24 July 2024

To: Geoscience and Remote Sensing Society Education
From: IEEE International Soil Moisture School (ISMS)
Re: ISMS Summer School Budapest 2024 Summary

Executive summary: From July 14 – 17 (Sunday – Wednesday), members of GRSS and students from around Europe and North America, convened at the Budapest University of Technology and Economics (BME), and the Hungarian Institute for Soil Sciences (TAKI) to participate in a 4-day summer school to engage about the remote sensing of soil moisture. In all, 12 instructors, 6 assistants from TAKI, 2 speakers from the Hungary Fulbright office, and one representative from the US Embassy provided the basic instructional and overview material for the course. The course materials, in the form of lectures, hands-on field experience and computer lab application, were delivered to 36 students that were selected from 10 countries (3 of which were Fulbright scholars from the US), and a wide diversity of backgrounds and education levels (MS to post-doc to early career professionals). Funding for the workshop was provided by IEEE GRSS and the Fulbright commission, with funds principally going towards student support (meals and lodging), with some additional provided for instructor housing.

In what follows is a more detailed summary of the workshop, with provided links for instructional materials (presentations) and photographs of participants in the workshop. A basic, outward-facing website that describes the school, its mission, and other topics can be found at the ISMS website.

The basic theme for the summer school was centered around the remote sensing of soil moisture. Although soil moisture may not be the principal observable of interest for many of the participants, its broad influence on the climate, ecosystems, wildfire, water resources and a host of other disciplines, makes it the ideal vehicle for engaging students in the discipline of remote sensing and especially in getting them interested in activities that are related to IEEE GRSS. In that a broad but brief set of topics is explored to give the students the experience ranging from theoretical learning, to fieldwork, and analysis using software.

Agenda

The workshop began on Sunday, July 14, with an afternoon session providing overviews, and a brief history of Budapest provided by a local historian. The second day (first full day) was dedicated to a basic understanding of the technologies of radar and radiometry. The third day consisted of fieldwork and computer labs, and then the fourth day related to signals of opportunity, commercial radar and a closeout. A full version of the agenda is provided in the following pages.

2024 International Soil Moisture School (ISMS)
Europe – Budapest

Agenda

July 14, 2024, Sunday 4 PM

Opening ceremony at Mercure Castle Hill Hotel

VENUE ADDRESS: HOTEL MERCURE/IBIS BUDAPEST CASTLE HILL, KRISZTINA KÖRÚT 41-43, 1013, BUDAPEST - HUNGARY

- Registration open from 2 PM to 8 PM at hotel

4:00 PM - 4:20 AM	Welcome, opening remarks, orientation	Zsofia Kugler
4:20 PM - 4:40 AM	Representative of the US Embassy in Hungary	Luke Thompson
4:40 PM - 5:00 PM	Global Activities of GRSS: Past-Present-Future	David Kunkee
5:00 PM - 5:20 PM	Introduction to the Fulbright program	Sas Annamária
5:20 PM - 5:40 PM	Outline of the SM School	Simon Yueh
5:40 PM - 6:00 PM	In the heart of Europe, history, art and culture	Beretzky Ágnes
6:00 PM – 8.00 PM	Ice-breaker dinner at hotel restaurant	

July 15, 2024, Monday (Day 1)

VENUE ADDRESS: BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS (BME), MŰEGYETEM RKP. 3, 1111, BUDAPEST - HUNGARY
LECTURE HALL LOCATION: BUILDING K, PÉCSI ESZTER ROOM (I. FLOOR 95 ROOM)

- Registration open from 8 AM to 12 AM at BME

7:00 AM - 8:00 AM	Breakfast at Hotel	
8:00 AM - 8:30 AM	Travel to venue at BME	
8:30 AM – 9:00 AM	ISMS Agenda, orientation	Zsofia Kugler
9:00 AM – 9:15 AM	Welcome from University Vice-President	János Levendovszky
9:15 AM - 9:45 AM	Remote Sensing in Hydrology	Jeff Walker
9:45 AM – 10:15 AM	Group photo	
10:15 AM - 10.30 AM	Coffee break	
10:30 AM - 11:30 AM	Soil Moisture NASA and ESA Missions	Simon Yueh (NASA) - Klaus Scipal (ESA)
11:30 AM - 12:30 AM	Introduction to Passive MWRS	Rajat Bindlish
12:30 AM - 1:00 AM	Discussion	
1:00 PM - 2:00 PM	Lunch	

2: 00 PM - 3: 00 PM	Passive MW Retrieval Algorithm	Rajat Bindlish
3: 00 PM – 4:00 PM	Introduction to Radar	Paul Siqueira
4:00 PM - 4:15 PM	Coffee break	
4:15 PM -5:15 PM	Radar Retrieval Algorithms	Seungbum Kim
5:15 PM - 5:45 PM	Passive MWRS for river monitoring	Zsofia Kugler
5:45 PM - 6:30 PM	Poster session (lightning talk) Competition	
6:30 PM - 7:30 PM	Dinner and back to hotel	

July 16, 2024, Tuesday (Day 2)

VENUE ADDRESS FOR MORNING SESSION: INSTITUTE FOR SOIL SCIENCES (TAKI), HERMAN OTTÓ ÚT 15., 1022, BUDAPEST – HUNGARY

VENUE ADDRESS FOR AFTERNOON SESSION: BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS (BME), MŰEGYETEM RKP. 3, 1111, BUDAPEST - HUNGARY
LECTURE HALL LOCATION: BUILDING K, PÉCSI ESZTER ROOM (I. FLOOR 95 ROOM)
COMPUTER LAB: BUILDING K, I. FLOOR 42 ROOM

7:00 AM - 8:00 AM	Breakfast				
8:00 AM – 8:45 AM	Travel to in situ field site at TAKI				
8:45 AM - 12:15 PM	In situ measurements (3.5h) breakout session	Jeff Walker & Agota Horel (local host)			
12:15 PM - 1:00 PM	Travel back to BME				
1:00 PM – 2:00 PM	Lunch				
2:00 PM - 3:30 PM	Hands-on Radar (in computer lab)	Seungbum Kim	Hands-on Satellite Pass **(in computer lab)**	Rajat Bindlish Narendra Das	sualization (in con
3:30 PM - 3:45 PM	coffe				
3:45 PM - 5:15 PM	Hands-on Radar (in computer lab)	Seungbum Kim	Hands-on Satellite Pass	Rajat Bindlish Narendra Das	sualization (in con
5:30 PM - 6:30 PM	Active-Passive MWRS for soil moisture	Narendra Das			
6:30 PM - 7:30 PM	Dinner and back to hotel				

July 17 2024, Wednesday (Day 3)

VENUE ADDRESS FOR AFTERNOON SESSION: BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS (BME), MŰEGYETEM RKP. 3, 1111, BUDAPEST - HUNGARY
LECTURE HALL LOCATION: BUILDING K, PÉCSI ESZTER ROOM (I. FLOOR 95 ROOM)

7:00 AM - 8:00 AM	Breakfast	
8:00 AM - 8:30 AM	Travel to venue at BME	
8:30 AM - 9:15 AM	Application soil moisture	Peter Weston
9:15 AM - 10:15 AM	GNSS Reflectometry	Adriano Camps & Mehmet Kurum
10:15 AM - 10:30 AM	Coffee Break	
10:30 AM - 11:45 AM	GNSS Reflectometry (Contd.)	Adriano Camps & Mehmet Kurum
11:15 AM - 12:00 AM	Industry Speaker	Roger Jove
12:00 AM - 12:45 PM	Closing Ceremony/ Awards; Discussion and feedback	
12:45 PM	Adjourn	
1:00 PM - 2:00 PM	Lunch (optional)	

Course materials provided to students

At the end of the course, all of the technical presentations were converted into pdf documents and provided to students along with various photos that were taken during the interaction. A copy of these materials can be found at the ISMS Budapest shared folder on a GoogleDrive. An example of what some of these materials look like is shown below.

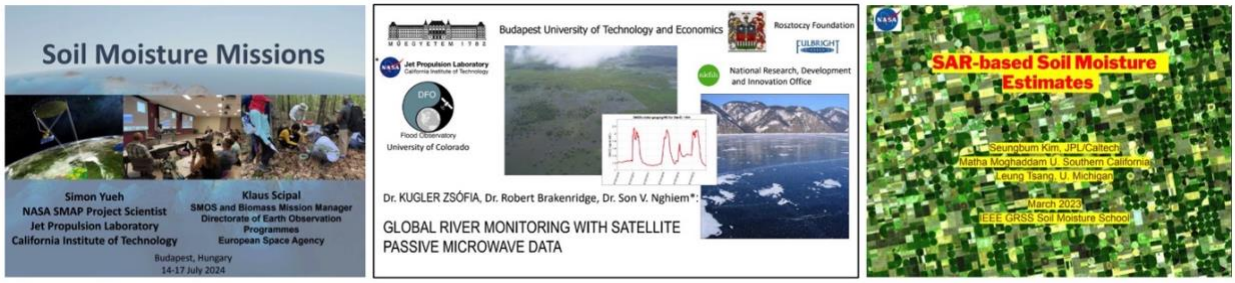

Figure 1. *Samples of the front cover slides for talks given during the ISMS.*

Evaluation

At the end of the session, a course evaluation form was provided to students in order to ask for feedback on the experience and course materials. A sample of one of these feedback forms is attached. A copy for all of the completed evaluation forms (28) can be provided by a direct email to Prof. Zsofia Kugler.

Table 1 below shows the scores to specific questions, which ranged from 1 (strongly disagree) to 5 (strongly agree).

Score (avg, min, max)	Question
4.8, 4, 5	The course material was organized clearly and logically.
4.9, 4, 5	The objectives of the course were satisfied.
4.6, 3, 5	The technical content was appropriate.
4.6, 3, 5	My knowledge on the topic increased to a level that made attendance worthwhile.
4.0, 2, 5	The instructor's speaking voice was clear and easy to understand.
4.3, 3, 5	The instructor clearly explained difficult concepts.
4.2, 2, 5	The length of the course was about right.

Among the topics that students identified the most for major topics for the course were in-field data collection, radar, GNSS-R, radiometry, and retrieval algorithms.

The vast majority of students (27/28) identified “Advanced Self-learning” as the reason for taking the course. This is understood to mean that many of the students may have been exposed to the material before, but that they had taken this course to become more acquainted with subject.

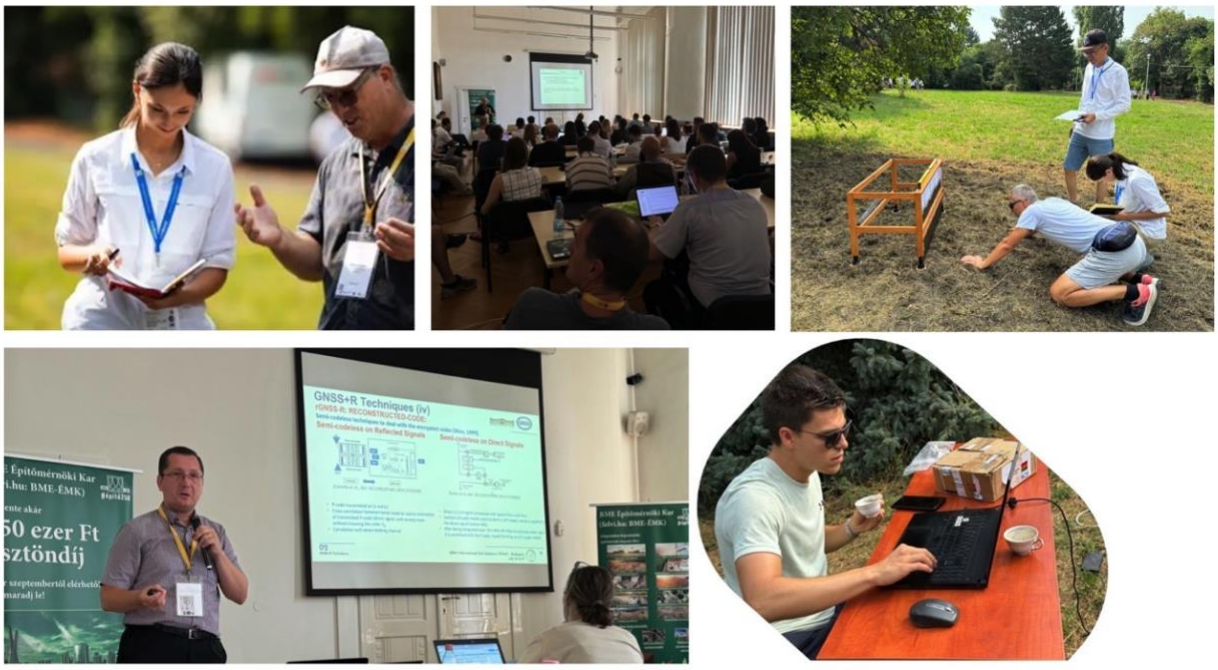

Figure 2. *Images of the fieldwork, lectures and participants in the activities.*

Figure 3. *Group photo at BME.*

Cost Summary

The initial (and core) funding for the summer school came from a $20,000 educational grant from the IEEE Geoscience and Remote Sensing society. These funds were augmented by a $5000 grant from the Fulbright commission, which paid for the opening reception and travel for three students from the US to attend the workshop. A facilities cost of $3000 that would go to Budapest University of Technology and Economics (BME), was waived by the Chancellor but included here in order to understand the overall budget.

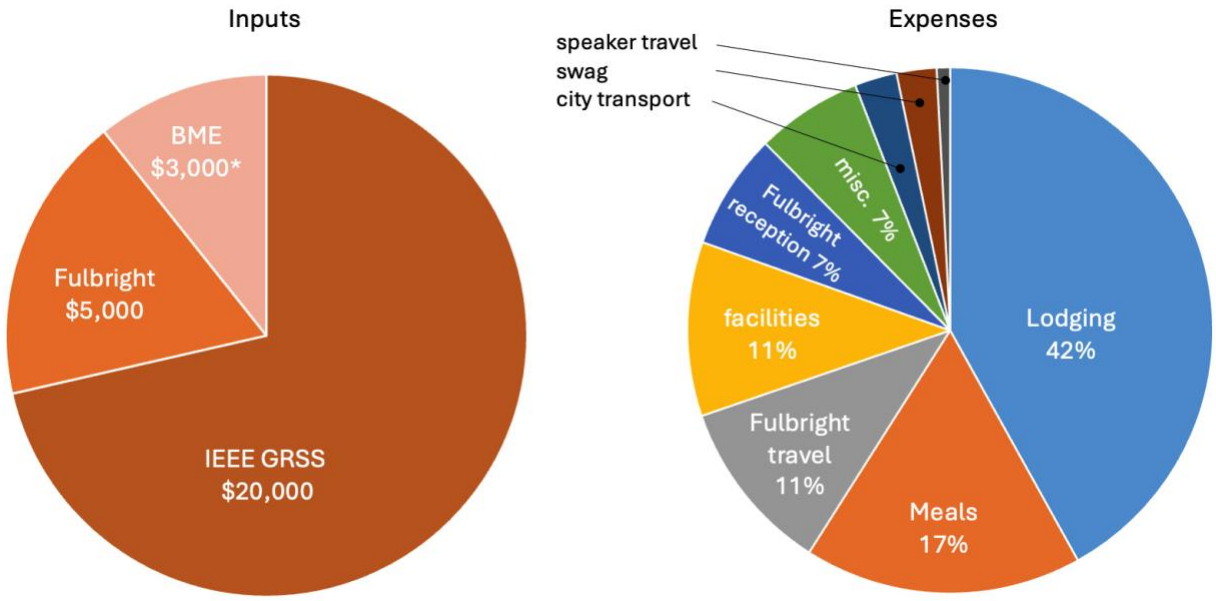

Figure 4. *Cost summary in terms of inputs and outputs. *An in kind contribution of $3000 from the Budapest University of Technology and Economics (BME) for access to facilities in included in the total cost of $28,000 USD for the summer school.*

IEEE Continuing Education Course Evaluation

Course Title: _2024 International Soil Moisture School - Budapest_ Date of Event: _July 14 to 17, 2024_

Instructor__chair Simon Yueh and Zsofia Kugler_____

Please indicate the extent to which you disagree or agree with the following statements:

	Strongly Disagree 1	2	3	4	Strongly Agree 5
A. The course material was organized clearly and logically.					X
B. The objectives of the course were satisfied.					X
C. The technical content was appropriate.					X
D. My knowledge on the topic increased to a level that made attendance worthwhile.				X	
E. The instructor's speaking voice was clear and easy to understand.					X
F. The instructor clearly explained difficult concepts.					X
G. The length of the course was about right.				X	

Please list two major topics from this course:

1. Soil Moisture retrieval from SAR
2. Soil Moisture retrieval from GNSS-R

What one topic from this course did you find most helpful to your job and why?

GNSS-R : never worked on it

Briefly summarize what this course was about in one or two sentences.

Soil moisture retrieval using different datasets

What was the primary reason that you took this training? Please circle:

- Job requirement
- Need CEU/PDH credit to renew PE license
- Advance self-learning
- Other

Do we have permission to use your comments in course marketing materials? X **Check here for YES**

Please complete the following information to ensure your receipt of the Continuing Education Units (CEUs):

Name (as you would like it to appear on CEU Certificate): GIOVANNI ANCONITANO

E-Mail: GIOVANNI.ANCONITANO@UNIROMA1.IT

PLEASE RETURN THIS FORM TO THE LOCAL EVENT COORDINATOR TO BE FORWARDED TO IEEE EDUCATIONAL ACTIVITIES STAFF