Integrated Land Ecosystem - Atmosphere Processes Study

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iLEAPS Melbourne Science Conference 2009 – selected highlights

In photo from left: Erika Zardin, Ella–Maria Kyrö, Joshua B. Fisher, Abigail Swann, Sachin S. Gunthe, Florence Bocquet, Christoph Rüdiger.

In August 2009, iLEAPS (Integrated Land Ecosystem–Atmosphere Processes Study) and GEWEX (Global Energy and Water Cycle Experiment) organised a parallel Science Conference "Water in a changing climate: Progress in land–atmosphere interactions and energy/water cycle research" with several joint sessions. Prior to the conference, iLEAPS and GEWEX hosted a 3–day Early–Career Scientist Workshop attended by that over 50 early–career scientists. Given that these young scientists represent the next generation of leading scientists in land–atmosphere research, we report here on their research foci. Specifically what topics, methods and scales of study form their research? Finally, what does this mean to the future of land–atmosphere exchange science?

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Reporting from the iLEAPS–GEWEX Early–Career Scientist Workshop, Melbourne, Australia, 20–22 August 2009

The New Generation of 'Land–Atmosphere Exchange' Scientists

An overview of the early–career scientists, and how their work will shape the direction of land–atmosphere science

The influence that local– to global–scale interactions between the Earth's surface and the atmosphere exert on climate is widely recognised. Nonetheless, a large fraction of these interactions are still not well understood and may have yet to be discovered. To further progress in this field, iLEAPS provides a major scientific pathway for scientists from a broad range of research areas to interact, communicate and inform one another. It enables scientists to collaborate towards a more thorough understanding of land–atmosphere exchange science.

In line with these objectives, iLEAPS arranged an Early–Career Scientist Workshop (ECSW) on 20–22 August, 2009, prior to the parallel iLEAPS and GEWEX science conferences held in Melbourne, Australia.

Topics of discussion included

- Earth system science
- remote sensing and applications
- land–atmosphere interaction and scaling issues
- climate and global change
- science–media communication
- pathways to careers combining science and politics or science and industry.

Integral to the workshop was interaction with foremost senior scientists: John Finnigan, Mike Raupach, and Ray Leuning (Commonwealth Scientific and Industrial Research Organisation-Marine Atmospheric Research), Einar–Arne Herland (European Space Agency), Lindsay Hutley (Charles Darwin University), and Will Steffen (Australian National University).

The following report is based on 32 surveys (out of 52 attendees) from the participants, including an equal number of male and female. Just over half were current PhD students; the remaining were early–career scientists (<5 years from PhD). Australian institutions were well represented with nearly a third of the respondents, and the rest came from more than 11 different countries.

The majority of the respondents were working on water and energy cycling (27%) as well as on aerosols and volatile organic compounds (VOCs) (24%). A diverse range of other topics were also represented, such as greenhouse gas fluxes and carbon/nitrogen cycling (13%), land–atmosphere coupling (13%), vegetation dynamics (9%), climate (7%), and turbulence and micrometeorology (7%) (Fig.1).

The majority worked with models (34%) and field measurements of vegetation, meteorology, and/or aerosols (30%). Satellite and aerial remote sensing were frequently used (16%) as well as eddy covariance (14%). Finally, a few scientists were working with tracers, isotopes and/or other laboratory studies (6%) (Fig. 2).

Most of the scientists studied processes on the local (39%) and/or regional (37%) scales, whereas the remaining fraction (24%) worked on the global scale (Fig. 3).

From this simple and admittedly biased survey (represents only the early–career scientists who attended the workshop, not a representative sample globally), it appears that the strengths of the early–career scientists cover the research areas of water and

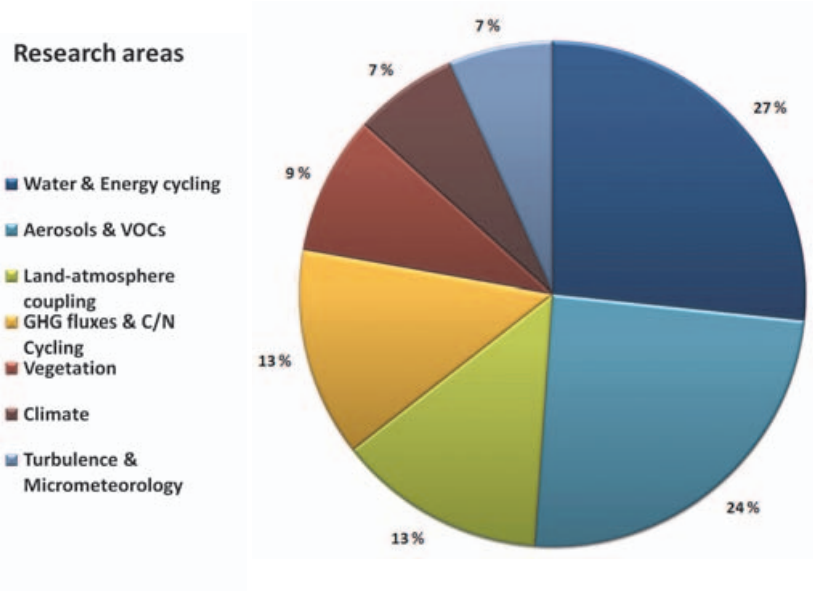

Figure 1. Research areas of the ECSW early–career scientists.

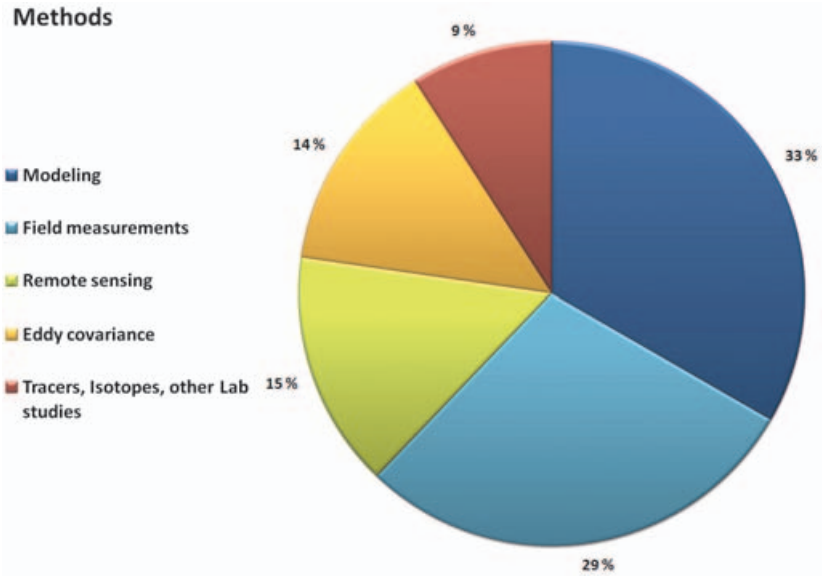

Figure 2. Research methods employed by the ECSW early–career scientists.

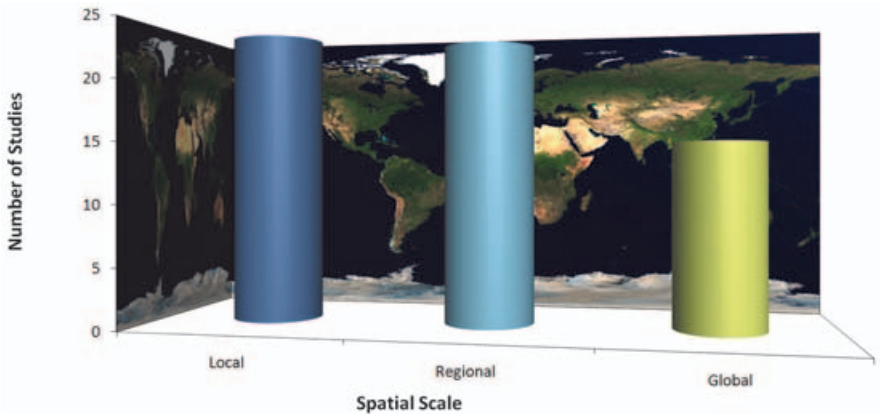

Figure 3. Spatial scales of study addressed by the ECSW early–career scientists.

Melbourne city center in August 2009. Photo by Ella–Maria Kyrö.

energy cycling, aerosols and VOCs, modelling and field measurements. Because of the research foci of the parallel iLEAPS–GEWEX conferences taking place the following week, it was indeed expected that water and energy cycling would be strongly represented. Nonetheless, the highly represented categories of aerosols and VOCs highlight the importance of physical and chemical land–atmosphere processes of these compounds.

Modelling and field measurements were the two main methods used by the respondents. Modelling is crucial in land–atmosphere interactions; yet to advance modelling practices, it is important to collect the data that are being used as well as to understand the physical and chemical processes behind the observations. Clearly, this new generation of land–atmosphere exchange scientists has the tools and training to advance their science.

Finally, the relatively even representation of spatial scales of study is also worth noting. Each scale category is rather well studied which is necessary to establish linkages among the scales and to yield an even broader understanding of scaling–related processes.

Furthermore, the ECSW group expressed their opinions on the current gaps in knowledge in their fields of research. Greater understanding of physical and physicochemical processes such as atmospheric turbulence and the formation of aerosols and cloud condensation nuclei is important to advance the science of land–atmosphere interactions. To this end, substantial field campaigns are necessary.

For example, additional in–depth observations of aerosols and gas processes from a large variety of ecosystems, at multiple spatial and temporal scales, can advance the understanding of the physical, chemical, and biological processes. Additionally, standardisation of analytical methods to link, analyse and parameterise the measurements (*e.g.* eddy covariance and remote sensing data) within models needs improvement.

The iLEAPS–GEWEX ECSW succeeded in bringing together early-career scientists from around the world whose research interests covered a diverse range of scientific topics related to ecosystem–atmosphere interactions. The workshop provided a forum for early–career scientists to express and build their views for linking the processes/issues scanned jointly by iLEAPS and GEWEX. This common platform is perhaps the most important outcome of the workshop.

The goals and interests of this new generation of land–atmosphere exchange scientists are summarised in the following:

- to further the understanding of atmospheric, biogeochemical, physical, biological and ecological processes at local, regional and global scales;
- define the scaling properties of measurements and models, and the effects of scale on ecosystems processes and feedbacks.
- to improve the parameterisation and representation of ecosystems processes and feedbacks in numerical models;
- to carry forward and aim at improving the interdisciplinary connections between the diverse fields of study;
- to coordinate the future research effort among measuring and modelling communities;
- to constructively merge the acquired scientific knowledge with policy–making debates driving our society of today and tomorrow.

The ECSW, in particular, addressed key challenges facing early–career scientists as they begin their careers, while highlighting promising research avenues that will enable them to become leading scientists carrying forward the scientific understanding of 'land–atmosphere exchange'. ■

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