Gerhard Jirka Summer School on Environmental Fluid Mechanics

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Background
Environmental Fluid Mechanics is concerned with the fluid motions and associated mass, momentum and energy transport processes that occur in the earth's hydrosphere and atmosphere and in engineered systems such as drainage, water supply and waste disposal systems on both local and regional scales. These flows interact with nearly all human activities and their understanding and modelling is critical for addressing issues in sustainable development.

The School is a signature IAHR event that was founded and energized by the late Professor Gerhard Jirka, with a vision to bring together renowned experts and top graduate students from around the world for a unique, interactive learning experience in environmental fluid mechanics. A central objective of the School has always been to combine theory, experiments and applications, with an emphasis on basic theoretical principles, and their mathematical description, as well as consideration of examples of engineering design and environmental applications. This objective is realized in the School through formal, in-class lectures as well as informal, out of class excursions and visits. In the School, the students have plenty of opportunities to present their own research projects and to discuss and seek advice on these projects from Lecturers and fellow students.

The school was previously held in: Karlsruhe, Germany, 1999; Dundee, Scotland, 2001; Budapest, Hungary, 2004; Karlsruhe, Germany, 2006; Santiago, Chile, 2009; Lucerne, Switzerland, 2012; Hong Kong, China, 2014

The summer school
This summer school was aimed at Ph.D. students, postdocs and engineers who wished to learn more about environmental fluid mechanics. A main goal of the School was to combine theory, experiments and applications, through formal in-class lectures accompanied by numerical, experimental and field sessions, where students have the opportunity to get hands-on experience in the topics studied in the lectures. In the School, all attendees presented their own research project and to discuss and seek advice on these projects from Lecturers and fellow students.

The summer school featured nine researchers of name and fame, the majority having participated as lecturers and/or participants in the previous schools:
- Heidi Nepf, Massachusetts Institute of Technology (MIT). Vegetated flow dynamics and wetlands
Figure 1: Vegetation effects on environmental flows

- Rui Miguel Lage Ferreira, Instituto Superior Técnico da Universidade de Lisboa. Particle Image Velocimetry (PIV) and Sediment Transport
Jose Góes Vasconcelos, Auburn University. Modelling of extreme flow events in hydraulic systems
Jakobus Ernst Van Zyl, University of Cape Town. Leakage and intrusion flows through leak openings in pipes.

Harry Edmar Schulz, Universidade de São Paulo (USP). Mass transfer through air-water interface.
Figure 5: Gas transfer lecture

- Leonardo Machado da Rosa, Universidade Regional de Blumenau (FURB). Computational Fluid Dynamics (CFD)

Figure 6: CFD lecture using Fluent to model the stratified flow of the lock exchange experiment

- Tobias Bleninger, Universidade Federal do Paraná (UFPR). Stratified Flows
Figure 7: Experimental results of the lock-exchange experiment

- Fábio Veríssimo Gonçalves, Universidade Federal do Mato Grosso do Sul (UFMS). Sediment transport

Figure 8: Sediment deposition and studies in Taquari River, Coxim/MS-Brazil

- Johannes Gerson Janzen, Universidade Federal do Mato Grosso do Sul (UFMS). CFD for vegetated flow dynamics and wetlands

The school was organized by the Federal University of Mato Grosso do Sul in collaboration with the Federal University of Paraná and University of Sao Paulo in Brazil. It was held at the Federal University of Mato Grosso do Sul, January 8 – 12, 2018.

The summer-school welcomed twenty-four students from different countries and world regions. The school included hands-on exercises on unsteady pipe flows including substance transport, an introductory CFD course using Fluent for the lock-exchange experiment, and an introductory lab course on PIV. In addition, the school included a visit and guided tour through Águas Guariroba, the Campo Grande’ water company, demonstrating applied research projects on leakage detection, pipe network optimization, and system monitoring.

During a joint dinner, the frequent coffee breaks and joint lunches and the overall open atmosphere the students had the opportunity to continuously get into closer contact with the lecturers and other students, being a fundamental requisite of the Environmental Fluid Mechanics Summer Schools and differentiating them with congress events for example. Within a student forum, the students took the opportunity to present their own research projects and discussed them to seek advice on these projects from Lecturers and fellow students.
The school program was:

<table>
<thead>
<tr>
<th>Time</th>
<th>Monday (Jan, 8)</th>
<th>Tuesday (Jan, 9)</th>
<th>Wednesday (Jan, 10)</th>
<th>Thursday (Jan, 11)</th>
<th>Friday (Jan, 12)</th>
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<tbody>
<tr>
<td>8:00 - 9:45</td>
<td>Registration and Introduction to the GJSS</td>
<td>Modelling of extreme flow events in hydraulic systems</td>
<td>CFD and Stratified flows/PIV</td>
<td>PIV/CFD and Stratified flows</td>
<td>Mass transfer through air-water interface</td>
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<td>9:45 - 10:15</td>
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<td>10:15 - 12:00</td>
<td>Modelling of extreme flow events in hydraulic systems</td>
<td>Vegetated flow dynamics and wetlands</td>
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<td>Vegetated flow dynamics and wetlands</td>
<td>Mass transfer through air-water interface</td>
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<td>12:00 - 14:00</td>
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<td>14:00 - 15:45</td>
<td>Modelling of extreme flow events in hydraulic systems</td>
<td>CFD and Stratified flows/PIV</td>
<td>PIV/CFD and Stratified flows</td>
<td>Leakage and intrusion flows through leak openings in pipes</td>
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<td>16:15</td>
<td>Student forum</td>
<td>CFD and Stratified flows/PIV</td>
<td>PIV/CFD and Stratified flows</td>
<td>Visit to Águas Guariroba, Campo Grande’ water company</td>
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<td>18:00</td>
<td>Student forum</td>
<td>Water quality benefits achieved by different floating treatment wetland configurations in a stormwater pond*</td>
<td>Student forum</td>
<td>Social event</td>
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<td>Ice breaker</td>
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<td>Evening Ice breaker</td>
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**Sponsorship**

The summer-school was sponsored by IAHR

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> Supported by Spain Water and IWHR, China

, with financial support provided by:

- The Brazilian Federal Agency for Post-Graduate Education (CAPES), funds for international lecturers travel expenses.

- The Federal University of Mato Grosso do Sul (UFMS), funds for national lecturer’s travel expenses.
Águas Guariroba, funding social events and visits

References: