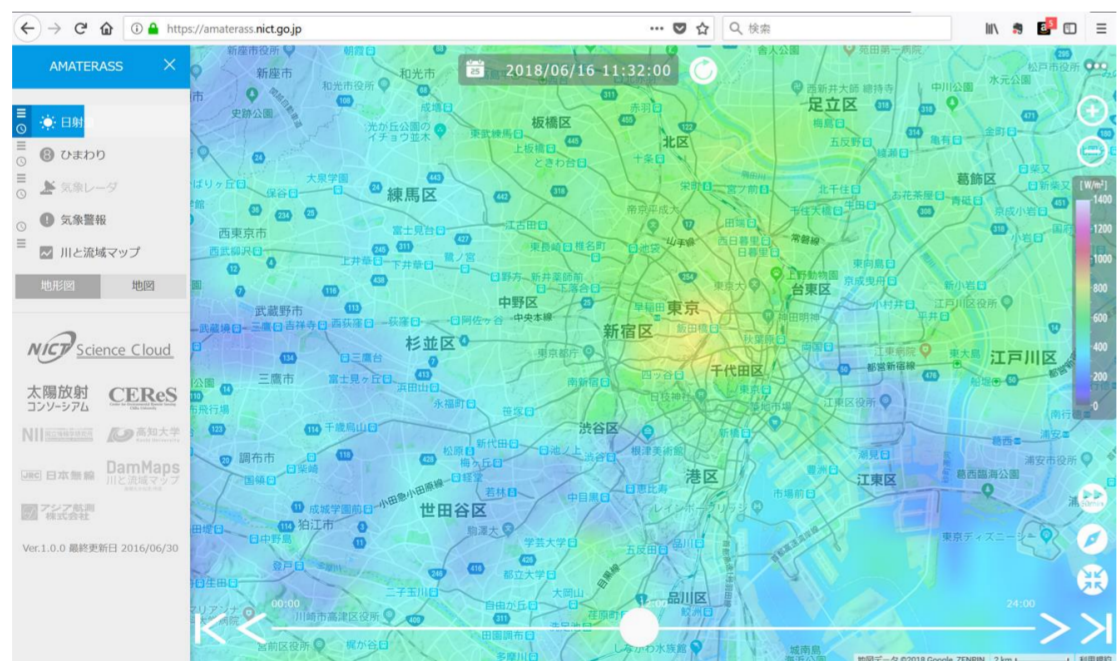


Fig. 2 Amaterass web (<http://amaterass.nict.go.jp/>)

### Visualization on TDW

- Data analytics using AI in NICT and Chiba University
- Data transmission using high performance copy (HCP)
- Data processing by supercomputer in Tohoku University and Nagoya University
- Data visualization on TDW in Chiba University, RIKEN and Kyushu University using STARS by NICT and ChOWDER by Kyushu University

## Concurrent Processing System

- Genomic information collected from Illumina Novaseq 6000 in Kyushu University
- Data transmission from Kyushu University to Kyoto University using HCP

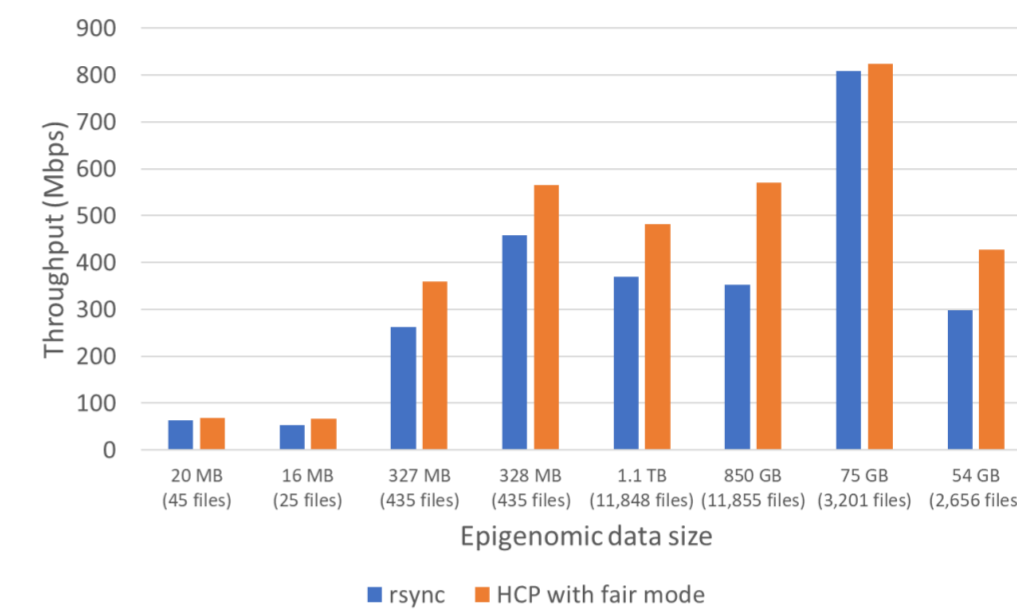


Fig. 3 Data transmission from Kyushu University to Kyoto University

- Visualization on web in real time

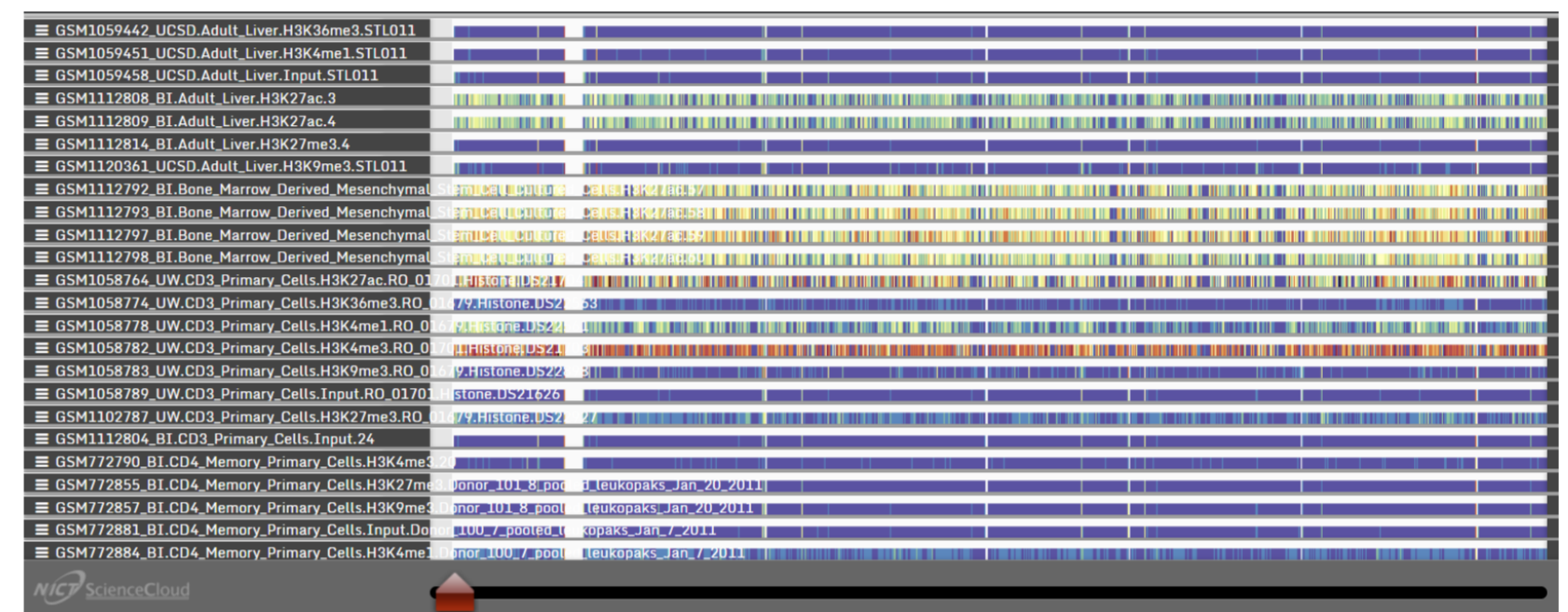


Fig. 4 Example of web application for viewing epigenomic data

## Extraction of Visual IoT Data using Deep Learning

### SmartSight camera

- Visual IoT with video transmission system using Raspberry Pi
- 20 locations:
  - 12 cameras for weather radar in Kochi prefecture
  - 2 cameras for aurora observation in Arctic region
  - 1 camera for river surveillance
  - 1 camera for landslide monitoring in Hirosaki University
  - 10 cameras for observation in Chikuma
  - 2 cameras for surveillance in Tokyo
  - etc.
- Video transmission with high resolution (full HD) and high frame rate (30 fps)
- Data analytics and processing using deep learning with TensorFlow on supercomputer in Kyoto University
- Data visualization on TDW in Kyoto University



(a) Visual IoT device

(b) Example of real-time monitoring system

Fig. 5 SmartSight camera

## Collaborating Researchers

Prathan Pavarangkoon<sup>1</sup>, Kazunori Yamamoto<sup>1</sup>, Kazuya Muranaga<sup>2</sup>, Takamichi Mizuhara<sup>3</sup>, Ayahiro Takaki<sup>3</sup>, Eizen Kimura<sup>4</sup>, Keiichiro Fukazawa<sup>5</sup>, Ryusuke Egawa<sup>6</sup>, Takuo Suganuma<sup>6</sup>, Osamu Tatebe<sup>7</sup>, Atsushi Higuchi<sup>8</sup>, Takahiro Katagiri<sup>9</sup>, Masao Ogino<sup>9</sup>, Hajime Shimada<sup>9</sup>, Yasuo Okabe<sup>5</sup>, Yasuyuki Ohkawa<sup>10</sup>, Kazumitsu Maehara<sup>10</sup>, Koji Okamura<sup>10</sup>, Yoshiaki Kasahara<sup>10</sup>, Takeshi Nanri<sup>10</sup>, Kenji Ono<sup>10</sup>, Tomoki Kimura<sup>6</sup>, Chihiro Tao<sup>1</sup>, Fuminori Tsuchiya<sup>6</sup>, Hajime Kita<sup>11</sup>, Goh Murakami<sup>11</sup>, Hideaki Takenaka<sup>11</sup>, Tomohiro Kawanabe<sup>12</sup>, Ryuho Kataoka<sup>13</sup>, and Hiroyuki Kusaka<sup>7</sup>

<sup>1</sup>National Institute of Information and Communications Technology; <sup>2</sup>Systems Engineering Consultants Co., Ltd.; <sup>3</sup>CLEALINKTECHNOLOGY Co., Ltd.; <sup>4</sup>National Institute of Public Health,

<sup>5</sup>Kyoto University; <sup>6</sup>Tohoku University; <sup>7</sup>University of Tsukuba; <sup>8</sup>Chiba University; <sup>9</sup>Nagoya University; <sup>10</sup>Kyushu University; <sup>11</sup>Japan Aerospace Exploration Agency; <sup>12</sup>RIKEN;

<sup>13</sup>National Institute of Polar Research