

# McGill Earth System Science Newsletter

May 2014





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[www.ess.mcgill.ca](http://www.ess.mcgill.ca)

**Welcome to the first-ever Earth System Science Newsletter. In it you will read about some of the exciting things going on in ESS at McGill. I hope you enjoy it.**

This is my second year as Head of the ESS Program. For me, it has been a fun time, mainly because of the great students and professors who are involved in the program. The undergraduate ESS students continually impress by their intellectual prowess, their enthusiasm for all things ESS, and their close-knit community. The profs are likewise awesome, team-teaching the core ESYS courses and receiving consistently high marks for their efforts. The original 6 ESS profs – Bruno Tremblay and Pavlos Kollias in AOS, Boz Wing and Jeff McKenzie in EPS, and Navin Ramankutty and Bernhard Lehner in Geography – have been supplemented more recently by great contributions from Michel Lapointe and Margaret Kalacska in Geography and Bill Minarik and Eric Galbraith in EPS.

Two people deserve special mention. This summer Navin Ramankutty is leaving McGill to join UBC. For me, it has been a great pleasure to work with Navin and learn a little about his fascinating work. We will miss Navin very much and wish him the very best in his new position. For two years now Bill Minarik has been the ESS student advisor. Bill has been doing a fantastic job steering students through the intricacies of the ESS program. Because the program provides substantial flexibility and choice for a student, the student advisor's role is most important, and Bill has provided wise counsel to a large number of ESS students. Thank you Bill.

Since last year students joining the ESS Program can choose among the major, the minor, or the Honour's program. This choice provides students with the options they need to follow their interests. We have also instituted some new things in ESS. In Fall 2013 we ran an inaugural ESS orientation weekend at the Gault Estate on Mt-St Hilaire. This gathering allowed profs and students to get to know each other better, and provided new students with an informal introduction to the program. We did some fun hikes and field trips amongst the splendid fall colours. The Fall 2014 weekend is scheduled for 3-5 October 2014, so mark it on your calendar.

We now also have a scholarship program for students at all levels of the program. We have an Undergraduate Research Fund whereby students apply for funds to conduct research. And we run a series of seminars during the year in which we invite outside experts to give lectures.

Each year the ESS students organize a field trip during reading week in March. This year the students went to Costa Rica, an ideal place to examine the interplay of processes within the Earth System. Jeff McKenzie has been very involved in this activity over the years, and I thank him for his participation, encouragement, and enthusiasm. Jeff and I are discussing turning this field trip into a proper credited field course in the future.

The above activities have been made possible through the support of the Faculty of Science and Dean Martin Grant. For this we are most grateful.

For the past two years I have been involved in the capstone ESS course, ESYS 500, in which students plan, undertake, and write up a research project of their own. Last year the students examined urban CO<sub>2</sub> emissions in Montreal, and this year they studied the Montreal heat island. Such amazingly good projects – it was a treat for me to be involved and advise students in their work.

So – ESS is alive, healthy, and brimming with enthusiasm. Read on and enjoy!

- John Stix



ESS Orientation Weekend, Mt-St Hilaire, 4-6 October 2013



During the 2013 year, the Earth System Science major grew to 22 majors, with the addition of nine new U1 students.

The ESYS Honours Major and the ESYS Minor were approved, along with some modifications to the major core requirements. These modifications served to reduce duplication in subject mater. They also added the requirement for a computer programming course early in the program (COMP 202) and one course in human geography.

We've now graduated 24 people from the ESYS program. Most are now employed in some field related to Earth System Science. Fourteen have gone on to pursue advanced degrees. The graduate program institutions include:

Carleton University  
Clark University  
Concordia University  
Dalhousie University  
McGill University  
McMaster University  
University of California, Berkeley  
University of Victoria  
University of Reading (UK)

We as humans are facing some difficult problems; you are the ones who will find the solutions.

- Bill Minarik

## 2014 ESS Undergraduate Research Fund recipients:

**Kayleigh Angrove (U3):** *"Use of total lead concentration and Glomus spores as dating techniques for sediment cores from Kouchibouguac National Park"*

**Nicholas Brown (U3):** *"North Atlantic fresh water dumping experiments in the CM2Mc model"*

**Julie Fortin (U2):** *"Computational landscape ecology – bears in western Canada"*

**Corey Lesk (U3):** *"Tree species diversity in homegardens of Kerala, south India"*

**Nicole McLaren (U2):** *"Registration for Canadian Society for Ecology & Evolution: From genomes to Biomes, Montreal, QC"*

### KEY NEW RESOURCES:

2013-2014 IPCC reports:  
<http://www.ipcc.ch/>

A new earth observing system:

[http://www.esa.int/Our\\_Activities/Observing](http://www.esa.int/Our_Activities/Observing)

U.S. government climate portal:  
<http://www.data.gov/climate/>

## 2014 ESS SCHOLARSHIPS:

### ESS U2 Student Scholars:

Julie Fortin, Nicole McLaren

### ESS U1 Student Scholar:

Ammar Adenwala

### Two interesting new books:

Batty M (2013) The new science of cities. Cambridge, MIT Press, 518 p.

Hecht SB, Morrison KD, Padoch C (eds) (2014) The social lives of forests. Chicago, University of Chicago Press, 507 p.

# Florida Field Trip, March 2013

In 2013 the ESS field trip was held during the spring break, in Florida, USA. Florida is a diverse and interesting state from an Earth System Science perspective which made it an ideal destination for our annual field trip. Just like in the previous years, the trip was organized by students and it aimed at providing us with a better understanding of the local ecosystem. The students participating researched a topic of their interest, specific to Florida's environment, and presented it to the rest of the group during the trip. This resulted in a great learning experience since students were able to observe in reality their theoretical knowledge. Activities were planned around interesting topics like the role of the Sub-Tropical Florida Lichens as air pollution indicators, the mangroves of Florida, the geological history of the Everglades or the South Florida Water Management System. Some of the highlights of the trip were the swim with the manatees in Crystal River where we were able to observe manatees in their natural environment and the kayak trip in the Everglades which allowed for mangrove study and alligator fun. The snorkeling activity in John Pennekamp Coral Reef State Park was a great experience which provided students with a deeper understanding of the diversity and the vulnerability of the coral reefs. Professor Pavlos Kollias, who supervised the trip, gave us a tour of the Department of Atmospheric Sciences at the University of Miami. There we received a presentation on radars and instruments which measure atmospheric variables from the engineer who designs them.

The success of the trip, as in the previous years, was insured by the students' enthusiasm for learning, the support provided by the professors in the program and the beautiful and fascinating environment we were immersed in.

- Cristina Gavrilă



Group picture by the University of Miami (photo by Kayleigh Angrove)

Kayak trip in Everglades National Park (photo K. Angrove)



Kayak trip - mangroves (photo K. Angrove)

Snorkeling in John Pennekamp Coral Reef State Park (photo K. Angrove)



Outdoors classroom – presentation on lichens and their role in determining air pollution (photo K. Angrove)

# Storm Chasing – May 2013

Last May I had the opportunity to go storm chasing with a team from the Department of Atmospheric and Oceanic Sciences. Led by our professor Eyad Atallah, we drove from Montreal all the way to New Mexico while chasing storms in Oklahoma, Kansas, and Texas. The experience was quite surreal. Seeing everything we had learned in class manifested in front of us in a powerful, intense storm was quite humbling.

Our typical day would entail waking up early in the morning and looking at the weather maps to determine where we think storms might “pop”. We would then drive towards our target area, stopping frequently to check the new weather maps, and refine our location of interest. Once we would see something appear on the radar, off we went into chase mode. We would chase a storm for hours, until sunset when it was no longer safe. Often times we would leave one storm to chase a new one of particular interest. As a result, chasing was a test of our forecasting skills. Where will the storms form, and which one is most likely to drop a tornado?

The most exciting storm we chased was in Bennington, Kansas. We approached the storm as soon as we saw it appear on the radar. We watched the entire evolution of the storm, from a small updraft on the horizon, to a full-blown supercell. We saw the lowering of the wall cloud, the creation of a funnel, and finally, we saw the tornado touch ground. It was later classified as an EF-4 tornado, and was on the ground for nearly an hour. It was strangely enough, almost completely stationary. We were therefore able to watch it for a long time before having to drive to safer ground.

Each storm had its unique features. We saw “UFO” shaped clouds, beautiful mammatus clouds, and intense lightning shows. This truly unique experience has left us with a better understanding of the atmosphere, and we can’t wait to go back.

- Alice Wood

Early stationary tornado in Bennington, Kansas



"UFO" shaped cloud



# What I did during my sabbatical

In 2012-2013 I spent my sabbatical year at the Lamont-Doherty Earth Observatory of Columbia University working on an Office of Naval Research funded research project entitled “Forecasting Sea Ice Conditions in the Marginal Ice Zone (MIZ): A Lagrangian Approach”.

The main goal of the project is to assess whether Global Climate Models are able to reproduce the source regions for sea ice that melt each summer in the MIZ. The underlying hypothesis is that advection of thick multi-year ice from the central Arctic in coastal regions will affect the ice edge position the following summer. For GCMs to correctly predict the ice position, a good simulation of the source region for sea ice melting in the MIZ is crucial. To this end, we calculated Lagrangian back-trajectories for different region of the Arctic based on satellite-derived drift trajectories from 1979-2013) and compared them with GCM model output. We used this diagnostic to then discriminate between GCMs and reduce the uncertainties in future regional sea ice extent forecasts.

I also helped develop a Lagrangian Ice Tracker program (<http://polarapps.ldeo.columbia.edu/>). This program can be used for scientific, environmental and educational purposes. The IceTracker was presented at the American Geophysical Union Fall meeting in San Francisco in December 2013. We also developed another application of the IceTracker program that is used for seasonal forecasting of the minimum sea ice extent several months in advance, entirely based on observations. The idea is to separate the total signal of sea ice loss each summer into a thermodynamic melt and dynamic (ice export) component. The thermodynamic melt component can be estimated several months in advance because of the high correlation between the sea ice thickness field before the melt season starts and the minimum sea ice extent at the end of the melt season (i.e. all ice of a certain thickness or thinner will melt each summer). The dynamic component (ice export through Fram Strait) has some predictability because of the link between ice export and surface ocean current induced by sea surface dynamic height difference between the Arctic and the North Atlantic that were built during the previous winter. The separation of the sea ice melt signal into its thermodynamic and dynamic components is a powerful tool to quantify/estimate the predictability and lead time of seasonal sea ice forecasting.

I was a co-convenor/organizer/presenter at the “*Warming Arctic, Changing Planet*” symposium presented at Columbia University. This event was co-sponsored by the Lamont-Doherty Earth Observatory, the Earth Institute, Columbia University and the Quebec Government Office. In this events, 7 panelists presented recent research on the trends in Arctic sea ice decline and its effect on land ecology, marine mammals and Inuit communities living in the North. The symposium can be viewed at <http://www.earth.columbia.edu/videos/watch/449>.

I was a co-organizer/presenter at the “*White Arctic Blue Arctic: Exploring Sea Ice Restoration*” workshop held at Columbia University. For this event, we invited politicians, economists, engineers, social and physical scientists to discuss avenues of sea ice restoration. The workshop set the stage for present and projected changes in summer sea-ice to disappear in the Arctic and restoration strategies including geo-engineering and mitigations – while keeping in mind the inherent time scales for changes in physical, political and technology systems. A white paper available upon request; simply contact me for details.

## Costa Rica 2014: a guide to Pura Vida

On Friday morning, February 28, 8 students of all years of ESS left a very cold Montreal to go learn about the Earth System in the field, in Costa Rica. Once arrived, we met up with Jeff, got in our rental cars, and drove out of the city. Our first stop was in La Selva Biological Station, a tropical forest research center. We got to see monkeys and sloths, and some very impressive ants. Hiking in the old growth forest and successional plots, the tropical ecology learned in our geography classes came in very useful to understand the complex interactions and adaptations. After two days discussing plants and watching birds, we left to go learn about some rocks. We hiked up (or almost ran up trying to follow our local guide) Rincon de la Vieja, a complex volcano in the northwest. We were lucky and the sky stayed clear, giving us great views of the crater. None of us had seen volcanoes before and we were all very impressed and curious. We then left for Tamarindo, an incredibly touristic beach destination on the Pacific Coast. We visited Playa Grande, a turtle nesting park, and learned about mangroves, trees that grow in the water. We then went to Monteverde, a cloud forest in the mountains of central Costa Rica, which developed over the years as an eco-tourism destination. We walked around the cloud forest, which was not very cloudy given as we were in the dry season.

Over the week, we realized how diverse Costa Rica is. We crossed jungles, prairies, mountainous regions, and wetlands. We learned about the biodiversity of the country, the volcanoes and the climate, but also its history, its natural resources management and its energy use. We discussed water contamination and availability, hydropower development, carbon footprint and trading pro's and con's, and the impact of tourism on the economy and the culture. We got back with sunburns and a better understanding of the system, thinking of how everything we had seen is related and has to be understood together.

- Caroline Aubry-Wake

### ESS'ers on Volcán Rincon de la Vieja





Courtesy NASA