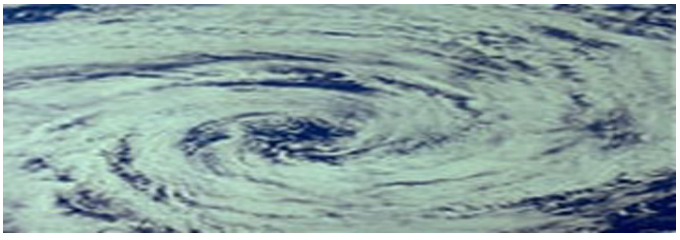


Climate Change Research Centre

Annual Report 2011



Climate Change Research Centre

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University of New South Wales

ANNUAL REPORT 2011

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1. *The Climate Change Research Centre at a Glance*

The Climate Change Research Centre (CCRC) was formed within the Faculty of Science in 2008 with initial financial support from the DVC Research and the Faculty. CCRC research focuses on basic climate system science, across several core disciplines. The CCRC interacts with numerous schools and Centres on campus. Within the Faculty of Science particularly strong research and teaching synergies exist between the Centre and the Schools of Mathematics and Statistics, Physics and Biological and Earth Sciences (BEES). Its research focus is innovative and arguably unique among university units worldwide, and it has quickly grown into the largest hub of such research in the Australian region.

CCRC stands as an autonomous staffing unit within the faculty. In 2011 the centre had 11 continuing academic staff and 23 contract research staff, most funded from Category 1 grants. Core academics include three prominent mid-career professors (England, Pitman, Sherwood) plus a strong cohort of young staff within 10 years of their Ph.D.'s. From 1 January 2011 Professor Steve Sherwood joined Professor Matthew England as CCRC Co-Director after Professor Andy Pitman stepped down from this role to assume directorship of the ARC Centre of Excellence for Climate System Science. (From mid-2012 Steve Sherwood will assume sole directorship of the CCRC).

The CCRC is overseen by a Management Committee chaired by Professor Mark Hoffman (AD-R, Faculty of Science). The other members of the Management Committee are: Michael Ashley (Physics), Rob Brooks, (EERC/BEES), Mark Holzer (Mathematics and Statistics) and Richard Stuetz (WRC/Civil and Environmental Engineering). The make up of the committee is a reflection of the collaborative ties the Centre has with different Schools and Centres across UNSW.

21 Ph.D. students were enrolled in program 1476 (Climate Science research) in 2011. The CCRC also supervised three master students, one honours student and hosted and supervised one PhD student from Computer Science and Engineering. Centre staff continued to be engaged in undergraduate teaching and in 2011. GENS0401 "Introduction to Climate Change" was successfully launched with close to 100 students enrolled. The CCRC engages heavily in public outreach including advising state and federal governments, frequent interaction with the media, and regular public lectures. The CCRC's Ph.D. and undergraduate programs are officially administered by BEES, but it manages its own finances, teaching development,

administration and IT (including an investment of 0.5 EFT in the Faculty IT unit), as well as administration relating to postgraduate students and the formal postgraduate review process.

The Centre has gone from strength to strength since its formation, culminating in the successful bid for the ARC Centre of Excellence for Climate System Science which commenced operations on 1 July 2011. In addition to CoE Director Andy Pitman, three CCRC academic staff are Chief Investigators in the Centre of Excellence - Alexander, England and Sherwood - each dedicating 0.3 FTE of their time to the Centre of Excellence. A further four CCRC staff were associate investigators in 2011. (Abramowitz, Evans, Sen Gupta, Taschetto). The two centres successfully share space and administrative support and there are significant opportunities for collaboration across the research strengths and foci of both centres.

Continuing staff appointed to the CCRC include one Laureate Fellow (England), one Future Fellow (Meissner), one ARC QEII Fellow (McNeil), and one ARC Australian Research Fellow (Evans). Jason Evans will commence a Future Fellowship in 2012. Fixed term staff include an ARC Australian Research Fellow, an ARC Postdoctoral Fellow and three SuperScience Fellows. The CCRC also houses Chris Turney, a Laureate Fellow appointed to BEES, and is attracting a growing number of distinguished visitors on sabbatical stays including two Fulbright scholars in 2011.

Core CCRC staff have won numerous prizes since the centre was established including two Tall Poppy Awards (Green, McNeil); NSW Scientist of the Year Category Winner (Pitman); Eureka Prize (England, Ummenhofer, Sen Gupta, Santoso); Australian Agricultural Industry Young Innovator (Evans); The AMOS Medal (Pitman); and the International Justice Award (jointly held by contributors to The Copenhagen Diagnosis). Three CCRC staff have been selected as authors or review editors of the upcoming Intergovernmental Panel on Climate Change (IPCC) Working Group I report, a number equalled by only six other university research units in the world (none in the Southern Hemisphere).

The CCRC was formally reviewed in 2011. The review panel's findings were broadly positive with the review summary report noting:

> "CCRC has met and mostly exceeded [its] key goal[s] and other objectives. The most notable achievement was the Centre's successful winning bid to establish the ARC Centre of Excellence for Climate System Science."

2 DIRECRTORS' REPORT

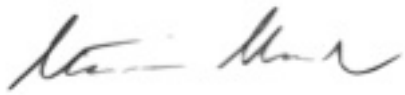
2011 was a landmark year for the CCRC. The most important event was undoubtedly the launch of the ARC Centre of Excellence for Climate System Science, officially beginning on 1 July, led by the CCRC but launched in collaboration with four other leading universities in partnership with CSIRO, the Bureau of Meteorology and seven international agencies. The CCRC recruited eight new postdoctoral research associates in 2011. In addition, several new recruits funded by the Centre of Excellence are situated at the CCRC and work very closely with CCRC researchers. We also accommodate two new postdocs working with Laureate Professor Chris Turney whose team has intrinsic ties to the CCRC. Three new professional staff have joined the combined Centres' business team including Alvin Stone, our communications manager. Stephen Gray and Simone Purdon were promoted to new managerial positions associated with the CoE.

A key CCRC goal has been to move toward financial independence by shifting as many staff as possible onto external support through Fellowships. Following on the award in 2010 of Matt England's ARC Laureate Fellowship, 2011 saw two more of our staff awarded prestigious ARC Fellowships to commence in 2012: Jason Evans was awarded a Future Fellowship, and Joe Kidston a DECRA (Distinguished Early Career Research Award). Three additional ARC Research Fellows are based at the CCRC: Andrea Taschetto (APD), Willem Sijp (ARF) and starting late 2012 Stephanie Waterman (DECRA). Overall, our staff garnered $3.343m ($2.6m Cat 1) worth of external research funding in 2011 (not counting the CoE). $2.6mil of this total was Category 1 income.

CCRC visibility appears very healthy. As mentioned above, we attracted ARC Laureate Fellow Chris Turney, who has joined BEES and the CCRC as an adjunct, with his main office in the CCRC. Fulbright Senior Visiting Fellow Tim Bralower arrived mid-year to spend 12 months as a sabbatical visitor, and another Fulbright Scholar Marvin Alfaro spent much of 2011 working on a project based at the CCRC. We also had some big events in the area of outreach, including Elsevier's publication of The Copenhagen Diagnosis, a new book by Donna Green, and the appointment of three of our staff as science advisors to the federal government's Climate Commission, including Matt England as the chair of the advisory panel.

We met an important teaching goal by starting up our new undergraduate course CLIM1001 on the science and policy of climate change, led by Gab Abramowitz and Lisa Alexander, which reached the initial enrolment cap of 100 students. The course runs with a novel design that involves faculty from around the university, providing students with a wide array of perspectives, but ensures that most learning happens in smaller tutorials with hands-on discussion, problem-solving and assessment. In tandem with the development of this new course, and an upper-level course commencing 2012, we revamped our undergraduate curriculum. The new curriculum has the rigor required for preparing students to think quantitatively about real-world problems and possibly to continue in science-related careers.

We are really happy with our progress in 2011, and hope that in 2012 we can continue to make greater strides and inspire greater scientific literacy both within the UNSW student body and across the broader community. We face challenges going forward, particularly with regard to space issues and how to maintain our small-group vibe as we grow larger. Among our goals for the year ahead are to continue to increase our scientific output, to nurture the next generation of scientists recently recruited to the CCRC, and to help the new ARC CoE develop in a way that will truly lift the climate sciences in Australia to a new level.



Professor Steven Sherwood

Professor Matthew England

2. Statement of financial performance for 2011

Summary of statement of financial performance

The Climate Change Research Centre's total revenue for 2011 was $5,341,262. 62.5% of this was from external income sources. The remainder was from a combination of Faculty and Central/Strategic funds, including generous support associated with Matthew England's Laureate Fellowship.

The Centre saw a tripling in external funding in 2011 from the previous year's figures. (From $1.1m to $3.3m) This was partly attributable to the timing of the release of funds, but also clearly representative of strong success in grant applications. Of the $3.3m research revenue earned in 2011, $2.6m was Category 1 income. These figures exclude the significant research revenues associated with the new Centre of Excellence which has its own cost centre and with funds related to Professor Turney's Laureate Fellowship (BEES).

At 82% of total expenditure, people costs account for by far the largest portion of the centre's expenditure across all fund types. Half of all people costs were externally funded in 2011.

Full countersigned financial statement follows.

Centres please note; the financial statements are prepared on a cash basis and any accrual information including unpaid invoices can be shown in the 'Notes to the Statement of Financial Performance' section beneath the financial statements. The account types below are meant as a guide, Centres are encouraged to include additional accounts or delete superfluous accounts. Seperate account lines should be shown to indicate the different sources of UNSW Internal Revenue/Funding ie. School, Faculty or DVC/VC

Climate Change Research Centre - CCRC

Statement of Financial Performance
for the Year Ended 31 December 2011

	Notes	2011 $	2010 $
Revenue:			
Research Revenue	1	3,288,930.46	1,074,427.43
Faculty Contributions	2	1,095,676.23	899,925.00
UNSW Contributions	3	910,001.40	1,590,564.00
Other External Revenue	4	46,654.00	115,742.57
Total Revenue:		5,341,262.09	3,680,659.00
Costs:			
People Costs	5	3,834,723.52	2,726,259.00
Scholarship Stipends		135,255.09	222,634.00
Travel	6	416,572.92	310,336.00
Equipment		106,850.72	140,769.00
Other Non People Costs		191,968.01	270,217.00
Total Costs:		4,685,370.26	3,670,215.00
Operating result	7	655,891.83	10,444.00
Opening Balance: Surplus(Deficit) from Prior Year		749,382.00	738,938.00
Correction of Prior Year Opening Balance	8	15,182.98	0.00
Adjusted Opening Balance		764,564.98	0.00
Closing Balance: Surplus(Deficit)		1,420,456.81	749,382.00

Notes to the Statement of Financial Performance

1. 2011 Category 1 income was $2.6m, which was up on 2010 figures.
2. Faculty's 2011 CCRC contribution consist of a 18% increase from 2010
3. Sources of UNSW funding for 2011 included $581k from the core SPF01 five year commitment and $329k in other strategic funds (SPF02, SIR30, SIR50).
4. Fundraising Contributions and Academic Support Funding
5. 82% of the Centre's total 2011 expenditure was on people costs compared to 74% in 2010 and 75% in 2009. In 2011, 50% of people costs came from base operating and strategic (SPF01, SPF02, SIR30, SIR50) funds meaning that half of the centre's salaries and on-costs are supported by fellowships or grants.
6. Travel accounted for the second largest proportion of expenditure, then 'Other non People Costs'. Of this travel expense 60% was funded by external grants.
7. The large surplus was due to a number of factors, but mostly as a result of time taken to spin up projects announced by the ARC in the second half of 2011.
8. Due to a misinterpretation of the revenue income categories an incorrect carry forward book entry balance has been corrected. No subsequent affect to the operating result.

L. McINTYRE FIPA

3. *Statement of in-kind contributions including academic and other salaries, infrastructure and other resources provided to the Centre;*

The value of the University's infrastructure and space in-kind contribution to the CCRC in 2011 was $228,096. (Figure based on calculation metrics provided by UNSW Space Audit Manager).

The Centre gratefully acknowledges support provided by UG student administrative staff in the Schools of BEES and Physics as well as assistance from the Science Student Centre, Faculty of Science Finance team, the Research Strategy Office and significant support from the Grants Management Office.

4. Research outputs and grant summary

The centre published 67 individual peer reviewed outputs in 2011 up substantially from 33 in 2010. The CCRC continues to publish papers primarily in the highest impact, high quality journals - those ranked A and A* under the former ERA scheme and those with high a Thomson ISI impact factor. See Appendix A for full list of publications.

Category	2010 Outputs (non weighted)	2011 Outputs (non weighted)
A1	1	1
B1	1	3
C1	28	54
E1	3	9

CCRC's success in attracting grant funding continued through 2011. In addition to research projects carrying on from previous years, ten newly awarded research projects commenced in 2011. Among the newly established projects are Dr Donna Green's NHMRC Project Grant which explores the health impacts of climate change on Indigenous Australians and three Discovery grants led by Dr Ben McNeil, Dr Alex Sen Gupta and Dr Gab Abramowitz. Dr Jason Evans was awarded two grants to make significant modelling contributions to the NSW Government's NSW and ACT Regional Climate Model (NARCLiM).

A full listing of research projects in progress in 2011 appears in Appendix B.

Below are some highlights of other awards, contributions and service throughout 2011

- The Centre's Executive Assistant Simone Purdon was awarded the John Chapman Memorial Grant to attend the Tertiary Education Management Conference in August.
- A number of CCRC staff are involved in the preparation of the IPCC's Fifth Assessment Report (AR5): Caroline Ummenhofer is a contributing author; Lisa Alexander and Steven Sherwood are chapter lead authors; and Andy Pitman is a Review Editor
- CCRC staff are very active on significant national and international committees, panels and associations: Steven Sherwood sat on the Bureau of Meteorology Training Program assessment panel; Steven Phipps is on the National Council for the Australian Meteorological and Oceanographic Society (AMOS) and was on the organizing committee for the 2012 AMOS conference which was led by Jason Evans; Gab Abramowitz is the only university-based representative on the CABLE Management Committee; Stephen Gray is the UNSW institutional Coordinator for the Association for Tertiary Education Management (ATEM)

- Katrin Meissner and Matthew England are members of ARC Selection Advisory Committees

5. Personnel

From 1 January 2011 Andy Pitman stepped down from his co-directorship of the Climate Change Research Centre to devote his attention to the ARC Centre of Excellence for Climate System Science. Steven Sherwood took on the role of Co-director through 2011, alongside Matthew England.

With the Establishment of the Centre of Excellence the Professional Staff team grew in order to manage both centres. Vila Co and Sarah King joined the CCRC while Stephen Gray and Simone Purdon transitioned to the CoE whilst also maintaining oversight of day-to-day CCRC operations. The CoE Media and Communications Manager Alvin Stone also provided valuable advice and input to the CCRC.

Laureate Professor Chris Turney joined the School of Biological, Earth and Environmental Sciences (BEES) in 2011. His research in the field of Palaeoclimate has natural synergies with the work of the Climate Change Research Centre. Chris and his research group are physically located in the Centre and play an integral role in the centre's activities and research.

The Centre hosted two Fullbright Fellows in 2011: Professor Tim Bralower from Penn State University and Marvin Alfaro who was a graduate from the University of Miami and had been accepted into a Postgraduate program at Columbia University.

A full list of personnel associated with the centre in 2011 appears in Appendix C.

6. Teaching and research supervision

The Climate Change Research Centre has a growing cohort of Postgraduate research students. There were 26 students enrolled in the centre's PhD, Master and Honours programs in 2011.

The CCRC continued its robust annual progress review scheme, led by PG coordinator Katrin Meissner. In addition to the stipulated annual reviews and presentations for all students, the centre runs half-yearly "informal" committee meetings for all enrolled students where progress can be discussed and students can raise any concerns they may have. Feedback from students regarding the centre's review process is overwhelmingly positive.

Staff from the CCRC were also actively involved in undergraduate teaching.

7. CCRC Management Committee and oversight

The CCRC is overseen by a Management Committee chaired by Professor Mark Hoffman (AD-R, Faculty of Science). The other members of the Management Committee are: Michael Ashley (Physics), Rob Brooks, (EERC/BEES), Mark Holzer

(Mathematics and Statistics) and Richard Stuetz (WRC/Civil and Environmental Engineering). The make up of the committee is a reflection of the collaborative ties the Centre has with different Schools and Centres across UNSW. The Management Committee primarily has a strategic advisory role. The Committee formally met on 1 May 2011. Input and feedback was also sought from board members during the preparation of material for the Centre's review in November.

Responsibility for day to day management and operation of the centre is shared between the co-directors, centre manager and staff with delegated portfolios (such as the PG Coordinator). The centre leadership team works closely and cooperatively with the Faculty of Science executive group and faculty committees.

Appendix A
2011 Publications

HERDC Category A1 – Books

Allison, I., Bindoff, N. L., Bindschadler, R. A., Cox, P. M., de Noblet, N., England, M. H., Francis, J. E.,, N. Gruber, Haywood, A. M., Karoly, D. J., Kaser, G., Le Quere, C., Lenton, T. M., Mann, M. E.,, B. I. McNeil, Pitman, A. J., Rahmstorf, S., Rignot, E., Schellnhuber, H. J., Schneider, S. H.,, and S. C. Sherwood, Somerville, R. C. J., Steffen, K., Steig, E. J., Visbeck, Martin and Weaver, A. J., 2011: *The Copenhagen Diagnosis: Updating the World on the Latest Climate Science*. Vol. 2, Elsevier.

HERDC Category B1 – Book Chapters

Ganachaud, A., A. R. Sen Gupta, J. Orrell, S. Wijffels, K. Ridgway, M. Hermer, C. Maes, C. Steinberg, A. Tribollet, B. Qiu, and J. Kruger, 2011: Observed and expected changes to the pacific ocean. *Vulnerability of Fisheries and Aquaculture in the Pacific to Climate Change*, J. Bell, J. Johnson, and A. Hobday, Eds., Secretariat of the Pacific Community.

Sen Gupta, A., 2011: The Pacific Community, fisheries, aquaculture and climate change: an introduction. *Vulnerability of Fisheries and Aquaculture in the Pacific to Climate change* J. Bell, J. Johnson, and A. Hobday, Eds., Secretariat of the Pacific Community

Turney, C., K. Richardson, W. Steffen, and D. Liverman, 2011: Going back to the future: Sea-level rise in the past. . *Climate Change: Global Risks, Challenges and Decisions*, Cambridge University Press, . 57-58.

HERDC Category C1 – Journal Articles

Ackerley, D., A. Lorrey, J. A. Renwick, S. J. Phipps, S. Wagner, S. Dean, J. Singarayer, P. Valdes, A. Abe-Ouchi, R. Ohgaito, and J. M. Jones, 2011: Using synoptic type analysis to understand New Zealand climate during the Mid-Holocene. *Climate of the Past Discussions*, **7,** 1301-1337.

Alexander, L. V., 2011: Extreme heat rooted in dry soils. *Nature Geoscience*, **4,** 12-13.

Alexander, L. V., X. L. Wang, and B. Trewin, 2011: Significant decline in storminess over south-east Australia since the late 19th century. *Australian Meteorological and Oceanographic Journal*, **61,** 23-30.

Allen, R. J. and S. C. Sherwood, 2011: The impact of natural versus anthropogenic aerosols on atmospheric circulation in the Community Atmosphere Model. *Climate Dynamics*, **36,** 1959-1978.

Arzel, O., M. H. England, and O. A. Saenko, 2011: The Impact of Wind Stress Feedback on the Stability of the Atlantic Meridional Overturning Circulation. *Journal of Climate*, **24,** 1965–1984.

Ashe, B., J. McAneney, and A. J. Pitman, 2011: Is the allocation of resources towards mitigation and response to fire in Australia optimal? *Journal of Risk Research* **14,** 381-393.

Avis, C. A., A. Weaver, and K. J. Meissner, 2011: Reduction in areal extent of high-latitude wetlands in response to permafrost thaw. *Nature Geoscience* **4,** 444-448.

Beaumont, L., A. J. Pitman, S. E. Perkins, N. E. Zimmerman, N. G. Yoccoz, and W. Thuiller, 2011: Impacts of climate change on the world's most exceptional ecoregions. *Proceedings of the National Academy of Sciences of the United States of America - Biological Sciences* **108,** 2306-2311.

Caesar, J., L. V. Alexander, B. Trewin, K. Tse-ring, L. Sorany, V. Vuniyayawa, N. Keosavang, A. Shimana, M. M. Htay, J. Karmacharya, D. A. Jayasinghearachchi, J. Sakkamart, E. Soares, L. T. Hung, L. T. Thuong, C. T. Hue, N. T. T. Dung, P. V. Hung, H. D. Cuong, N. M. Cuong, and S. Siribaha, 2011: Changes in temperature and precipitation extremes over the Indo-Pacific region from 1971 to 2005. *International Journal of Climatology*, **31,** 791-801.

Cai, W., T. Cowan, A. M. Sullivan, J. Ribbe, and G. Shi, 2011: Are anthropogenic aerosols responsible for the northwest Australia summer rainfall increase? A CMIP3 perspective and implications. *Journal of*

Climate, **24,** 2556 - 2564.

Chae, J. H., D. L. Wu, W. G. Read, and S. C. Sherwood, 2011: The role of tropical deep convective clouds on temperature, water vapor, and dehydration in the tropical tropopause layer (TTL). *Atmospheric Chemistry and Physics Discussions*, **10,** 8963-8994.

Ciasto, L. M., M. A. Alexander, C. Deser, and M. England, 2011: On the persistence of cold-season SST anomalies associated with the Annular Modes. *Journal of Climate* **24,** 2500-2515.

Ciasto, L. M. and M. H. England, 2011: Observed ENSO teleconnections to Southern Ocean SST anomalies diagnosed from a surface mixed layer heat budget. *Geophysical Research Letters*, **38,** L09701.

Clarke, H. C., P. L. Smith, and A. J. Pitman, 2011: Regional signatures of future fire weather over Eastern Australia from Global Climate Models. *International Journal of Wildland Fire*, **20,** 550-562.

Cowan, T. and W. Cai, 2011: The impact of Asian and non-Asian anthropogenic aerosols on 20th century Asian summer monsoon. *Geophysical Research Letters* **38,** 5pp.

D'Arrigo, R., N. Abram, C. C. Ummenhofer, J. Palmer, and M. Mudelsee, 2011: Reconstructed streamflow for Citarum River, Java, Indonesia: linkages to tropical climate dynamics. *Climate Dynamics*, **36,** 451-462.

D'Arrigo, R., J. Palmer, C. C. Ummenhofer, N. N. Kyaw, and P. Krusic, 2011: Three centuries of Myanmar monsoon climate variability inferred from teak tree rings. *Geophysical Research Letters* **38,** L24705.

d'Orgeville, M., M. H. England, and W. P. Sijp, 2011: Buffered versus non-buffered ocean carbon reservoir variations: Application to the sensitivity of atmospheric pCO2 to ocean circulation changes. *Geophysical Research Letters* **38**.

Damien B. Irving, Sarah E. Perkins, Josephine R. Brown, Alex Sen Gupta, Aurel F. Moise, Bradley F. Murphy, Les C. Muir, Robert A. Colman, Scott B. Power, Francois P. Delage, and J. N. Brown, 2011: Evaluating global climate models for the Pacific island region. *Climate Research* **49,** 169-187.

Donat, M. G., G. C. Leckebusch, S. Wild, and U. Ulbrich, 2011: Future changes in European winter storm losses and extreme wind speeds in multi-model GCM and RCM simulations. *Natural Hazards and Earth System Sciences*, **11,** 1351-1370.

Donat, M. G., T. Pardowitz, G. C. Leckebusch, U. Ulbrich, and O. Burghoff, 2011: High-resolution refinement of a storm loss model and estimation of return periods of loss-intensive storms over Germany. *Natural Hazards Earth System Science*, **11,** 2821-2833.

Donat, M. G., D. Renggli, S. Wild, L. V. Alexander, G. C. Leckebusch, and U. Ulbrich, 2011: Reanalysis suggests long-term upward trends in European storminess since 1871. *Geophysical Research Letters*, **38,** L14703.

Dufour, C. O., J. Le Sommer, T. Penduff, B. Barnier, and M. H. England, 2011: Structure and Causes of the Pulsation Mode in the Antarctic Circumpolar Current South of Australia. *Journal of Physical Oceanography*, **41,** 253–268.

Evans, J. P. and A. Alsamawi, 2011: The Importance of the Zagros Mountains Barrier Jet to Future Precipitation in the Fertile Crescent. *The Open Atmospheric Science Journal,*, **5,** 87-95.

Evans, J. P., M. Ekström, and F. Ji, 2011: Evaluating the performance of a WRF physics ensemble over South-East Australia. *Climate Dynamics*.

Evans, J. P., A. J. Pitman, and F. T. Cruz, 2011: Coupled atmospheric and land surface dynamics over southeast Australia: a review, analysis and identification of future research priorities. *International Journal of Climatology*, **31,** 1758-1772.

Garcia-Garcia, D., C. C. Ummenhofer, and V. Zlotnicki, 2011: Australian water mass variations from GRACE data linked to Indo-Pacific climate variability. *Remote Sensing of Environment*, **115,** 2175-2183.

Green, D. L., 2011: What legal recourse do non-state Islands have to obtain resources to adapt to climate change? *Macquarie Journal of International and Comparative Environmental Law* **7,** 69-91.

Hein, A. S., C. J. Fogwill, D. E. Sugden, and S. Xu, 2011: Glacial/interglacial ice-stream stability in the Weddell Sea embayment, Antarctica. *Earth and Planetary Science Letters*, **307(1-2),** 211-221.

Hein, A. S., C. J. Fogwill, D. E. Sugden, and S. Xu, 2011: Glacial/interglacial ice sheet stability in the Weddell Sea embayment, Antarctica. *Earth and Planetary Science Letters*, **307,** 211-221.

Hill, K., A. Taschetto, and M. England, 2011: Sensitivity of South American summer rainfall to tropical Pacific Ocean SST anomalies. *Geophysical Research Letters* **38,** 6pp.

Hogg, A., J. Palmer, G. Boswijk, and C. Turney, 2011: High-precision radiocarbon measurements of the tree-ring dated wood from New Zealand: 200 BC-AD 950. *Radiocarbon*, **53,** 529-542.

Johnson, F., S. Westra, A. Sharma, and A. J. Pitman, 2011: An Assessment of GCM Skill in Simulating Persistence across Multiple Time Scales. *Journal of Climate*, **24,** 3609-3623.

Kidston, J., A. S. Taschetto, D. W. J. Thompson, and M. H. England, 2011: The influence of Southern Hemisphere sea-ice extent on the latitude of the mid-latitude jet stream. *Geophysical Research Letters*, **38,** L15804.

Kvale, K. F., K. J. Meissner, M. d'Orgeville, R. J. Matear, B. I. McNeil, and M. H. England, 2011: The combined impact of CO2-dependent parameterisations of Redfield and Rain ratios on ocean carbonate saturation. *Biogeosciences Discussions* **8,** 6265.

Liu, Y. Y., R. A. M. De Jeu, M. F. McCabe, J. P. Evans, and A. I. J. M. van Dijk, 2011: Global long-term passive microwave satellite-based retrievals of vegetation optical depth. *Geophysical Research Letters* **38**.

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Mao, J., S. J. Phipps, A. J. Pitman, Y. P. Wang, G. Abramowitz, and B. Pak, 2011: The CSIRO Mk3L climate system model v1.0 coupled to the CABLE land surface scheme v1.4b: Evaluation of the control climatology. *Geoscientific Model Development* **4,** 1115-1131.

Mao, J., A. J. Pitman, S. J. Phipps, G. Abramowitz, and Y.-P. Wang, 2011: Global and regional coupled climate sensitivity to the parameterization of rainfall interception. *Climate Dynamics*, **37,** 171-186.

McNeil, B. I., C. Sweeney, and J. A. E. Gibson, 2011: Natural seasonal variability of aragonite saturation state within two Antarctic coastal ocean sites. *Antarctic Science*, **23,** 1-2.

Montenegro, A., P. Spence, K. J. Meissner, M. Eby, M. J. Melchin, and S. T. Johnston, 2011: Climate simulations of the Permian-Triassic boundary: Ocean acidification and the extinction event. *Paleoceanography*, **26**.

Phipps, S. J., L. D. Rotstayn, H. B. Gordon, J. L. Roberts, A. C. Hirst, and W. F. Budd, 2011: The CSIRO Mk3L climate system model version 1.0 - Part 1: Description and evaluation. *Geoscientific Model Development*, **4,** 483-509.

Robinson, F. J., S. C. Sherwood, D. Gerstle, C. Liu, and D. J. Kirshbaum, 2011: Exploring the land-ocean contrast in convective vigor using islands. *Journal of the Atmospheric Science*, **68,** 602-618.

Saenko, O. A., X.-Y. Yang, M. H. England, and W. G. Lee, 2011: Subduction and Transport in the Indian and Pacific Oceans in a 2 X CO2 Climate. *Journal of Climate*, **24,** 1821-1838.

Santoso, A., W. Cai, M. H. England, and S. J. Phipps, 2011: The role of the Indonesian Throughflow on ENSO dynamics in a coupled climate model. *Journal of Climate*, **24,** 585-601.

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Azcurra, C. S., C. E. Hughes, S. Parkes, S. E. Hollins, J. J. Gibson, M. F. McCabe, and J. P. Evans, 2011: A comparison between direct and pan-derived measurements of the isotopic composition of atmospheric waters. *MODSIM2011 International Congress on Modelling and Simulation.*

Bormann, K., J. P. Evans, and M. F. McCabe, 2011: A New Approach to Snow Detection in Australia using MODIS & Landsat TM. *34th International Symposium on Remote Sensing of Environment*

Ershadi, A., M. F. McCabe, J. P. Evans, and J. P. Walker, 2011: Evaluation of energy balance, combination, and complementary schemes for estimation of evaporation. *Hydro-climatology - Variability and Change Symposium, part of the 25th International Union of Geodesy and Geophysics General* International Association of Hydrological Sciences 52-56.

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Baker, A., C. Azcurra, C. Bradley, M. F. McCabe, I. J. Fairchild, and J. P. Evans, 2011: Forward modelling of the speleothem oxygen isotope paleoclimate proxy. *XVIII International Union for Quaternary Research Congress.*

Cai, Y., J. Strauss, S. Parkes, M. F. McCabe, J. P. Evans, and A. D. Griffiths, 2011: Stable water isotopes in land surface modeling: comparison with in-situ isotopic measurements. *11th Australasian Environmental Isotope Conference & 4th Australasian Hydrogeology Research Conference*

Ershadi, A., M. F. McCabe, and J. P. Evans, 2011: Issues of scale in surface heat flux retrieval using multi-resolution, multi-temporal satellite imagery. *XXV IUGG General Assembly; Earth on the Edge: Science for a Sustainable Planet*

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Evans, J. P., 2011: Regional scale projections - the NARCLIM Project. *Climate 11 - Impacts and adaptations*.

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Evans, J. P., M. Ekstrom, and F. J. . 2011: A physical ensemble investigation of the 8 July 2007 Newcastle storm. *Joint conference on Extreme Weather,*.

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Liu, Y. Y., M. F. McCabe, R. A. M. De Jeu, and J. P. Evans, 2011: Discriminating between climate and human-induced land degradation in Mongolia. *34th International Symposium on Remote Sensing of Environment*

Liu, Y. Y., R. A. M. De Jeu, M. F. McCabe, J. P. Evans, and A. I. J. M. van Dijk, 2011: Comparing Optical and Microwave Remote Sensing-based Vegetation Density over Mongolia for 1988-2006. *34th International Symposium on Remote Sensing of Environment* Sydney, Australia.

HERDC Category R1- Reports

Collins, D., A. Sen Gupta, S. Power, K. Braganza, J. N. Brown, J. R. Brown, W. Cai, J. Church, R. Colman, A. Dowdy, P. Durack, D. Jones, Y. Kuchinke, Y. Kuleshov, A. Lorrey, C. Lucas, S. McGree, K. McInnes, A. Moise, L. Muir, B. Murphy, S. J. Phipps, I. Smith, B. Tilbrook, and N. White, 2011: Chapter 3: Observed Climate Variability and Trends. in Climate Change in the Pacific: Scientific Assessment and New Research 51-77 pp.

Appendix B

CCRC Research Grants Active in 2011

Investigators	Alexander, L. Karoly, D. Vose, R. Zwiers, F.
GrantScheme	ARC Linkage Grants (ARC portion)
GrantTitle	Transforming our research capacity in the analysis of climate extremes
Duration	2010 -- 2013

Investigators	Alexander, L. Karoly, D. Vose, R. Zwiers, F.
GrantScheme	Linkage Grants (Industry portion)
GrantTitle	Transforming our research capacity in the analysis of climate extremes
Duration	2010 -- 2013

Investigators	England, M. Evans, J. Pitman, A. Sherwood, S.
GrantScheme	ARC Super Science
GrantTitle	Precipitation-groundwater interactions over eastern Australia: climate change impacts at multiple scales
Duration	2010 -- 2013

Investigators	England, M.
GrantScheme	ARC Laureate Fellowships
GrantTitle	Future risks associated with ocean surface warming: impacts on climate, rainfall, carbon and circulation
Duration	2010 -- 2015

Investigators	England, M.
GrantScheme	DCCEE Contract Research
GrantTitle	Science Advisory Panel for the Climate Commission
Duration	2011 -- 2011

Investigators	Evans, J.
GrantScheme	ARC ARF
GrantTitle	Vulnerability of the Murray Darling basin hydrometeorology to human modification
Duration	2007 -- 2011

Appendix B

CCRC Research Grants Active in 2011

Investigators	Evans, J.
GrantScheme	Government Grants (Non-Cat 1)
GrantTitle	NARCLiM Sydney. NSW Office of Environment and Heritage
Duration	2011 -- 2013

Investigators	Evans, J.
GrantScheme	Government Grants (Non-Cat 1)
GrantTitle	NARCLiM (NSW and ACT Regional Climate Model)
Duration	2011 -- 2013

Investigators	Green, D. Bambrick, H. Alexander, L. Pitman, A.
GrantScheme	NHMRC Project Grant
GrantTitle	Health impacts of climate change on Indigenous Australians: identifying climate thresholds to enable the development of informed adaptation strategies
Duration	2011 -- 2013

Investigators	Macadam, I. Pitman, A.
GrantScheme	CSIRO Marine and Atmospheric Rsch Top up
GrantTitle	Improving projections of future regional climate conditions
Duration	2009 -- 2012

Investigators	McGregor, H. (U. Woodroffe, C (U. Phipps, S.
GrantScheme	ARC Discovery Grants
GrantTitle	Untangling the links between El Nino and the changing global climate
Duration	2010 -- 2012

Investigators	McNeil, B. Meissner, K. Matear, R
GrantScheme	ARC Discovery Grants
GrantTitle	Examining the vulnerability of ocean carbon biogeochemistry in a high CO_2 world
Duration	2011 -- 2013

Appendix B
CCRC Research Grants Active in 2011

Investigators	McNeil, B.
GrantScheme	ARC QEII Fellowship
GrantTitle	An investigation into oceanic $C0_2$ variability and its influence on atmospheric $C0_2$ concentrations
Duration	2008 -- 2012

Investigators	Meissner, K.
GrantScheme	ARC Future Fellowships
GrantTitle	What caused abrupt climate change events in the past and what can they tell us about the future?
Duration	2010 -- 2014

Investigators	Pitman, A. Abramowitz, G. Leunig, R.
GrantScheme	ARC Discovery Grants
GrantTitle	Are proposed land-based sinks for greenhouse gases resilient to climate change and natural variability?
Duration	2011 -- 2013

Investigators	Pitman, A.
GrantScheme	Government Grants (Non-Cat 1)
GrantTitle	Department of Climate Change and Energy Efficieny: Science Advisory Panel for the Climate Commission
Duration	2011 -- 2011

Investigators	Pitman, A.
GrantScheme	NSW Environmental Trust
GrantTitle	NSW Environmental Trust Research Program: Dynamically downscaled climate projections for the Eastern Seaboard
Duration	2011 -- 2013

Investigators	Sen Gupta, A. England, M. Karumuri, A Raghavan, K
GrantScheme	ARC Discovery Grants
GrantTitle	The changing relationship between the South Asian and Australian Monsoon in a warming world
Duration	2011 -- 2013

Appendix B

CCRC Research Grants Active in 2011

Investigators	Shaw, E. McNeil, B.
GrantScheme	CSIRO Flagship Scholarships
GrantTitle	Assessing the risk of ocean acidification in the Australian Region
Duration	2009 -- 2011

Investigators	Sherwood, S.
GrantScheme	Goldstar
GrantTitle	Are global circulation changes altering Australian rainfall?
Duration	2011 -- 2011

Investigators	Sijp, W.
GrantScheme	ARC ARF
GrantTitle	The equable climate conundrum: the role of the global ocean in multiple climate regimes
Duration	2010 -- 2014

Investigators	Tascheto, A.
GrantScheme	ARC Discovery Grants
GrantTitle	Modes of Pacific Ocean variability and their relationship to regional Southern Hemisphere climate
Duration	2010 -- 2013

Investigators	Trevena, J. England, M.
GrantScheme	CSIRO OCE Postgraduate Studentship
GrantTitle	Australian Rainfall Teleconnection
Duration	2009 -- 2011

Investigators	Ummenhofer, C.
GrantScheme	AAS Australia-Germany Research Mobility Call
GrantTitle	Characteristics and evolution of Indian Ocean Dipole events in high-resolution
Duration	2010 -- 2011

Appendix C
Centre Personnel 2011

There were no resignations or retirements among full time, permanent academic staff in 2011.

Professors

Prof Matthew England (Australian Laureate Fellow, CCRC Co-Director)
Prof Andy Pitman (CoECSS Director)
Prof Steven Sherwood (CCRC Co-Director)
Prof Chris Turney (ARC Laureate Fellow, Adjunct)

Academic Staff and Research Fellows

Dr Gab Abramowitz
Dr Lisa Alexander
Dr Jason Evans (ARC Australian Research Fellow)
Dr Donna Green
Dr Joseph Kidston
Dr Ben McNeil (ARC QEII Research Fellow)
Dr Katrin Meissner (ARC Future Fellow)
Dr Alex Sen Gupta

Post Doctoral Research Fellows, Research Associates and Research Assistants

Laura Ciasto
Mark Decker
Eden Duthie
Dr Chris Fogwill (Adjunct)
Nicholas Jourdain
Shayne McGregor
Benedicte Pasquer
Agus Santoso
Paul Spence
Andrea Taschetto
Erik van Sebille
Kirien Whan
Qinglong You
Charlotte Cook (Adjunct)
Markus Donat
Dr Jean-Francois Exbrayat
James Gilmore
Yi Liu
Xianhong Meng
Steven Phipps
Willem Sijp
Yoichi Takayama
Caroline Ummenhofer
Leanne Webb
Hongang Yang
Jan Zika

Postgraduate Research Students (and their primary supervisor)

Francia Avila (Pitman)
Kathryn Bormann (Evans)
Timothy Cowan (England)
David Fuchs (CSE, co-sup Sherwood)
David Hutchinson (England)
Andrew King (Alexander)
Timothy Leslie (England)
Ian Macadam (Pitman)
Claire O'Neill
Michael Bates (England)
Hamish Clarke (Pitman)
Annika Dean (Green)
Willem Huiskamp (Honours, Meissner)
Agata Imielska (Alexander)
Karin Kvale (Meissner)
Yue Li (MS, Sen Gupta)
Penny Maher (Sherwood)
Clinton Rakich (England)

Nina Ridder (England)
Seyed Shahrokhi (Evans)
Alejandro Silva Brito (MS, England)
Jessica Trevena (MS, England)
Tristan Sasse (McNeil)
Emily Shaw (McNeil)
Graham Simpkins (England)
Bevan Warren (Green)

Professional Staff

Vilia Co (Finance Officer)
Stephen Gray (Executive Officer. CoECSS Manager Jul-Dec)
Sarah King (Administrative Assistant)
Simone Purdon (Executive Assistant, CoECSS Jul-DEC)
Alvin Stone (Media and Communications Manager, CoECSS)

Visiting Fellows

Prof Tim Bralower
Dr William Capehart
Marc d'Orgeville
Prof Lance Leslie
Dr Michael Molitor
Dr Oleg Saenko
Dr Milton Speer
A. Prof David Thompson

Affiliated UNSW staff

Prof Mike Banner
A/Prof Michael Box
Dr Gail Box
A/Prof Dale Dominey-Howes
Dr Gary Froyland
Dr Ben Newell
Dr Scott Mooney
Dr Angela Moles
Dr Jane McAdam
Prof Frank Muller
Dr Robin Robertson
A/Prof Ashish Sharma
Dr Scott Sisson