

**Mon. May 27, 2019**

[J] Poster | U (Union) : Union

5:15 PM - 6:30 PM JST | 8:15 AM - 9:30 AM UTC | Poster Hall International Exhibition Hall8, Makuhari Messe\_1

**[U-05] Large-scale Research Projects: Master Plan 2020 and its beyond**

convener: Eiichi Tajika (Department of Earth and Planetary Science, Graduate School of Science, The University of Tokyo), Shigeo Haruyama (Department of Environmental Science, Graduate School of Bioresources, Mie University), Ryoichi Fujii (Research Organization of Information and Systems), Hodaka Kawahata (Atmosphere Ocean Research Institute, the University of Tokyo)

[U05-P01] Planetary Exploration Roadmap from Japanese Society for Planetary Sciences

Kiyoshi Kuramoto<sup>1</sup>, Hidenori Genda<sup>2</sup>, \*Naoki Terada<sup>3</sup>, Hiroki Senshu<sup>4</sup>, Taishi Nakamoto<sup>5</sup>, Planetary Exploration Committee JSPS, Working term for revision of reply document for RFI JSPS (1. Graduate School of Sciences, Hokkaido University, 2. Earth-Life Science Institute, Tokyo Institute of Technology, 3. Graduate School of Science, Tohoku University, 4. Planetary Exploration Research Center, Chiba Institute of Technology, 5. Tokyo Institute of Technology)

[J] Poster | A (Atmospheric and Hydrospheric Sciences) : A-OS Ocean Sciences & Ocean Environment

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**[A-OS15] Freshwater discharge through rivers and estuaries to the ocean**

convener: Shinichiro Kida (Research Institute for Applied Mechanics, Kyushu University), Dai Yamazaki (Institute of Industrial Sciences, The University of Tokyo), Yosuke Alexandre Yamashiki (Earth & Planetary Water Resources Assessment Laboratory Graduate School of Advanced Integrated Studies in Human Survivability Kyoto University), Humio Mitsudera (Institute of Low Temperature Science, Hokkaido University)

[AOS15-P01] MERIT Hydro: Global 90m-resolution hydrography map based on latest topography datasets.

\*Dai Yamazaki<sup>1</sup> (1. Institute of Industrial Sciences, The University of Tokyo)

[AOS15-P02] Comparison of model performance between global- and regional-scale river models in simulating compound flooding in coastal deltas in the world's continental rivers

\*Hiroaki Ikeuchi<sup>1,2</sup>, Dai Yamazaki<sup>2</sup>, Yukiko Hirabayashi<sup>3</sup> (1. Graduate School of Engineering, The University of Tokyo, 2. Institute of Industrial Science, The University of Tokyo, 3. Graduate School of Engineering and Science, Shibaura Institute of Technology)

[AOS15-P03] Observation of a river plume by drone-mounted visible/infrared cameras

\*Kenta Araki<sup>1</sup>, Shinichiro Kida<sup>2</sup>, Atsuhiko Isobe<sup>2</sup> (1. Interdisciplinary Graduate School of Engineering Sciences, Kyushu University, 2. Research Institute for Applied Mechanics, Kyushu University)

[AOS15-P04] Numerical simulation of typhoon storm surge in the LUOYUAN Bay

\*Nan Yuan<sup>1</sup>, Humio Mitsudera<sup>1</sup> (1. Hokkaido University, the Institute of Low Temperature Science)

[AOS15-P05] Laboratory and numerical experiments on the ballooning of river-plume bulge

\*fujita yusuke<sup>1</sup>, Atsuhiko Isobe<sup>2</sup> (1. interdisciplinary graduate school of engineering science, Kyushu University, 2. Research Institute for Applied Mechanics Kyushu Univ)

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### [U-05] Large-scale Research Projects: Master Plan 2020 and its beyond

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Many of top sciences in Earth and Planetary Science (EPS) are progressed by big projects that require 10 billion JPY or more in 10 years or so. In order to realize such projects, we need an arena where they are brushed up through critical reviews among various fields in EPS. Deeper mutual understandings through serious discussions there will enable us to reach a final consensus on the priorities of the projects. The Master Plan (MP) of Large-scale Research issued by the Science Council of Japan strongly motivates us to follow the process described above. Indeed some of the selected projects have been funded by the Ministry of Education, Culture, Sports, Science & Technology since 2010. Since the current Master Plan 2017 is going to be thoroughly revised in 2020, we propose to hold a session in which large-scale research projects are concisely introduced and critically reviewed. This session is to be convened by JpGU and EPS Committee of Science Council of Japan.

#### [U05-P01] Planetary Exploration Roadmap from Japanese Society for Planetary Sciences

Kiyoshi Kuramoto<sup>1</sup>, Hidenori Genda<sup>2</sup>, \*Naoki Terada<sup>3</sup>, Hiroki Senshu<sup>4</sup>, Taishi Nakamoto<sup>5</sup>, Planetary Exploration Committee JSPS, Working term for revision of reply document for RFI JSPS (1. Graduate School of Sciences, Hokkaido University, 2. Earth-Life Science Institute, Tokyo Institute of Technology, 3. Graduate School of Science, Tohoku University, 4. Planetary Exploration Research Center, Chiba Institute of Technology, 5. Tokyo Institute of Technology)

## Planetary Exploration Roadmap from Japanese Society for Planetary Sciences

Kiyoshi Kuramoto<sup>1</sup>, Hidenori Genda<sup>2</sup>, \*Naoki Terada<sup>3</sup>, Hiroki Senshu<sup>4</sup>, Taishi Nakamoto<sup>5</sup>,  
Planetary Exploration Committee JSPS, Working term for revision of reply document for RFI JSPS

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The previous version of reply document for the Request For Information (RFI) on "the purpose, strategy, and roadmap of each committee" released by ISAS was submitted on Feb. 2015, and then revised on Jan. 2018. The document has been revised again following the change in circumstances surrounding our community regarding solar and extra-solar system exploration. The revision has been conducted by recommended or self appointed members of the Japanese Society for Planetary Sciences. The new version of the reply document of the RFI will be published on the web site of the Japanese Society for Planetary Sciences after the request for public comments from the members of Japanese Society for Planetary Sciences.

The reply document contains the status of domestic and international planetary exploration programs, brief explanation on on-going and near-future missions, a list of instruments under development in Japan, and the roadmap of planetary explorations proposed by the Japanese Society for Planetary Sciences. In this presentation we will present our roadmap of planetary explorations in coming 20 years.

Keywords: Planetary Exploration, Roadmap, Japanese Society for Planetary Sciences

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**[A-OS15] Freshwater discharge through rivers and estuaries to the ocean**

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The water cycle from land to the ocean involves complex dynamics of rivers and buoyancy driven flows in estuaries and the ocean. Recent progress in satellite observations and numerical models are beginning to illuminate how this water cycle occurs on various time scales globally and regionally. This session welcomes various process studies that investigate the dynamics and material circulation related to the freshwater cycle from land to the ocean such as surface runoff, river transport, estuarine circulation, and coastal river plumes based on numerical, observational, or theoretical studies.

[AOS15-P01] MERIT Hydro: Global 90m-resolution hydrography map based on latest topography datasets.

\*Dai Yamazaki<sup>1</sup> (1. Institute of Industrial Sciences, The University of Tokyo)

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[AOS15-P02] Comparison of model performance between global- and regional-scale river models in simulating compound flooding in coastal deltas in the world's continental rivers

\*Hiroaki Ikeuchi<sup>1,2</sup>, Dai Yamazaki<sup>2</sup>, Yukiko Hirabayashi<sup>3</sup> (1. Graduate School of Engineering, The University of Tokyo, 2. Institute of Industrial Science, The University of Tokyo, 3. Graduate School of Engineering and Science, Shibaura Institute of Technology)

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[AOS15-P03] Observation of a river plume by drone-mounted visible/infrared cameras

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[AOS15-P04] Numerical simulation of typhoon storm surge in the LUOYUAN Bay

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[AOS15-P05] Laboratory and numerical experiments on the ballooning of river-plume bulge

\*fujita yusuke<sup>1</sup>, Atsuhiko Isobe<sup>2</sup> (1. interdisciplinary graduate school of engineering science, Kyushu University, 2. Research Institute for Applied Mechanics Kyushu Univ)

## MERIT Hydro: Global 90m-resolution hydrography map based on latest topography datasets.

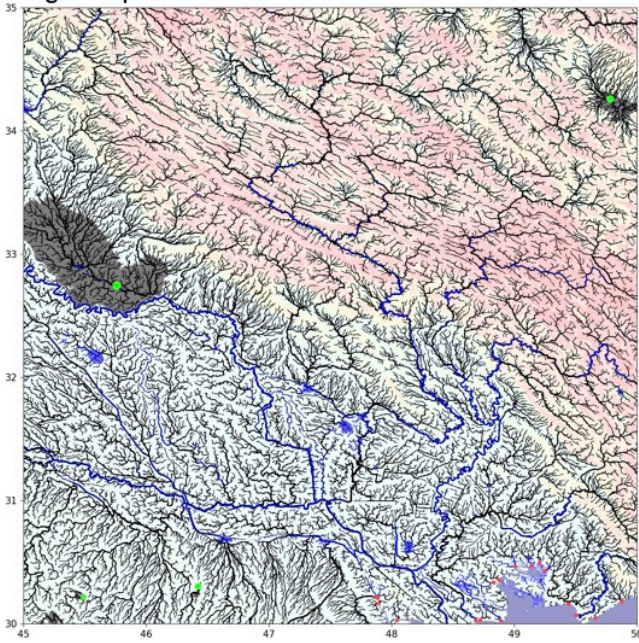
\*Dai Yamazaki<sup>1</sup>

1. Institute of Industrial Sciences, The University of Tokyo

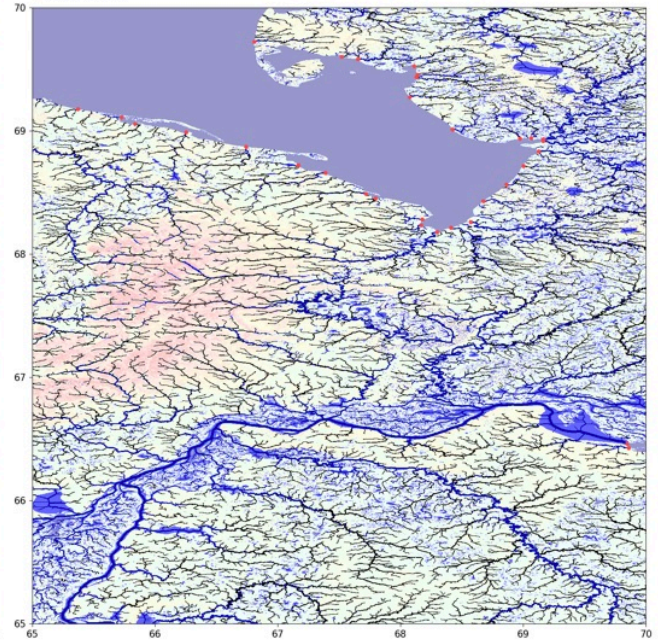
High-resolution raster hydrography maps are a fundamental data source for many geoscience applications. Here we introduce MERIT Hydro, a new global flow direction map at 3 arc-second resolution (~90 m at the equator) derived from the latest elevation data (MERIT DEM) and water body datasets (G1WBM, GSWO, and OpenStreetMap). We developed a new algorithm to extract river networks near-automatically by separating actual inland basins from dummy depressions caused by the errors in input elevation data. After a minimum amount of hand-editing, the constructed hydrography map shows good agreement with existing quality-controlled river network datasets in terms of flow accumulation area and inland basin distribution. The location of river streamlines was realistically aligned with existing satellite-based global river channel data. Comparison to GRDC gauges confirmed the accuracy of drainage basin delineation for global river networks in most cases. Discrepancies in flow accumulation area were found mostly in arid river basins containing depressions that are occasionally connected at high water levels and thus resulting in uncertain watershed boundaries. MERIT Hydro improves on existing global hydrography datasets in terms of spatial coverage (between N90 and S60) and representation of small streams, mainly due to increased availability of high-quality baseline geospatial datasets. The new flow direction and flow accumulation maps, along with accompanying supplementary layers on hydrologically adjusted elevation and channel width, will advance geoscience studies related to river hydrology at both global and local scales.

Keywords: Global Hydrology, River dataset

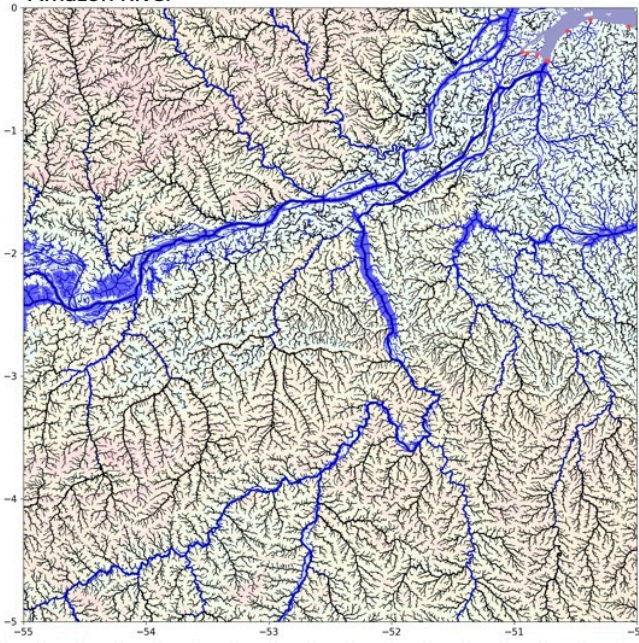
Tigris-Euphrates River



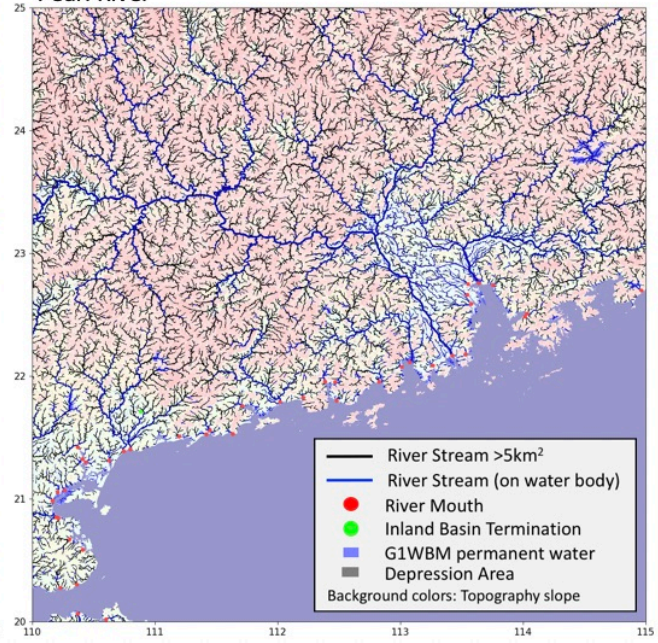
Ob River



Amazon River



Pearl River



- River Stream >5km<sup>2</sup>
- River Stream (on water body)
- River Mouth
- Inland Basin Termination
- G1WBM permanent water
- Depression Area
- Background colors: Topography slope

# Comparison of model performance between global- and regional-scale river models in simulating compound flooding in coastal deltas in the world's continental rivers

\*Hiroaki Ikeuchi<sup>1,2</sup>, Dai Yamazaki<sup>2</sup>, Yukiko Hirabayashi<sup>3</sup>

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Compound flooding, the co-occurrence of river and coastal flooding, is a major threat for delta regions and is rapidly gaining both social and academic attention. Global river models are widely used these days for various purposes such as flood forecast, flood risk assessment, and earth system sciences, and they can be used for flood risk assessment in delta regions as well. CaMa-Flood is a state-of-the-art global hydrodynamic model replicating river routing and floodplain inundation dynamics, and recently it has been applied to conduct compound flooding simulation by coupling a global tide and surge reanalysis data for the first time. However, because the model solves 1 dimensional momentum equations, complex water flow processes in river-coast interface may not be fully expressed.

The objective of this study is to enhance our understanding on issues in modelling compound flooding in the framework of global river models. To achieve this, we compare the difference in model performance between a global- and a regional-scale river model for the simulation of flood inundation in delta regions. We selected CaMa-Flood as a global model and LISFLOOD-FP as a regional model respectively. The reason for the choice of these models is that both the momentum equation and the sub-grid approximation of floodplain inundation dynamics are the same in the models, which enables us to compare the model performance in terms of dimensions, i.e., 1 dimensional flow equation for CaMa-Flood, and 2 dimension for LISFLOOD-FP. We proposed a method to construct LISFLOOD-FP model based on the topography and river channel bathymetry taken in CaMa-Flood to make the input topographical data as similar as possible. Simulation results suggest that while the overall flood extent was similar for both models, the spatial pattern of floodplain inundation depth differed because of the unit-catchment shape, i.e., the spatial unit of calculation taken in the CaMa-Flood model.

Keywords: compound flooding, global models, coastal deltas

# Observation of a river plume by drone-mounted visible/infrared cameras

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## Introduction

Thermal infrared observations of the sea surface temperature (SST) from satellites are important for understanding the ocean. However, the use of satellites is still difficult for observing coastal oceanic process with small spatio-temporal scales. The purpose of this study is to use drones and observe ocean color and SST distributions of the coastal area with a spatial resolution of about a few centimeters. Drones can be used for remote sensing of the sea surface from an altitude less than 150m.

## Observation

On September 11, 2018, we conducted observations of the coastal ocean at the Lyonada of the western Seto inland sea and the Hiji river using the Ehime University research ship "Isana". We used drone-mounted visible and infrared cameras and took images of the sea surface from 100m above the sea level. A total of 18 images were acquired over the observation time of about 7 minutes. The area covered by each image of the visible image and the infrared image are 100 m × 70 m and 80 m × 60 m, respectively. We also pursued CTD observations at the same time to examine the oceanic structure across the front.

## Result and Discussion

In the observed infrared image, we found vignetting, which is a difference in brightness from the center to the periphery of the image. Therefore, we will need to remove this impact of vignetting to understand the actual SST distribution. Observed visible image showed the river plume clearly so we are currently working to detect the location of the front that matches with the infrared image. We plan to present the microstructure of the front found in the visible and infrared images. We also plan to compare the vertical cross section of the front obtained from CTD data with the sea surface temperature observed in the infrared image.

Keywords: drone, sea surface temperature, river plume

# Numerical simulation of typhoon storm surge in the LUOYUAN Bay

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According to the statistics of China Marine Disaster Bulletin published in May 2018, from 2008 to 2017, around 100 billion financial loss happened in each year due to marine disasters. Over 80% loss was caused by storm surges. Further, unfortunately, the FUJIAN Province is a place they prefer to visit. The research area, the LUOYUAN bay, is located on the northeastern area of the FUJIAN Province, which was so inconspicuous that not so many researchers concerned the storm surges happened there. However, it brings demands of study with the increase of financial developments and people's settling down in this area. Therefore, this research started.

For studying the response of the sea level in this area to a storm, a high-resolution model with the ADvanced CIRCulation model (ADCIRC) was established first. It used unstructured fine grids, and the topography from electronic chart partially and coastline data with resolution 1:10000. By comparing the simulated water level with the observation, we can see that both match with each other quite well. Furthermore, via harmonic analysis and contrasting with previous studies, the accuracy of this model was verified.

Based on the model, some experiments were conducted to assess the response inside of the bay to different kinds of typhoon, primarily with different intensities on the north-south (N-S) moving path, and the northwest-southeast (NW-SE) moving path. Results are as follows. On the one hand, there are common features we can understand easily: the surge increases gradually with the strength of typhoons, and the peak-value surge can reach approximately 3 meters if a typhoon landed as a SUPER TYPHOON; the low pressure of a typhoon and strong wind will lead to a surge, and this surge would be more obvious when the typhoon passes near coastal areas; because of the cyclonic structure of a typhoon, it is easier for a typhoon that moves on an offshore path to induce the rising of water level on the southern part of bay than the northern part. On the other hand, there are also other findings that might be difficult to understand just by imagination: for the N-S path, there is a steep reduction of the sea level inside of the bay after the peak-value time. Such a rapid reduction of sea levels does not happen for the NW-SE path but for those in the southern area along the FUJIAN Province. By analyzing the data, we consider that wind direction and the shape of the bay would be the main reasons causing this phenomenon. Further, there is an oscillation in the sea level after peak-value time for the typhoon on the N-S path, and a larger reduction exists inside of the bay than the outside. Resonance between the different frequency of sea level changes, caused by various moving speeds of typhoons, and the local natural frequency of the bay might have some effects. We attempt to investigate resonance for the future study. The experiments with various parallel paths to the N-S path, as well as those parallel to the NW-SE path, also give similar results.

Keywords: Luoyuan Bay, typhoon, storm surge, marine disaster prevention and mitigation

## Laboratory and numerical experiments on the ballooning of river-plume bulge

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Ballooning (infinitely growing) of river-plume bulges are observed only in laboratory and numerical experiments, but in the actual ocean we have no infinitely growing bulges. Thus, the mechanism of river-plume bulges remains obscure in detail. In this study, we focus on the dependence of growing rate of a bulge on the curvature of the line connecting estuary axis and coastline (i.e., the curvature of river-plume release) to elucidate the mechanism to cause the ballooning. First, we conducted a rotating water tank experiments under an extreme condition. Namely, we adopted two curvature: The one is that a coastline lies in parallel with the estuary axis (infinite curvature radius), and the other is that the coastline takes a right angle to the estuarine axis (null curvature radius). In the experiment with the right angle, the ballooning of river-plume bulge was observed as observed in conventional experiments. Meanwhile, when the angle between the coastline and estuarine axis was parallel, the bulge formation was not observed. We next conducted experiments using a numerical model that we could control the parameters governing fluid motion to clarify the mechanism of the ballooning. We adopted unstructured Finite Volume Coastal Ocean Model in which we can freely change the curvature using triangle cell grids.