The CISM Graduate Space Weather Summer School

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Introduction:
The CISM Summer School is an intensive two-week program aimed primarily at students entering graduate school in space or solar physics, although others entering the space weather field, particularly in industry, government or the military, have also benefited from attending. The school provides an overview of the space environment, space weather hazards, and models that are used to understand, specify, and predict the space environment – Reality, Harsh Reality, and Virtual Reality. Hands-on use of space weather models is a core component of the school. The goal is to provide students with the Sun-Earth system context for their subsequent more detailed and theoretical study in graduate school, and their thesis research topic. The school is introducing innovative pedagogy at the graduate level. The school receives excellent reviews from participants.

The Curriculum:
The summer school curriculum is divided into 5 courses that are taught concurrently. Most meet each day. A typical day is constructed so that the opening class deals with some region of the space environment. The second class discusses how this region produces a space weather hazard; the third class discusses how these threats can be modeled, and the afternoon session has the students using a model of this part of the space weather system. Some afternoons a guest lecturer from government or industry presents a seminar on some aspect of space weather processes or policy. Through the two weeks the topics move from the Sun to the upper atmosphere. The two-week schedule of lectures, seminars, and labs from 2004 is given below.

The Faculty:
The summer school faculty are drawn from throughout the CISM team and beyond. Below are listed those scientists who participated in teaching the 2004 summer school. The CISM team members are also identified by their primary thrust, showing that they are drawn from all CISM thrusts. We also show expertise from outside CISM, particularly from international collaborations and for those topics (such as ionospheric scintillation) not within CISM's models.

The Students:
The students who attend the summer school are diverse in several respects, gender, employment (civilian, military, student), geographic location, etc. Approximately 30% of those attending are employed by government, industry or the military. Close to 50% are graduate students, and benefit from a knowledge of space weather. These, usually young professionals, have different perspectives in space weather that benefit the majority of attendees who are beginning their graduate studies, showing from the non-scientist aspects of space weather. We also deliberately include a few students from overseas in addition to those attending from the United States. The two tables on the right show how the different students attending the 2003/2004/2005 summer schools split demographically and by current or previous professional status.

The Capstone Integrative Project:
The final day of the summer school is devoted to a capstone project designed to allow the students to use the knowledge they have gained during the two weeks. Students analyze real observational data from several days around a significant space weather event using expert and jigsaw collaborative learning techniques.

Pedagogy:
Various innovative pedagogies are used in the summer school to improve the learning experience. The use of these methods is novel at a graduate level. The use has been introduced within teaching faculty who've been introduced to these methods during the summer school; to introduce them into their regular academic year classes; to use them in short JCP sessions to give new insight into some of their courses. The sessions are designed to introduce new pedagogical tools to the students, many of which have been introduced to the class at the start of the afternoon session.

Evaluations:
Students were asked to fill in an evaluation sheet at the end of each day of the summer school. The sheet asked five questions of each lecture of the day.

Q.1: Did you find the material presented today useful? (1-5 scale)
Q.2: Was the lecture engaging? (1-5 scale)
Q.3: Rate your personal experience [1-5 rating]
Q.4: What was the best part of the lecture? (Free response)
Q.5: What advice did you take from the capstone project and about the summer school overall?

The tables below show the student response to the first three questions averaged for each day and for each lecture series. The (SW)T04 seminars on operations and policy were not evaluated.

Demographics of Summer School Students

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<th>Summer School Attendees</th>
<th>Summer</th>
<th>Civilian</th>
<th>Military</th>
<th>Student</th>
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<td>Summer School Students</td>
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Not shown in these numerical scores are any of the comments received in response to the free response questions. Most of the comments received focused on the presenters and on the active learning techniques. The capstone project and the school overview received lots of very positive comments.