Sixth WESTPAC Summer School on Monsoon Onset Monitoring and its Social & Ecosystem Impacts (MOMSEI Summer School-VI)

Programme Booklet

Phuket, Thailand, 26-30 October 2015

Organized by

IOC Sub-Commission for the Western Pacific (WESTPAC)

Hosted by
26-30 October 2015
Phuket, Thailand

Sixth WESTPAC Summer School on Monsoon Onset Monitoring and its Social & Ecosystem Impacts (MOMSEI Summer School-VI)

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<td>Arrival of participants and check in at the Kantary Bay Hotel, Phuket</td>
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<td>08:45 – 09:05</td>
<td>Advancing marine science to meet societal needs</td>
<td>Mr. Wenxi Zhu, Head of WESTPAC Office, Bangkok, Thailand</td>
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<td>Dr. Somkiat Khokiattiwong, Chairperson of IOC/WESTPAC</td>
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<td>10:00 – 12:00</td>
<td>Key ocean and climate processes in Bay of Bengal and Andaman Sea</td>
<td>Dr. Weidong Yu, FIO/SOA, China</td>
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<td>Monsoon and its rainfall simulation in climate models: a partial review and some perspectives</td>
<td>Dr. Laurent Zhaixin Li, LMD, Univ. Paris 6, France</td>
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<tr>
<td>15:30 – 16:00</td>
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<td>Monsoon and its rainfall simulation in climate models: a partial review and some perspectives (cont.)</td>
<td>Dr. Laurent Zhaixin Li, LMD, Univ. Paris 6, France</td>
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<td>18:00 – 18:30</td>
<td>Group discussion</td>
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<td>Basic aspects of climate: from paleo-, modern to future climate</td>
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<td>Marine Zooplankton Ecology and Oceanography</td>
<td>Dr. Cabell Davis, Woods Hole Oceanographic Institute, USA</td>
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<td>Biological-physical interactions and modeling</td>
<td>Dr. Rubao Ji, Woods Hole Oceanographic Institute, USA</td>
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<td>Dr. Zhaohui Aleck Wang, Woods Hole Oceanographic Institute, USA</td>
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<td>Dr. Anne Cohen, Woods Hole Oceanographic Institute, USA</td>
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<td>Dr. Cabell Davis, Woods Hole Oceanographic Institute, USA</td>
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<td>Tidally driven internal wave generation at the edge of a continental shelf</td>
<td>Dr. Weifeng Gorden Zhang, Woods Hole Oceanographic Institute, USA</td>
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<td><strong>Friday 30 October 2015</strong></td>
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<td>08:30 – 10:00</td>
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**Team Report and Excursion**

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| 13:00 – 15:00| Trainees are invited to brief their research and propose their ideas how to apply the knowledge from this MOMSEI Summer School to their future work.
|              | 10 minutes presentation is expected from each country team’s homework.                                                                     |
| 15:00 – 18:00| City Tour                                                                                                                                  |
| 18:00 – 20:30| Farewell Banquet                                                               Hosted by PMBC and Thailand-China Joint Laboratory for Climate and Marine Ecosystem |
Abstracts &
Lecturers
**Dr Weidong Yu, Research Scientist, First Institute of Oceanography, State Oceanic Administration, China**

Dr. Yu is a seagoing scientist with research interests in air-sea interaction, monsoon climate and climate variability, ocean observation and etc. He is particularly interested in the monsoon research, trying to understand the role of ocean in shaping the giant Asian-Australian-African monsoon climate system. He joined the international effort to set up the Indian Ocean Observing System and to revitalize the scientific focus over Indian Ocean by promoting the Second International Indian Ocean Expedition (IIOE-2). Dr. Yu is MOMSEI project leader and this project has active participants from Myanmar, Thailand, Malaysia, Indonesia and draws much interests from nearby countries.

- **Presentation:**

**Key ocean and climate processes in Bay of Bengal and Andaman Sea**

Bay of Bengal (BoB) and Andaman Sea (AS) locate on the critical pathway of Asian Monsoon, linking the Indian Ocean with the Asian continent. The oceanic and climate processes in BoB&AS are highly dynamic and closely linked with the basin-scale processes.

BoB&AS are the regions where the Asian monsoon firstly onsets. Usually the southwest monsoon is established here in late April to early May, which leads South China Sea region by 3-4 pentads and leads Indian monsoon by one month. For monsoon, not only the seasonal rainfall amount is important, but also the date when the rain comes. It is not fully understood why the continental scale Asian monsoon onset exhibits such strong regionality and how this onset sequence is established. Under the complex ocean-atmosphere-land configuration of monsoon system, the role of regional ocean in triggering monsoon onset is particularly interesting. The recent development of Indian Ocean Observing System (IndOOS) provides unprecedented data to reveal this mystery.

Under the forcing of the changing monsoon, the surface circulation in BoB&AS are of high variability. Their seasonal cycle is complex and not fully documented. Beyond the strong seasonality, the high-frequency processes, like MJO (BSISO), and the meso-scale variations, like eddies, are active. New observing capacity associated with remote sensing and in situ development provides new chance to understand such dynamic variations.

The above oceanic and climate variations over BoB&AS load significant impacts on the regional marine ecosystem. AS is taken here as one example to illustrate how the regional ocean is coupled together with the external basin variability and how such complicated variations impact on the local coral reef along the Andaman Sea coast. The coral's response and/or adaptation to such habitat changes are yet to explore.
Dr Zhaoxin Laurent Li, Senior Scientist, LMD/IPSL, CNRS, University Pierre and Marie Curie, France

The research activities of Dr. Laurent Li cover a large spectre of climate and environmental resources, including atmospheric general circulation, coupling of ocean and atmosphere, scale interaction in the climate system, and impacts of climate change. He is author or co-author of more than 100 publications in these fields. He was supervisor or co-supervisor of 10 Ph.D students and about 10 post-doctoral researchers in LMD. He teaches in a number of Parisian academic establishments, such as, ENS and University of Paris VI.

Laurent Li has experiences in several European Union (EU) research projects, ECCLoud (role of clouds in climate), SIDDACLICH (climate change projection), SINTEX (scale interaction in climate system), METRIC (climate effects of man-made short-living gases), and French national programmes, PNEDC (climate dynamics) and GICC (impact and management of climate change). He was, in particular, the scientific coordinator of the MedWater project concentrated on climate downscaling in the Mediterranean region and impacts of climate change on the regional atmospheric circulation and hydrology. He was sub-project leader of two EU climate projects devoted respectively to the Mediterranean region (CIRCE) and Eastern Europe (CLAVIER).

Laurent Li is now team leader of the regional climate and Mediterranean climate inside LMD and IPSL (“Institut Pierre-Simon Laplace”, a federation of five Parisian laboratories on environmental issues).

- Presentation:

Monsoon and its rainfall simulation in climate models: a review and some perspectives

Monsoon is a major component of the climate system. A review will be presented to show recent progresses in numerical modelling of global monsoon with focus on Southeast Asian monsoon. After a short discussion about the role of the Asian summer monsoon in the global monsoon system and their connection, some examples of monsoon simulation in atmosphere-only and ocean-atmosphere coupled models will be presented. A further investigation will be on the role of the Tibetan Plateau in the Asian monsoon. It is also planned to discuss regionally-oriented climate simulations and links with other relevant research fields. Finally some perspectives will be developed for future works.

Professor Richard Lindzen, Emeritus Professor of Meteorology, Biology Department, Woods Hole Oceanographic Institution, USA

Prof. Lindzen is a dynamical meteorologist with interests in the broad topics of climate, planetary waves, monsoon meteorology, planetary atmospheres, and hydrodynamic instability. His research involves studies of the role of the tropics in mid-latitude weather and global heat transport, the
moisture budget and its role in global change, the origins of ice ages, seasonal effects in atmospheric transport, stratospheric waves, and the observational determination of climate sensitivity. He has made major contributions to the current theory for the Hadley Circulation, and has advanced the understanding of the role of small scale gravity waves in producing the reversal of global temperature gradients at the mesopause, and provided accepted explanations for atmospheric tides and the quasi-biennial oscillation of the tropical stratosphere. He pioneered the study of how ozone photochemistry, radiative transfer and dynamics interact with each other. He has also been developing a new approach to air-sea interaction in the tropics, and is actively involved in parameterizing the role of cumulus convection in heating and drying the atmosphere and in generating upper level cirrus clouds. He has developed models for the Earth's climate with specific concern for the stability of the ice caps, the sensitivity to increases in CO₂, the origin of the 100,000 year cycle in glaciation, and the maintenance of regional variations in climate. Prof. Lindzen is a recipient of the AMS's Meisinger, and Charney Awards, the AGU's Macelwane Medal, and the Leo Huss Walin Prize. He is a member of the National Academy of Sciences, and a fellow of the American Academy of Arts and Sciences, the American Association for the Advancement of Sciences, the American Geophysical Union and the American Meteorological Society. Further information at http://www-eaps.mit.edu/faculty/lindzen.htm

- Presentation:

Basic aspects of climate: from paleo-, modern to future climate

These lectures will review various aspects of climate. We begin with a description of various examples of past climate with descriptions of the likely physical causes. These will include the cycles of major glaciation of the past 2 million years, the Eocene warm period, and the temperate climate of 2.5 billion years ago. We will next briefly look at some examples of much shorter time scale fluctuations in climate like ENSO, PDO and AMO. These involve the interaction of ocean circulations with the atmosphere. We will then examine the paradigm of climate as represented by a single number (global mean temperature anomaly) forced by a single number (radiative forcing). In general, this paradigm is inappropriate except when dealing with global forcing. This is reasonable because most major climate change involves changes in the temperature difference between the tropics and the poles, and such differences generally involve dynamics of the atmosphere and ocean which in turn depend on pressure gradients rather than on mean values. However, present climate concerns do involve global forcing by increases in well-mixed greenhouse gases (mainly CO₂). For such global forcing, the crucial issue is climate sensitivity. We shall review the essential components of this issue: namely the greenhouse effect, and feedbacks. From the point of view of oceanography, it should be noted that high sensitivity implies weak thermal coupling of the atmosphere and ocean.

Dr Cabell Davis, Senior Scientist, Biology Department, Woods Hole Oceanographic Institution, USA

Dr. Cabell Davis is a sea-going scientist joining around 80 cruises around the globe from tropics to poles. He is particularly known for his development and application of the breaking-through instrument Video Plankton Recorder (VPR), which was instrumented in 1990s. He is an expert on zooplankton, including species population dynamics, trophic
interactions, production rates, seasonal species succession, biological/physical interactions controlling species distributions, mathematical modeling, laboratory culture, and field experimental work. His full CV is available from http://www.whoi.edu/profile/cdavis/CV

- **Presentation:**

**Marine Zooplankton Ecology and Oceanography**

Marine zooplankton is a key group of animals that provide a critical link in the ocean food web. An overview of marine zooplankton will be presented including an initial taxonomic summary and examples from each group. The interactions of zooplankton with their biological and physical environment will be discussed including upwelling systems, gyres, eddies, and fronts. A description of links between lower and upper trophic levels will be shown and related to fisheries and coral ecosystems.

**Sampling methods in zooplankton ecology**

The history of sampling zooplankton will be presented. The early, non-quantitative methods, to the more robust methods used today will be discussed. Past methods have included a suite of ingenious techniques, some of which have persisted to today. Sampling and sub-sampling errors associated with the various methods will be discussed. The lecture will include a discussion of the latest optical sampling systems and analysis methods. A detailed presentation of sampling and analysis using the Video Plankton Recorder and the Digital Holographic Imaging system will be given.

**Dr Rubao Ji, Tenured Associate Scientist, Biology Department, Woods Hole Oceanographic Institution, USA**

Dr. Ji is a biologist with the powerful tool of numerical model. His interests include the coupled biological-physical numerical modeling, food web dynamics in coastal oceans, plankton phenology and biogeography, zooplankton population dynamics, Arctic oceanography and biological production, and metapopulation connectivity. He is PI or co-PI of 16 research projects over the last 6 years and published 41 peer-reviewed research articles (27 in English, 14 in Chinese) as lead- or co-author on topics such as biological-physical coupled modeling, plankton dynamics and food web dynamics.

- **Presentation:**

**Biological-physical interactions and modeling**

The dynamics of marine ecosystems are controlled by strong nonlinear interactions between multiple processes with different spatial and temporal scales. These processes include physical dynamics (e.g., mixing, stratification, advection), as well as biogeochemical processes (e.g., nutrient cycling, production/consumption, and predator-prey interactions). Studying biological-physical interactions in the ocean is critical to the understanding of spatio-temporal distributional patterns of marine organisms and their variability, and to a better projection of future changes under
climate change scenarios. An important tool for these purposes is biological-physical coupled modeling. In this lecture, I will start by introducing some basic concepts of biological-physical interactions with a focus on processes controlling plankton dynamics, followed by some case studies showing phytoplankton blooms, zooplankton population dynamics and (if time allows) marine population connectivity. Throughout the lecture, some basic computer modeling concept and methodology will also be introduced and demonstrated.

Dr Zhaohui Aleck Wang, Associate Scientist, Marine Chemistry & Geochemistry Department, Woods Hole Oceanographic Institution, USA

Dr Wang is a marine chemist with strong field work orientation. His interests cover seawater carbonate chemistry, carbon cycling, air-sea CO₂ exchange, coastal carbon and nutrient biogeochemistry, chemical oceanography and marine biogeochemistry. Dr Wang is particularly interested in chemical sensor developments for in-situ measurements of the seawater CO₂ system (pH, pCO₂/fCO₂, total dissolved inorganic carbon, and total alkalinity), nutrients, and trace metals. His full CV is available from http://www.whoi.edu/profile.do?id=zawang.

- Presentation:

The Marine CO₂ system and Ocean Acidification

The marine CO₂ (inorganic carbon) system is central to the marine carbon cycle, which plays a critical role in regulating the world’s oceans as CO₂ sinks or sources to the atmospheric reservoir. Anthropogenic perturbation of the global carbon cycle has significantly affected global and regional climate and will continue doing so in the future. The ocean has taken up about 25-30% of anthropogenically released CO₂, which has caused ocean acidification. This ‘another CO₂ problem’ has a profound, long-term consequence in marine biology, marine ecology, and marine biogeochemistry. This lecture will introduce the fundamental concepts in seawater carbonate chemistry, seawater equilibria, ocean acidification and the physical and biogeochemical processes that control and affect the marine CO₂ system. I will also discuss how to make precise and accurate measurements of CO₂ parameters, and how to make the best effort to conduct the ‘best CO₂ practice’ in ocean acidification studies. If time permits, the lecture will also cover some latest CO₂ studies in marine environments.

Dr Anne Cohen, Associate Scientist, Geology & Geophysics Department, Woods Hole Oceanographic Institution, USA

Dr. Anne Cohen’s research focuses on climate change and its impact on life in the ocean. She is particularly interested in calcification, a process that produces the tiniest seashells, and coral reef ecosystems so big they can be seen from space. Together with organic matter production in the surface oceans, marine calcification exerts significant control on ocean-atmosphere CO₂ exchange and is therefore of global
biogeochemical significance and critical to survival of myriad kinds of marine organisms. Her lab utilizes laboratory-based and field experiments and observations to gain insight into the fundamental processes of calcification, to identify the primary biological, physical and biogeochemical drivers of calcification from organism- to ecosystem-scales, and to develop new climate proxies that allow us to build records of ocean climate change spanning the past millenium. Her full CV is available from http://www.whoi.edu/profile/acohen/

- Presentation:

**Coral Reef Responses to Ocean Acidification: from the laboratory to the field and back again**

Theory predicts, and CO$_2$ manipulation experiments generally show, that ocean acidification (OA) slows coral and coral community calcification, the process fundamental for reef-building. But results from field studies are less clear. Results to date show that net community calcification rates do not track oceanic pH/$\Omega_{ar}$ and that corals in naturally low pH waters do not necessarily calcify more slowly than corals in high pH waters. These unexpected results do not negate OA’s effects. Rather, they are important clues that other processes, including biophysical feedbacks, can mask or exacerbate its impact. Here I present coral calcification rates from >19 study sites spanning the Pacific basin and representing a strong natural gradient in pH, temperature and productivity. I show that ocean productivity is a stronger predictor of coral calcification rates than either temperature or $\Omega_{ar}$, and that this observation is supported by experimental data. However within coral reef sites grouped according to “higher” (eutrophic) and “lower” (oligotrophic) productivity, calcification rates are significantly negatively correlated with $\Omega_{ar}$. While calcification rates of corals are substantially higher on more productive reefs, they exhibit stronger sensitivity to ocean acidification, an observation also supported by experimental data. This study reveals OA as one of multiple, interacting climate change variables to which the biotic and abiotic components of coral reef ecosystems are currently responding and highlights the importance of “unexpected” observations in improving our understanding of coral reef futures under 21st century climate change.

**Dr Weifeng Zhang, Associate Scientist, Applied Ocean Physics & Engineering Department, Woods Hole Oceanographic Institution, USA**

Dr. Zhang got his PhD from The State University of New Jersey in 2009 and then moved to WHOI for postdoctoral research during 2009-2011. He now works in applied ocean physics and engineering depart of WHOI. His major scientific interests include the coastal ocean circulation, frontal dynamics, internal wave dynamics, gravity currents, bio-physical interactions, numerical ocean modeling, data assimilation, model-based observing system design.

His full CV is available from http://www.whoi.edu/hpb/Site.do?id=9472

- Presentation:

**Tidally driven internal wave generation at the edge of a continental shelf**
Tidal currents over the steep topography at the edge of a continental shelf (shelfbreak) can covert tidal energy to available potential energy in the ocean interior, which then radiates away in the form of ocean internal waves. The internal wave generation process is subject to the influences of nonlinear dynamics, turbulent mixing and irregular topography. These influences are often neglected in studies of shelfbreak internal wave generation. Through resonant or non-resonant triad interactions, nonlinear processes, such as momentum advection, can transfer the internal waves from the tidal forcing frequency to other (higher or lower) frequencies. Strong vertical shear associated with the internal waves enhances local turbulent energy dissipation and results in substantial loss of the harmonic energy. Shelfbreak canyons can greatly modify the spatial pattern of the internal wave generation, causing inhomogeneous energy conversion and beam-like wave radiation. Even for canyons of symmetrical shape, the internal wave generation is enhanced on one side of the canyon and suppressed on the other, owing to topographically driven source phase variation and the associated multiple-scattering effects. Meanwhile, through single-scattering effect, the phase variation of the distributed internal wave source causes focused onshore wave radiation in the form of horizontal beams.
Logistic Information
Sixth WESTPAC Summer School on the Monsoon Onset Monitoring and its Social & Ecosystem Impacts (MOMSEI)

Phuket Aquarium, Phuket Marine Biological Center, Phuket, Thailand

26-30 October 2015

Logistics Information

1. **VENUE:**

The 6th WESTPAC Summer School on the Monsoon Onset Monitoring and its Social & Ecosystem Impacts (MOMSEI Summer School-VI) will be taking place at the Phuket Aquarium, which is located in the Phuket Marine Biological Center, Phuket, Thailand.

   **Address:**
   Phuket Marine Biological Center
   51 Moo 8, Wichit, Muang, Phuket
   Thailand, 83000

   The Phuket Marine Biological Center is within 50 minutes from the Phuket International Airport and 15 minutes drive from Phuket town. However, please take into account that rush hour traffic could add up to an hour or two hours on the estimated travel time.

   **Location Maps are attached as Annex A.**

2. **ACCOMMODATION:**

   The Kantary Bay Hotel, Phuket
   31/11 Mu 8, Sakdidej Rd., Cape Panwa
   Phuket 83000, Thailand.
   Tel: +66 76 39 1514
   Fax: +66 76 39 1208,

   The Kantary Bay Hotel is within 10 minutes walk from the Phuket Aquarium.

   To ensure the application of a special room rate set for participants to this summer school, PMBC will provide all participants with the reservation service.

<table>
<thead>
<tr>
<th>Room Type</th>
<th>Special Room Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Studio Suite (Single/Twin)</td>
<td>THB1,400 (US$ 40)</td>
</tr>
</tbody>
</table>

   **The special room rate** is inclusive of 10% service charge, VAT and breakfast. **Free WIFI** is available in-room and public areas of the hotel. **Check-in time:** 14:00 p.m.; **Check-out time:** 12:00 p.m. **Late Check-Out time:** 18.00 p.m., with extra 50% of room rate charged.

   The participants are personally responsible for clearing their hotel bills upon departure.
3. TRANSPORTATION:

Local committee will provide airport pick-up and drop off service upon receiving your itinerary. So please make sure that you send your itinerary to:

Ms. Kingkanjana Sangtunchai  
Email: kingkanjana.pouy@gmail.com

When you enter the Passenger Hall, please look for our representatives holding up a sign with “WESTPAC MOMSEI Summer School-VI”. They will be standing in front of the exit from the customs checkpoint of International Arrival Hall.

In case of any problems due to unforeseeable circumstances, please call our mobile for assistance at 66 (0) 96 636 0192 (Ms Kingkanjana).
4. REGISTRATION

Participants are required to register upon arrival at the venue on the morning of 26 October 2015. The registration desk will open at 08:30 a.m., 26 October 2015, in front of the meeting room on the second floor of the Phuket Aquarium Building, Phuket Marine Biological Center. Please provide your name card to the Secretariat upon registration.

5. MEAL

Free Buffet Lunch and dinner will be provided on all working days, from 26-30 October 2015.

6. RECEPTION

Reception and farewell dinners are planned for the evening of 26 and 30 October 2015 for all participants from 18:30-20:30 hrs. The place for dinners will be announced at the meeting.

7. GENERAL INFORMATION:

Climate:
Thailand is a tropical country and the information on the weather conditions of Phuket, Thailand may be obtained through the web http://wikitravel.org/en/Phuket and http://www.tmd.go.th/en/province.php?id=75.

Language:
The summer school will be held in English.

Exchange rates:
On October 19, 2015, 1 USD = 35.3045 THB (Source:www.xe.com)

Visa:
Participants requiring an entry visa to Thailand are strongly advised to apply for it with the Thai Embassy or Consulates in your country as soon as possible in order to secure the required entry visa prior to your departure.

Information on visa requirement and procedure can be found on the website of the Ministry of Foreign Affairs of the Kingdom of Thailand at http://www.mfa.go.th/main/en/services/123.

Electricity:
The electrical currents in Thailand are 220 volts with the following electrical outlets:
WESTPAC Office disclaims all responsibilities for medical, accident and travel insurances, for compensation for death or disability compensation, for loss of or damage to personal property and for any other losses that may be incurred during travel time or the period of participation. In this context, it is strongly recommended that participants will secure international medical, accident and travel insurances for the period of participation prior to departure.

Should you have any questions or require any assistance on the logistic arrangements, please feel free to contact:

Local Committee
Ms. Kingkanjana Sangtunchai
Email: kingkanjana.pouy@gmail.com
Cell phone: +66 96 636 0192

Finally, we wish you a pleasant stay in Phuket, the Pearl of Andaman Sea!

IOC Sub-Commission for the Western Pacific (WESTPAC)
Annex A

Location Map
List of participants
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