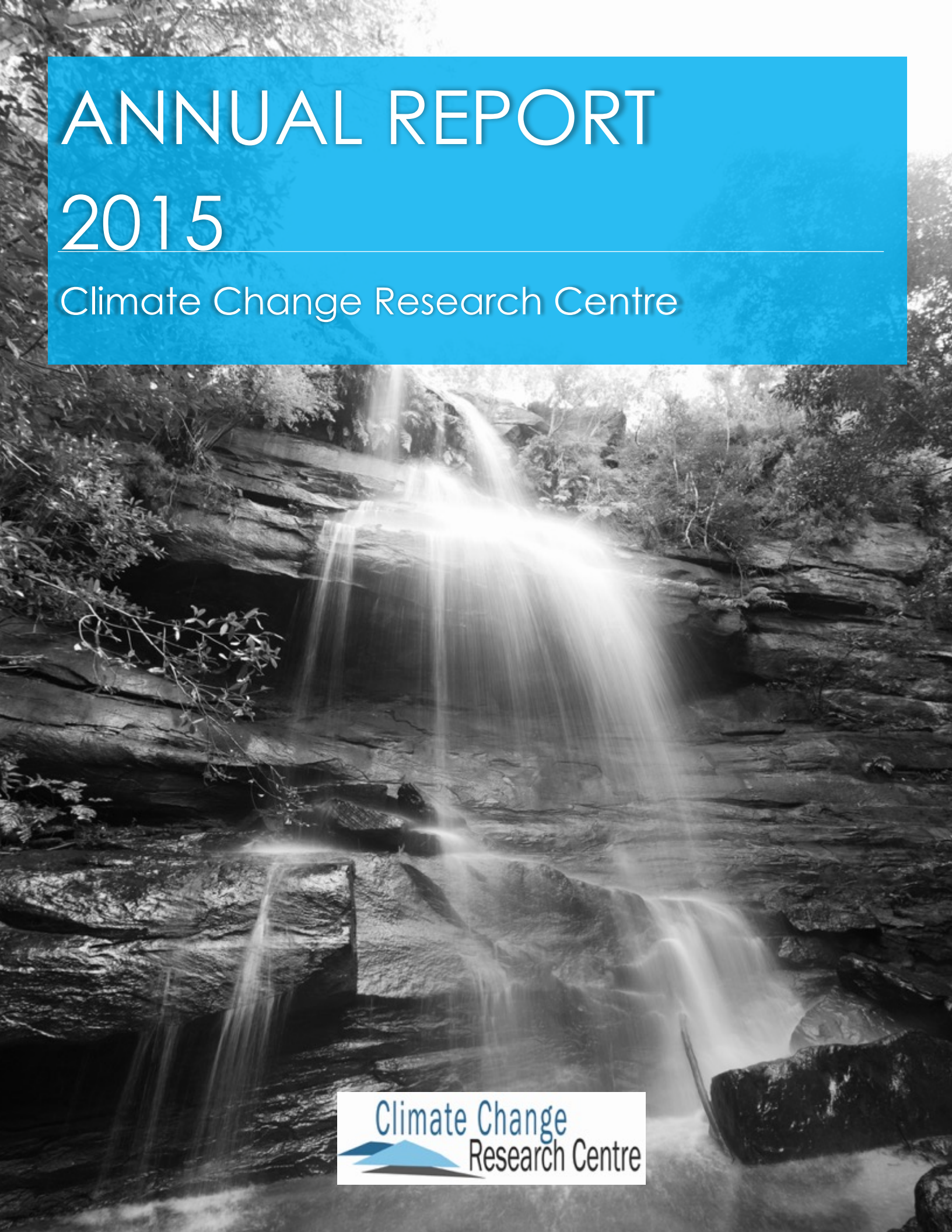
ANNUAL REPORT 2015

Climate Change Research Centre



ANNUAL REPORT 2015

Climate Change Research Centre

Our Vision

The CCRC strives to make fundamental contributions to our understanding of the Earth's climate system and be recognised as one of the world's top research programs in physical and biophysical climate sciences.

Climate Change Research Centre

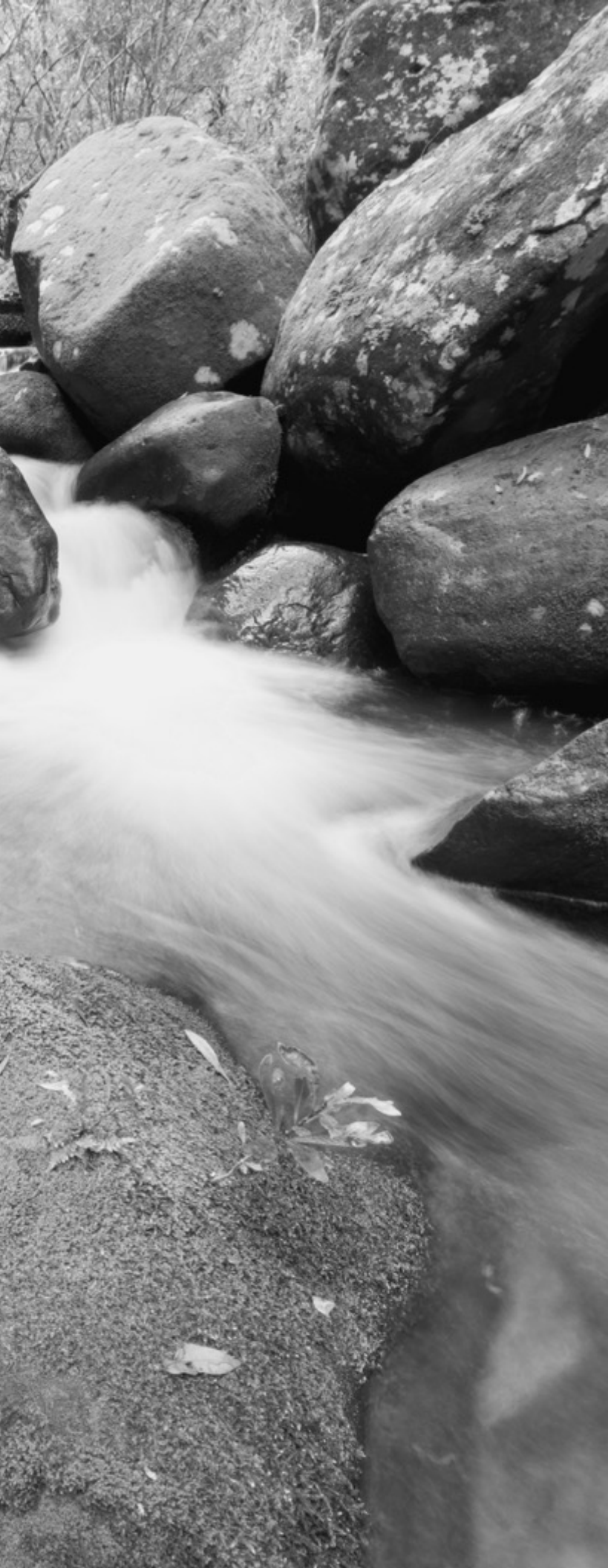


Table of Contents

Centre Vision	2
Table of Contents	3
Director's Report	4
CCRC at a Glance	5
Personnel	6
Research outputs Centre Impact & Grant Summary	7
Snapshot 1 – Research	8
Research supervision & Teaching	9
Snapshot 2 – High Impact Science	10
Statement of Financial Performance	11
Signed Statement of Financial Performance	12
Statement of In-kind contributions	13
Management & Oversight	14
Appendix A – 2015 Publications	15
Active Research Projects	20
Appendix C – Centre Personnel	24
Appendix D – Media & Publicity	26

Director's Report

It has been a busy year, kicked off by the CCRC hosting several international workshops early in 2015 including one on Data for Climate Extremes, hosted by Lisa Alexander; Heat Waves, hosted by Sarah Perkins; El-Nino, hosted by Agus Santoso; and Holocene Climate hosted by Steven Phipps, plus workshops for Australian students and ECRs on scientific writing and student well-being. The CCRC also hosted A/Prof. Paul O'Gorman from MIT and Prof. Stefan Rahmstorf from Potsdam University for six-month visits, plus the usual stream of shorter visits by eminent climate scientists from around the world.

One exciting event of the year was an extended visit to the CCRC in April by the new UNSW VC and President, Professor Ian Jacobs. Prof. Jacobs has identified climate change as a key area of personal interest, and the university selected this area as the first of its new Grand Challenges.

In 2015 staff continued to win prestigious awards. Centre Director Steven Sherwood was awarded a Laureate Fellowship by the ARC, one of 15 nationally across all fields of research. Andy Pitman was elected as a Fellow of the American Meteorological Society, and Andrea Taschetto received the Dorothy Hill Award from the Australian Academy of Science. Lisa Alexander was promoted to Associate Professor. The CCRC is also slowly populating other Australian universities with climate scientists by adding to their academic staff: Jatin Kala took up a faculty appointment at Murdoch University, Steven Phipps joined University of Tasmania, Shayne McGregor moved to Monash, and farther afield, Erik van Sebille joined Imperial College London. Mitigating these losses, three new DECRA Fellows commenced during 2015: Markus Donat, Laurie Menviel and Paul Spence.

In 2015 the centre attracted 2.2m in external research income, including participation in the new NESP (National Environmental Science Program) hub for Earth Systems and Climate Change. Our publications increased by 15% from the previous year (a total of 139 papers), including 10 in Nature family journals; these described key findings on western boundary currents, future ice losses, global precipitation changes and other topics. We hosted the editor of Nature Climate Change for a day to give a seminar on publishing in high-profile journals.

Importantly, the CCRC/UNSW bid to host a renewed ARC Centre of Excellence in the climate science area passed to the full proposal stage; a full proposal was duly submitted late in the year, with final results to be announced around mid-2016 for what will undoubtedly be a highly competitive round. The existing UNSW-hosted ARC Centre, which runs through mid-2018, continues to be highly successful and was rated by Nature in 2015 as one of the most collaborative research groups in the world according to a new analysis.

Professor Steven Sherwood

CCRC at a Glance

UNSW CCRC is a multi-disciplinary research group comprising one of the largest university research facilities of its kind in Australia.CCRC houses research expertise in the key areas of Earth's climate: atmospheric, oceanic and terrestrial processes. We apply basic scientific principles to pressing questions on climate dynamics, global climate change, and extremes of weather and climate.

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. The Centre and its staff now reside in the School of Biological Earth and Environmental Science (BEES). CCRC also hosts the UNSW lead node of the Australian Research Council Centre of Excellence for Climate System Science (ARCCSS).

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 Earth and Environmental 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.

2015 saw the CCRC continue its successful track record in attracting grant funding and producing and publishing excellent, world-class research.

Key Achievements

- 2.2 million external research revenue
- 139 peer reviewed publications, an increase of 15% over 2015 figures. The vast majority of our publications are in top, highly ranked journals
- High-profile publications like Ph.D. student K. Alexander, et al., 'Sudden spreading of corrosive bottom water during the Palaeocene-Eocene Thermal Maximum' in Nature Geosciences
- CCRC Staff extensively quoted and interviewed in the media with 219 articles, interviews, appearances or quotes
- 17 Contributions to *The Conversations (Op Eds, articles, quotes)*
- 39 PhD Students with 35 supervised in the Centre
- 5 PhD submissions in 2015
- 4 Honours submissions in 2015

Personnel Highlights

- Professor Steven Sherwood awarded an ARC Laureate Fellowship commencing in 2015
- Professor Andy Pitman was accepted as a Fellow of the American Meteorological Society. Andy was also the recipient of the Taylor Fry Silver Prize from the Actuaries Institute
- Dr Markus Donat, Dr Laurie Menviel & Dr Paul Spence took up ARC DECRA Fellowships commencing in 2015
- Dr Andrea Taschetto was awarded as the winner of the 2016 AAS Dorothy Hill Award for Outstanding Research in Earth Sciences
- Dr Lisa Alexander was promoted to Associate Professor early 2015
- CCRC welcomed 6 new fixed term researchers
- CCRC hosted international workshops WCRP Grand Challenge on Extremes Data 2015 (Lisa Alexander) & 2015 ENSO Extremes & Diversity (Agus Santoso)
- Dr Sarah Perkins Kirkpatrick received the ARCCSS Director's Prize in 2015
- Student Peter Gibson was honoured for the best MSc thesis in New Zealand 2014/2015 by the New Zealand Geographical Society

2015 Personnel

The Climate Change Research Centre has a well established culture of excellence, collegiality and collaboration both within and across traditional disciplinary boundaries. We are strongly committed to effective professional development of our mid and early career researchers. The centre is comprised of a core cohort of 10 permanent faculty, each of whom lead research groups comprised of research associates and HDR students.

Continuing staff appointed to the CCRC included two Laureate Fellows (England & Sherwood), two ARC Future Fellows (Meissner and Evans) and 6 ARC DECRA Fellows.

The CCRC also houses Chris Turney, a Laureate Fellow appointed to BEES. Chris' research group includes Future Fellow Dr. Chris Fogwill.

The Centre continued to attract distinguished visitors on sabbatical stays including UNSW Faculty of Science Visiting Research Fellow Professor Stefan Rahmstof (Potsdam University) and A/Professor Paul O'Gorman (MIT) who both spent several months working closely with CCRC staff.

The Centre is also a sought-out destination for international researchers making shorter visits. We welcomed around 20 research visitors to the CCRC in as well as hosting many seminar speakers from around Australia and overseas; thus demonstrating that the Climate Change Research Centre has critical momentum that enhances UNSW's reputation at the very forefront of Climate Science in Australia.

A full list of personnel associated with the Centre in 2015 appears in Appendix C.

Research Outputs, Centre impact & Grant Summary

The CCRC published 139 individual peer reviewed outputs in 2015 which included a book chapter (Green). 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 a high Thomson ISI impact factor. See Appendix A for a full list of publications.

The CCRC has also been the headquarters for the ARC Centre of Excellence for Climate System Science (ARCCSS) since 1 July 2011. In addition to ARCCSS Director Andy Pitman, 4 CCRC academic staff are Chief Investigators in the Centre of Excellence - Alexander, England, Hart and Sherwood. A further 14 CCRC staff were Associate Investigators in 2015. (Abramowitz, Donat, Evans, Green, Liu, Maharaj, McGregor, Meissner, Menviel, Perkins, Santoso, Sen Gupta, Stewart and 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 groups.

UNSW and the CCRC particularly benefit from access to supercomputing resources at NCI as well as increased collaboration with overseas partners via the linkages formally established by the Centre of Excellence. The CCRC graduate student experience is further enhanced by ARCCSS activities such as winter schools, writing workshops, visits to Australian partner universities and opportunities for travel to overseas labs, summer schools and workshops and the mentorship and pastoral care provided by both the CCRC Postgraduate Coordinator (Dr Gab Abramowitz) and the ARRCCS Graduate Director, Dr Melissa Hart.

The Centre continued from strength to strength in 2015 with three highly talented post doctoral researchers commencing DECRAs: Dr Laurie Menviel, Dr Paul Spence and Dr Markus Donat. The research presence of the CCRC and ARCCSS on campus continues to be promoted with Jason Evans continuing as the Centre's representative to the Science Faculty Research Management Committee (in addition to his role as IT coordinator).

Hamish Clarke, Annika Dean, David Hutchinson and Annette Hirsch submitted PhD theses and were all subsequently awarded their doctorates. We wish them well in their future endeavours in the postdoctoral research positions they secured in Australia and overseas

2015 Impact

- Two papers published in Nature (Sherwood and Sen Gupta)
- 13 papers published in Nature family journals.
- 1 paper published in Science
- 7 papers in Geophysical Research Letters
- 12 papers published in Journal of Climate
- Significant media coverage of Centre research accomplishments in 2015 including:
  - 16 TV appearances/interviews
  - 29 Radio appearances/interviews
  - Over 100 print and online articles, interviews and op eds
  - Professor Andy Pitman accepted as fellow of the American Meteorological Society. Andy was also the recipient of the Actuaries Institute's Taylor Fry Silver Prize
  - Dr Andrea Taschetto awarded the AAS Dorothy Hill Award for Earth Sciences
  - Student Mathew Lipson received the AMOS Award for Academic Excellence

Snapshot 1 – Research:
Solution to corrosive ocean mystery reveals our future climate

Around 55 million years ago, an abrupt global warming event triggered a highly corrosive deep-water current to flow through the North Atlantic Ocean. The origin of this corrosive water has puzzled scientists for a decade.

In 2015 researchers at The Climate Change Research Centre have discovered this current and how it formed. The findings, published in Nature Geoscience, also have profound implications for the sensitivity of our current climate to carbon dioxide emissions.

The team consisting of CCRCs PhD student and lead author Kaitlin Alexander, and A/Prof Katrin Meissner, explored the acidification of the ocean that occurred during a period known as the Paleocene Eocene Thermal Maximum (PETM) when the Earth warmed 5°C in response to a rapid rise in CO_2 in the atmosphere and one of the largest mass extinctions occurred in the deep ocean.

This period is considered to closely resemble the scenario of global warming we are experiencing today.

There has been a longstanding mystery about why ocean acidification caused by rising atmospheric CO_2 during the PETM was so much worse in the Atlantic compared to the rest of the world's oceans. The research suggests the shape of the ocean basins and changes to ocean currents played a key role in this difference. Understanding how this event occurred may help other researchers to better estimate the sensitivity of our climate to increasing CO_2

Today we are emitting CO_2 into the atmosphere ten times faster than the rate of natural CO2 emissions during the PETM. If we continue as we are, we will see the same temperature increase that took a few thousand years during the PETM occur in just a few hundred years. This is an order of magnitude faster and likely to have profound impacts on the climate system.

Alexander, K., Meissner, K.J. and T.J. Bralower, 2015: Sudden spreading of corrosive bottom water during the Paleocene-Eocene Thermal Maximum. *Nature Geoscience*, 8, 458-461

Research Supervision & Teaching

The Climate Change Research Centre has a growing cohort of postgraduate research students. There were 38 students enrolled in the Centre's PhD program, and 5 honours students supervised in 2015. The CCRC has benefited greatly from the ARCCSS summer scholar scheme which provides funding for undergraduate students to undertake small research projects, supervised by an ECR over the summer. Many of our recent honours and PhD applicants have been previous summer scholars.

The CCRC continued its robust annual progress review scheme, led by the Centre's Post Graduate Coordinator, Dr Gab Abramowitz. 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. The Centre also invites a nominated student representative to join its bi-monthly staff meetings.

CCRC continued to align its postgraduate review schedule with that of BEES. Dr Alex Sen Gupta continues as the PhD completion coordinator for the whole School as well as the BEES representative on the HDR Committee. Dr Abramowitz continues to look after the recruitment and progression of PhD students within the CCRC. Dr Donna Green served on a BEES honours committee in 2015 and continues to look after the CCRC Honours student cohort as well as the sole nominated BEES staff member on the Science Faculty Board.

Courses run by CCRC staff are CLIM1001 – Introduction to Climate Change, MSCI0501 – The Marine Environment (with the School of BEES), CLIM2001 – Fundamentals of Atmospheric Science (with the School of Physics) GEOS2241 – Peak Carbon: Climate Change and Energy Policy and CLIM3001 – Climate Systems Science.

CCRC Staff also regularly give guest lectures in courses taught by a number of other schools.

5 PhD students and 4 honours students submitted 2015.

- Hamish Clarke. PhD (*Supervised by Andy Pitman)*
- Annika Dean. PhD (*Supervised by Donna Green)*
- Nicholas Grosfeld. Honours *(Supervised by Shayne McGregor)*
- Mia Gross. Honours (*Supervised by Lisa Alexander)*
- Matthew Hale. Honours (*Supervised by Gab Abramowitz)*
- Annette Hirsch. PhD (*Supervised by Andy Pitman)*
- Keith Huang. Honours (*Supervised by Angela Maharaj)*
- David Hutchinson. PhD (*Supervised by Matt England)*
- Jessica Roe. PhD *(Supervised by Chris Turney)*

Snapshot 2 – High Impact Science: *Climate scientists confirm elusive tropospheric hot spot*

CCRC researchers have published results in Environmental Research Letters confirming strong warming in the upper troposphere, known colloquially as the tropospheric hotspot. The hotspot has been long expected as part of global warming theory and appears in many global climate models.

The inability to detect this hotspot previously has been used by those who doubt man-made global warming to suggest climate change is not occurring as a result of increasing carbon dioxide emissions.

Lead author Professor Steve Sherwood stated that "Using more recent data and better analysis methods we have been able to re-examine the global weather balloon network, known as radiosondes, and have found clear indications of warming in the upper troposphere. We were able to do this by producing a publicly available temperature and wind data set of the upper troposphere extending from 1958-2012, so it is there for anyone to see and deduced from the data what natural weather and climate variations look like, then found anomalies in the data that looked more like sudden one-off shifts from these natural variations and removed them. All of this was done using a well established procedure developed by statisticians in 1977".

The results show that even though there has been a slowdown in the warming of the global average temperatures on the surface of the Earth, the warming has continued strongly throughout the troposphere except for a very thin layer at around 14-15km above the surface of the Earth where it has warmed slightly less.

As well as confirming the tropospheric hotspot, the researchers also found a 10% increase in winds over the Southern Ocean. The character of this increase suggests it may be the result of ozone depletion.

S. C. Sherwood and N. Nishant 2015: Atmospheric changes through 2012 as shown by iteratively homogenized radiosonde temperature and wind data (IUKv2) *Environmental Research Letters* 10 054007-054007

Statement of Financial Performance

Summary of statement of financial performance

The Climate Change Research Centre's total revenue for 2015 was $5,456,030. $2.2 mil of this was from external income sources. The remainder was from a combination of Faculty and Central/Strategic funds, including generous co-support associated with Matthew England's Laureate Fellowship, LIEF and MREII grants.

Of the $2,205,607 research revenue earned in 2015, $1.77m (80%) was Category 1 income.

This research income figure does not include the additional funding allocated to the ARC Centre of Excellence for Climate System Science from the ARC, Partner Organisations and UNSW strategic funds.

At 80% of total expenditure, people costs account for by far the largest portion of the centre's expenditure across all fund types.

Total 2015 expenditure was $5,372,418. The CCRC's 2015 opening carry over was $1.38m. The closing carry forward was a surplus of $1.46m.

Full countersigned financial statement follows.

Climate Change Research Centre - CCRC

Statement of Financial Performance
for the Year Ended 31 December 2015

	Notes	2015 $	2014 $
Funds:			
Research Funds		**2,205,607**	**1,927,437**
ARC Research Funds	1	1,770,096	1,575,978
NHMRC Research Funds		-	5,000
Other External Research Funds		414,425	364,546
Fundraising Contributions	2	12,947	219
Faculty Contributions	3	**2,234,536**	**2,191,039**
UNSW Contributions		**1,015,887**	**884,632**
Strategic Funds	4	569,186	384,375
MREII		-	170,689
Super Science & LIEF UNSW Contributions		217,660	150,000
EB Gap	5	229,041	179,568
Total Funds:		5,456,030	5,003,108
Costs:			
People Costs	6	4,292,357	4,620,549
Scholarship Stipends		332,654	321,821
Travel	7	375,056	372,937
Equipment		74,592	237,396
Other Non People Costs		297,759	331,197
Total Costs:		5,372,418	5,883,899
Operating result		83,612	- 880,791
Opening Balance: Surplus(Deficit) from Prior Year		1,375,808	2,256,599
Correction of Prior Year Opening Balance		-	-
Adjusted Opening Balance		-	-
Closing Balance: Surplus(Deficit)	8	1,459,420	1,375,808

Notes to the Statement of Financial Performance

1 2015 Category 1 income was $1.8m
2 Carry forward balance from the Bluesand donation
3 Faculty's 2015 CCRC contribution consist of a 5% increase from 2014
4 Sources of UNSW funding for 2015 included $49k from SIR30 fund, $403K in SIR50 fund, $101k from SIR70 fund, and $16k in SF
5 Change in the EB gap process allows identification of EB Gap in 2015
6 80% of the Centre's total 2015 expenditure was on people costs compared to 77% in 2014, 76% in 2013, 81% in 2012, 82% in 2011, 74% in 2010 and 75% in 2009. In 2015, 56% of people costs came from base operating and strategic (IR001, SPF02, SPF04, SIR30, SIR50, SIR70) funds meaning that less than half of the centre's salaries and on-costs are
7 In 2015, 75% was funded by external grants compared to 78% in 2014 and 80% in 2013.
8 Closing cash balance agreed to NS financial reports

U. Stamios

Urania Stamios CPA
Science Faculty Finance Manager

17/2/2016

Date

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

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 Graduate Research School, Research Strategy Office and significant support from the Grants Management Office. We acknowledge also the invaluable expertise and support provided by the Faculty's IT staff from desktop support to assistance with major computational infrastructure. CCRC staff have also benefited from the work of the ARCCSS Computational Modelling Support (CMS) team whose work has saved many person-hours that used to be spent by students and staff in setting up and trouble shooting climate model runs and managing data.

The CCRC occupies space on Level 4 of the Mathews Building that was purpose renovated for us to occupy in 2008. This space was slightly expanded in 2013 to accommodate the Centre's growth in student and post-doc numbers.

Management & Oversight

Until the end of 2012 CCRC stood as an autonomous staffing unit within the Faculty. From 2013 the CCRC became a centre situated within The School of Biological, Earth and Environmental Sciences (BEES), although remaining separately budgeted by the Faculty of Science

The CCRC is overseen by a Steering Committee chaired by Professor Chris Tinney (AD-R, Faculty of Science). The other members of the 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 Steering Committee primarily has a strategic advisory role.

Responsibility for day-to-day management and operation of the centre is shared between the Director, Centre Manager and staff with delegated portfolios (such as the PG Coordinator, IT coordinator, UG Coordinator, Honours Coordination, Marketing/outreach coordinator, etc). The centre leadership team works closely and cooperatively with the Faculty of Science executive group and faculty committees. The Centre Director meets regularly with the Head of School of BEES as the two organisations come together more closely through finding shared synergies and alignment of processes and roles. Bimonthly staff meetings are held to reflect UNSW's school governance structure of regular board meetings.

The CCRC's PhD and undergraduate programs are officially administered by BEES, but the centre 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 student applications, enrolment and scholarships and the formal postgraduate review process.

Appendix A – 2015 Publications

Book Sections

D. Green and L. Webb 2015: Climate Change, Health and Well-being in *Indigenous Australia Journal*

Journal Articles

E. Abellán and S. McGregor 2015: The role of the southward wind shift in both, the seasonal synchronization and duration of ENSO events *Climate Dynamics* 1-19 http://dx.doi.org/10.1007/s00382-015-2853-1

G. Abramowitz and C. H. Bishop 2015: Climate Model Dependence and the Ensemble Dependence Transformation of CMIP Projections *Journal of Climate* 28 2332-2348 http://dx.doi.org/10.1175/jcli-d-14-00364.1

C. Aiken, A. Santoso, S. McGregor and M. H. England 2015: Optimal forcing of ENSO either side of the 1970's climate shift and its implications for predictability *Climate Dynamics* 45 47-65 http://dx.doi.org/10.1007/s00382-014-2306-8

H. Ajami, M. F. McCabe and J. P. Evans 2015: Impacts of model initialization on an integrated surface water-groundwater model *Hydrological Processes* http://dx.doi.org/10.1002/hyp.10478

K. Alexander and S. M. Easterbrook 2015: The software architecture of climate models: a graphical comparison of CMIP5 and EMICAR5 configurations *Geosci. Model Dev. Discuss.* 8 351-379 http://dx.doi.org/10.5194/gmdd-8-351-2015

K. Alexander, K. J. Meissner and T. J. Bralower 2015: Sudden spreading of corrosive bottom water during the Palaeocene-Eocene Thermal Maximum *Nature Geosci* 8 458-461 http://dx.doi.org/10.1038/ngeo2430

J. Andrys, T. J. Lyons and J. Kala 2015: Multidecadal Evaluation of WRF Downscaling Capabilities over Western Australia in Simulating Rainfall and Temperature Extremes *Journal of Applied Meteorology and Climatology* 54 370-394 http://dx.doi.org/10.1175/JAMC-D-14-0212.1

M. R. Anwar, D. L. Liu, R. Farquharson, I. Macadam, A. Abadi, J. Finlayson, B. Wang and T. Ramilan 2015: Climate change impacts on phenology and yields of five broadacre crops at four climatologically distinct locations in Australia *Agricultural Systems* 132 133-144 http://dx.doi.org/10.1016/j.agsy.2014.09.010

D. Argüeso, A. Di Luca and J. Evans 2015: Precipitation over urban areas in the western Maritime Continent using a convection-permitting model *Climate Dynamics* 1-17 http://dx.doi.org/10.1007/s00382-015-2893-6

D. Argüeso, A. Di Luca and J. P. Evans 2015: Precipitation over urban areas in the western Maritime Continent using a convection-permitting model *Climate Dynamics* 1-17 http://dx.doi.org/10.1007/s00382-015-2893-6

D. Argüeso, J. P. Evans, A. J. Pitman and A. Di Luca 2015: Effects of City Expansion on Heat Stress under Climate Change Conditions *PLOS ONE* 10 e0117066-e0117066 http://dx.doi.org/10.1371/journal.pone.0117066

W. Bagniewski, K. J. Meissner, L. Menviel and C. E. Brennan 2015: Quantification of factors impacting seawater and calcite δ18O during Heinrich Stadials 1 and 4 *Paleoceanography* 30 895-911 http://dx.doi.org/10.1002/2014PA002751

R. Batehup, S. McGregor and A. J. E. Gallant 2015: The influence of non-stationary teleconnections on palaeoclimate reconstructions of ENSO variance using a pseudoproxy framework *Clim. Past* 11 1733-1749 http://dx.doi.org/10.5194/cp-11-1733-2015

M. J. Best, G. Abramowitz, H. R. Johnson, A. J. Pitman, G. Balsamo, A. Boone, M. Cuntz, B. Decharme, P. A. Dirmeyer, J. Dong, M. Ek, Z. Guo, V. Haverd, B. J. J. van den Hurk, G. S. Nearing, B. Pak, C. Peters-Lidard, J. A. Santanello, L. Stevens and N. Vuichard 2015: The Plumbing of Land Surface Models: Benchmarking Model Performance *Journal of Hydrometeorology* 16 1425-1442 http://dx.doi.org/10.1175/jhm-d-14-0158.1

S. Bony, B. Stevens, D. M. W. Frierson, C. Jakob, M. Kageyama, R. Pincus, T. G. Shepherd, S. C. Sherwood, A. P. Siebesma, A. H. Sobel, M. Watanabe and M. J. Webb 2015: Clouds, circulation and climate sensitivity *Nature Geoscience* 8 261-268 http://dx.doi.org/10.1038/ngeo2398

J. Boucharel, A. Timmermann, A. Santoso, M. H. England, F. F. Jin and M. A. Balmaseda 2015: A surface layer variance heat budget for ENSO *Geophysical Research Letters* http://dx.doi.org/10.1002/2015gl063843

J. N. Brown, C. Langlais and A. Sen Gupta 2015: Projected sea surface temperature changes in the equatorial Pacific relative to the Warm Pool edge *Deep Sea Research Part II: Topical Studies in Oceanography* 113 47-58 http://dx.doi.org/10.1016/j.dsr2.2014.10.022

M. Y. Cai, L. Wang, S. D. Parkes, J. Strauss, M. F. McCabe, J. P. Evans and A. D. Griffiths 2015: Stable water isotope and surface heat flux simulation using ISOLSM: Evaluation against in-situ measurements *Journal of Hydrology* 523 67-78 http://dx.doi.org/10.1016/j.jhydrol.2015.01.019

W. Cai, A. Santoso, G. Wang, S.-W. Yeh, S.-I. An, K. M. Cobb, M. Collins, E. Guilyardi, F.-F. Jin, J.-S. Kug, M. Lengaigne, M. J. McPhaden, K. Takahashi, A. Timmermann, G. Vecchi, M. Watanabe and L. Wu 2015: ENSO and greenhouse warming *Nature Clim. Change* 5 849-859 http://dx.doi.org/10.1038/nclimate2743

W. Cai, G. Wang, A. Santoso, M. J. McPhaden, L. Wu, F. F. Jin, A. Timmermann, M. Collins, G. Vecchi, M. Lengaigne, M. H. England, D. Dommenget, K. Takahashi and E. Guilyardi 2015: Increased frequency of extreme La Niña events under greenhouse warming *Nature Climate Change* 5 132-137 http://dx.doi.org/10.1038/nclimate2492

W. Chang, M. Haran, R. Olson and K. Keller 2015: A composite likelihood approach to computer model calibration with high-dimensional spatial data *Statistica Sinica* 25 243-259 http://dx.doi.org/10.5705/ss.2013.219w

L. M. Ciasto, G. R. Simpkins and M. H. England 2015: Teleconnections between Tropical Pacific SST Anomalies and Extratropical Southern Hemisphere Climate *Journal of Climate* 28 56-65 http://dx.doi.org/10.1175/jcli-d-14-00438.1

G. Clark, E. Marzinelli, C. J. Fogwill, C. S. M. Turney and E. Johnston 2015: Effects of sea-ice cover on marine benthic communities: a natural experiment in Commonwealth Bay, East Antarctica *Polar Biology* 38 1213-1222 http://dx.doi.org/10.1007/s00300-015-1688-x

S. Contractor, L. V. Alexander, M. G. Donat and N. Herold 2015: How Well Do Gridded Datasets of Observed Daily Precipitation Compare over Australia? *Advances in Meteorology* 2015 15 http://dx.doi.org/22w 10.1155/2015/325718

A. Cooper, C. Turney, K. A. Hughen, B. W. Brook, H. G. McDonald and C. J. A. Bradshaw 2015: Abrupt warming events drove Late Pleistocene Holarctic megafaunal turnover *Science* 349 602-606 http://dx.doi.org/10.1126/science.aac4315

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C. S. M. Turney, C. J. Fogwill, A. Klekociuk, T. D. van Ommen, M. A. J. Curran, A. D. Moy and J. G. Palmer 2015: Tropical and mid-latitude forcing of continental Antarctic temperatures *The Cryosphere Discuss.* 9 4019-4042 http://dx.doi.org/10.5194/tcd-9-4019-2015

C. S. M. Turney, Z. A. Thomas, D. K. Hutchinson, C. J. A. Bradshaw, B. W. Brook, M. H. England, C. J. Fogwill, R. T. Jones, J. Palmer, K. A. Hughen and A. Cooper 2015: Obliquity-driven expansion of North Atlantic sea ice during the last glacial *Geophysical Research Letters* 42 10,382–10,390 http://dx.doi.org/10.1002/2015gl066344

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E. van Sebille, P. Scussolini, J. V. Durgadoo, F. J. C. Peeters, A. Biastoch, W. Weijer, C. Turney, C. B. Paris and R. Zahn 2015: Ocean currents generate large footprints in marine palaeoclimate proxies *Nature Communications* 6 6521-6521 http://dx.doi.org/10.1038/ncomms7521

E. van Sebille, S. Waterman, A. Barthel, R. Lumpkin, S. R. Keating, C. Fogwill and C. Turney 2015: Pairwise surface drifter separation in the western Pacific sector of the Southern Ocean *Journal of Geophysical Research: Oceans* 120 6769-6781 http://dx.doi.org/10.1002/2015jc010972

E. Van Sebille, C. Wilcox, L. Lebreton, N. Maximenko, B. Hardesty, J. van Franeker, A. , M. Eriksen, D. Siegel, F. Galgani and K. Law 2015: A global inventory of small floating plastic debris *Environmental Research Letters* 10 124006 http://dx.doi.org/10.1088/1748-9326/10/12/124006

B. Wang, D. L. Liu, S. Asseng, I. Macadam and Q. Yu 2015: Impact of climate change on wheat flowering time in eastern Australia *Agricultural and Forest Meteorology* 209–210 11-21 http://dx.doi.org/10.1016/j.agrformet.2015.04.028

Y.-P. Wang, Q. Zhang, A. Pitman and Y. J. Dai 2015: Nitrogen and phosphorous limitation reduces the effects of land use change on land carbon uptake or emission *Environmental Research Letters* 10 014001 http://dx.doi.org/10.1088/1748-9326/10/1/014001

M. J. Webb, A. P. Lock, C. S. Bretherton, S. Bony, J. N. S. Cole, A. Idelkadi, S. M. Kang, T. Koshiro, H. Kawai, T. Ogura, R. Roehrig, Y. Shin, T. Mauritsen, S. C. Sherwood, J. Vial, M. Watanabe, M. D. Woelfle and M. Zhao 2015: The impact of parametrized convection on cloud feedback *Philosophical Transactions of the Royal Society of London A: Mathematical, Physical and Engineering Sciences* 373 http://dx.doi.org/10.1098/rsta.2014.0414

2015 Active Research Projects

Investigator	Abramowitz, G
Grant Scheme	CSIRO/ EIF Subcontract
Grant title	Development of research infrastructure to support the protocol for the analysis of land surface models (pals) online web application.
Duration	2012 - 2016
Awarded Budget	$285,000

Investigator	Alexander, Lisa
Grant Scheme	International Contract
Grant title	Workshop of data requirements to address wcrp grand challenge on weather & climate extremes
Duration	2015-2015
Awarded Budget	$12,500

Investigator	Donat, Markus
Grant Scheme	ARC Discovery Early Career Researcher Award (DECRA)
Grant title	How far in advance can we predict extreme temperature and rainfall events?
Duration	2015-2017
Awarded Budget	367,536

Investigator	England, M
Grant Scheme	ARC Australian Laureate Fellowship
Grant title	Postgraduate researcher (2) - Nicola Maher - future risks associated with ocean surface warming: impacts on climate, rainfall, carbon, and circulation
Duration	2012 - 2016
Awarded Budget	$106,676

Investigator	England, M
Grant Scheme	ARC Australian Laureate Fellowship
Grant title	Future risks associated with ocean surface warming: impacts on climate, rainfall, carbon, and circulation
Duration	2011 - 2016
Awarded Budget	$1,250,252

Investigator	England, M
Grant Scheme	ARC Australian Laureate Fellowship
Grant title	Salary support - future risk associated with ocean surface warming: impacts on climate, rainfall, carbon and circulation.
Duration	2011 - 2016
Awarded Budget	$652,960

Investigator	England, M
Grant Scheme	ARC Australian Laureate Fellowship
Grant title	Postgraduate researcher (1) - David Hutchinson - future risks associated with ocean surface warming: impacts on climate, rainfall, carbon, and circulation
Duration	2011 - 2015
Awarded Budget	$106,676

Investigator	England, M
Grant Scheme	ARC Australian Laureate Fellowship
Grant title	Postdoctoral research associate 2 - Andrea Taschetto - future risks associated with ocean surface warming: impacts on climate, rainfall, carbon, and circula
Duration	2011 - 2016
Awarded Budget	$400,910

Investigator	England, M
Grant Scheme	ARC Australian Laureate Fellowship
Grant title	Postdoctoral research associate 1 - Agus Santosa - future risks associated with ocean surface warming: impacts on climate, rainfall, carbon, and circulation
Duration	2011 - 2016
Awarded Budget	$400,910

Investigator	England, M
Grant Scheme	Postgraduate Studentship
Grant title	Global atmospheric and oceanic influences on changes in southern hemisphere extratropical climate – scholarship for Ariaan Purich
Duration	2014 - 2017
Awarded Budget	$33,000

Investigator	England, M
Grant Scheme	ARC Discovery Project
Grant title	Remote forcing of pacific ocean variability and impacts on global climate
Awarded Budget	$621,400

Investigator	England, M
Grant Scheme	ARC Discovery Early Career Researcher Award (DECRA) Shared Grant
Grant title	Understanding the termination of el nino-southern oscillation events - PhD student Esteban Abellan
Duration	2015-2017
Awarded Budget	$41,583

Investigator	Evans, J
Grant Scheme	ARC Linkage Project
Grant title	Will east coast lows change in frequency or intensity in the future?
Duration	2013 - 2015
Awarded Budget	$240,000

Investigator	Evans, J
Grant Scheme	Contract Research
Grant title	Narclim (NSW and ACT regional climate model).
Duration	2011 - 2016
Awarded Budget	$683,027

Investigator	Evans, J
Grant Scheme	ARC Linkage Project Industry Partner Contribution
Grant title	Will east coast lows change in frequency or intensity in the future?
Duration	2013 - 2015
Awarded Budget	$150,000

Investigator	Evans, J
Grant Scheme	ARC Future Fellowship
Grant title	Salary support: how will climate change affect sub-daily precipitation?
Duration	2012 - 2016
Awarded Budget	$514,528

Investigator	Evans, J
Grant Scheme	ARC Future Fellowship
Grant title	How will climate change affect sub-daily precipitation?
Duration	2012 - 2016
Awarded Budget	$67,369

Investigator	Evans, J
Grant Scheme	Contract Research
Grant title	Phase 1 ? modelling and analysis of rainfall extremes in the greater sydney region.
Duration	2012-2015
Awarded Budget	$148,538

Investigator	Green, D. Bambrock, H. Alexander, L.
Grant Scheme	NHMRC Project Grant
Grant title	Health impacts of climate change on indigenous australians: identifying climate thresholds to enable the development of informed adaptation strategies
Duration	2011 - 2016
Awarded Budget	$348,749

Investigator	Hart, Melissa
Grant Scheme	Environmental Research Program
Grant title	Forecasting air pollution impacts from hazard reduction burns
Duration	2015-2018
Awarded Budget	$149,900

Investigator	Hart, Melissa
Grant Scheme	State Government Contract
Grant title	Forecasting air pollution impacts from hazard reduction burns
Duration	2015-2018
Awarded Budget	$30,000

Investigator	Liu, Yi
Grant Scheme	ARC Discovery Early Career Researcher Award (DECRA)
Grant title	Characterising changes in Australia's vegetation for biomass monitoring, cardon accounting and fire hazard mapping
Duration	2014-2016
Awarded Budget	$385,279

Investigator	Mcgregor, S
Grant Scheme	ARC Discovery Early Career Researcher Award (DECRA)
Grant title	Understanding the termination of el nino-southern oscillation events
Duration	2013 - 2015
Awarded Budget	$375,000

Investigator	Meissner, K
Grant Scheme	ARC Future Fellowship
Grant title	What caused abrupt climate change events in the past and what can they tell us about the future?
Duration	2010 - 2015
Awarded Budget	$680,542

Investigator	Menviel, Laurie
Grant Scheme	ARC Discovery Early Career Researcher Award (DECRA)
Grant title	What is the impact of abrupt climate change on the global carbon cycle?
Duration	2015-2017
Awarded Budget	$369,536

Investigator	Perkins-Kirkpatrick, Sarah
Grant Scheme	ARC Discovery Early Career Researcher Award (DECRA)
Grant title	A comprehensive understanding of Australian heat waves: past, present and future
Duration	2014-2016
Awarded Budget	$394,299

Investigator	Pitman, A
Grant Scheme	ARC LIEF
Grant title	Connecting big data with high performance computing for climate science
Duration	2015-2015
Awarded Budget	$490,000

Investigator	Pitman, A
Grant Scheme	ARC LIEF Subcontract (UNSW ADMIN)
Grant title	Connecting big data with high performance computing for climate science
Duration	2015-2015
Awarded Budget	$200,000

Investigator	Pitman, A. Hirsch, A.
Grant Scheme	CSIRO Scholarship
Grant title	OCE PhD scholarship for annette hirsch ? earth system science ? role of land surface dynamics in climate processes.
Duration	2012 - 2015
Awarded Budget	$51,000

Investigator	Santoso, Agus
Grant Scheme	CSIRO - Commonwealth Scientific and Industrial Research Organisation/Commonwealth Government Contract
Grant title	Tropical variability in a warming world 2013
Duration	2013 - 2017
Awarded Budget	$190,909

Investigator	Santoso, Agus
Grant Scheme	CSIRO - Commonwealth Scientific and Industrial Research Organisation/Commonwealth Government Contract
Grant title	Tropical variability in a warming world 2015
Duration	2015-2016
Awarded Budget	$150,000

Investigator	Sen Gupta, A. England, M. Karumuri, A.
Grant Scheme	ARC Discovery Project
Grant title	The changing relationship between the south asian and australian monsoon in a warming world.
Duration	2011 - 2015
Awarded Budget	$300,000

Investigator	Sen Gupta, A
Grant Scheme	Flagship Postgraduate Scholarship
Grant title	Mesoscale and regional ocean dynamics and prediction - scholarship for yue li
Duration	2014 - 2016
Awarded Budget	$17,874

Investigator	Sen Gupta, A
Grant Scheme	ARC Linkage Project
Grant title	Understanding the effect of small-scale ocean process on tuna populations - a new tool to forecast tuna distributions for use in fisheries management
Duration	2015-2017
Awarded Budget	$160,518

Investigator	Sen Gupta, A
Grant Scheme	ARC Linkage Project Industry Partner Contribution
Grant title	Understanding the effect of small-scale ocean process on tuna populations - a new tool to forecast tuna distributions for use in fisheries management
Duration	2015-2017
Awarded Budget	$60,000

Grant Scheme	ARC Discovery Project
Grant title	Testing a new explanation of cloud feedback on global climate
Duration	2014 - 2017
Awarded Budget	$360,000

Investigator	Sherwood, S
Grant Scheme	ARC Australian Laureate Fellowship
Grant title	PGR 1 - Revisiting the physics of clouds - Jiawei Bao
Duration	2015-2020
Awarded Budget	$101,624

Investigator	Sherwood, S
Grant Scheme	ARC Australian Laureate Fellowship
Grant title	Revisiting the physics of clouds
Duration	2015-2020
Awarded Budget	$884,883

Investigator	Sherwood, S
Grant Scheme	ARC Australian Laureate Fellowship
Grant title	PDRA 1 - Revisiting the physics of clouds - Abhnil Prasad
Duration	2015-2020
Awarded Budget	$462,190

Investigator	Sherwood, S
Grant Scheme	ARC Australian Laureate Fellowship
Grant title	AFL salary support - Revisiting the physics of clouds
Duration	2015-2020
Awarded Budget	$752,770

Investigator	Sherwood, S
Grant Scheme	ARC Australian Laureate Fellowship
Grant title	PDRA 2 - Revisiting the physics of clouds - Damianos Mantsis
Duration	2015-2020
Awarded Budget	$462,190

Investigator	Sherwood, S
Grant Scheme	ARC Australian Laureate Fellowship
Grant title	PGR 2 - Revisiting the physics of clouds
Duration	2015-2020
Awarded Budget	$101,624

Investigator	Sherwood, S
Grant Scheme	Dept. Of Environment - National Environmental Science Programme (NESP) Shared Grant
Grant title	Earth systems and climate change hub
Duration	2015-2020
Awarded Budget	$10,000

Investigator	Sijp, W
Grant Scheme	ARC Discovery Project
Grant title	ARF The equable climate conundrum: the role of the global ocean in multiple climate regimes.
Duration	2010 - 2015
Awarded Budget	$524,830

Investigator	Spence, Paul
Grant Scheme	ARC Discovery Early Career Researcher Award (DECRA)
Grant title	Dynamics, variability and change in southern ocean abyssal flows.
Duration	2051-2017
Awarded Budget	$357,024

Investigator	Taschetto, A
Grant Scheme	ARC Discovery Project
Grant title	Modes of pacific ocean variability and their relationship to regional southern hemisphere climate
Duration	2010 - 2015
Awarded Budget	$240,548

Investigator	Van Sebille, E
Grant Scheme	ARC Discovery Early Career Researcher Award (DECRA)
Grant title	Inter-ocean exchange around australia and its relation to regional and global climate
Duration	2013 - 2015
Awarded Budget	$374,354

Investigator	Pitman, A. Sherwood, S. Alexander, L. England, M.
Grant Scheme	ARC Centres of Excellence
Grant title	ARC Centre of Excellence for Climate System Science
Duration	2011 - 2018
Awarded Budget	$21,400,000

Appendix C – 2015 Centre Personnel

Professors

Prof Matthew England (ARC Laureate Fellow, CCRC Deputy Director)
Prof Andy Pitman (ARCCSS Director)
Prof Steven Sherwood (CCRC Director)
Prof Chris Turney (ARC Laureate Fellow)

Faculty

Dr Gab Abramowitz
A/Prof Lisa Alexander
A/Prof Jason Evans (ARC Future Fellow)
Dr Donna Green
Dr Melissa Hart (ARCCSS Graduate Director)
Dr Angela Maharaj
Dr Ben McNeil
A/Prof Katrin Meissner (ARC Future Fellow)
Dr Alex Sen Gupta

Post Doctoral Research Fellows, Research Associates and Research Assistants

Dr Christopher Aiken
Dr Joe Andersen
Dr Daniel Argueso
Dr Simon Borlace
Dr Julien Boucharel
Dr Paulina Cetina Heredia
Dr Claire Carouge
Dr Mark Decker
Dr Alejandro Di Luca
Dr Giovanni Di Virgilio
Dr Markus Donat
Dr Chris Fogwill
Dr Leela Frankcombe
Dr David Fuchs
Dr Olivier Geoffroy
Dr Nicholas Hannah
Dr Daniel Hernandez-Deckers
Dr Nicolas Herold
Dr Jules Kajtar
Dr Yi Liu
Dr Ruth Lorenz
Dr Shaoxiu Ma
Dr Damianos Mantsis
Dr Shayne McGregor
Dr Laurie Menviel
Dr Roman Olson
Dr Jonathan Palmer
Dr Sarah Perkins-Kirkpatrick
Dr Steven Phipps
Dr Abhnil Prasad
Dr Bastien Rouquie
Dr Agus Santoso
Dr Willem Sijp
Dr Paul Spence
Dr Kial Stewart
Dr Andrea Taschetto
Dr Zoe Thomas
Dr Stephanie Waterman
Dr Anna Ukkola

Professional Staff

Vilia Co
Stephen Gray
Simone Purdon
Swa Rath
Bronwen Smith
Alvin Stone

Honours Students (and their primary supervisor)

Nicholas Grosfeld (McGregor)
Mia Gross (Alexander)
Matthew Hale (Abramowitz)
Keith Huang (Maharaj)

Higher Degree Research Students (and their primary supervisor)

Esteban Abellan Villardon (McGregor)
Kaitlin Alexander (Meissner)
Oliver Angelil (Perkins-Kirkpatrick)
Witold Bagniewski (Meissner)
Jiawei Bao (Sherwood)
Alice Barthel (Waterman)
Chris Bull (Van Sebille)
Cameron Cairns (Sherwood)
Wasin Chaivaranont (Evans)
Xi Chen (Liu)
Hamish Clarke (Pitman)
Maxime Colin (Sherwood)
Steefan Contractor (Alexander)
Annika Dean (Green)
Peter Gibson (Perkins)
James Goldie (Alexander)
Ned Haughton (Abramowitz)
Nadja Herger (Abramowitz)
Annette Hirsch (Pitman)
Sanaa Hobeichi (Abramowitz)
Willem Huiskamp (Turney)
David Hutchinson (England)
Carlo Jamandre (Hart)
Yue Li (Sen Gupta)
Mat Lipson (Hart)
Tammas Loughran (Perkins-Kirkpatrick)
Nicola Maher (England)
Helen Millman (Fogwill)
Nidhi Nishant (Sherwood)
Marissa Parry (Green)
Valeria Prando (Spence)
Acacia Pepler (Alexander)
Sarah Perry (McGregor)
Ariaan Purich (England)
Shirley Qin (Sen Gupta)
Jessica Roe (Turney)
Rosalie Schultz (Green)
David Webb (England)

Adjuncts, Visiting Fellows and Visiting Researchers

Dr Marc Dorgeville
Prof Hoshin Gupta
Prof Babette Hoogakker
Dr Joseph Kidston
Dr Ruby Leung
Prof Paul O'Gorman
Prof Stefan Rahmstorf
Prof Roger Smith

Affiliated UNSW Staff

Prof Mike Archer
A/Prof Jeremy Bailey
Prof Andy Baker
Prof Alan Dupont
A/Prof Gary Froyland
Prof Michael Goldstein
A/Prof Mark Holzer
Dr Fiona Johnson
Dr Nicolas Jourdain
Dr Ian Macadam
Prof Jane McAdam
Dr Shayne McGregor
Dr Michael Molitor
Dr Scott Mooney
Dr Vincent Rossi
Dr Oleg Saenko
Prof Asish Sharma
A/Prof Scott Sisson
Prof Ashish Sharma
Dr Krishna Shrestha
Dr Milton Speer
Amelia Thorpe
Dr Caroline Ummenhofer
Dr Erik Van Sebille
Dr Ying Zheng

Visiting Students and Research Interns

Daisy Ambach
Tomas Beuzen
Lyla Bonfim
Mollie Burns
Jacqueline Fenwick
Josephine Fong
Lawrence Garcia Villada
Lukas Guske
Ryan Holmes
Antony Jones
Katie Kirpatrick
Niamh Kyriakou
William Li
Alex Lin
Gabriel Pontes
James Roberts
Michael Su
Francis Torok
Georgia Tsambos
Elizabeth Vogel
Steffie Ypma

Appendix D – 2015 Media & Publicity

Name	Media Type	Media Outlet	Article Program Name
Alexander, K.	Newspaper	The Globe and Mail	Analysis resolves ancient climate puzzle
Alexander, K.	Online	Science World Report	Corrosive ocean 55 million years ago may have implications for modern global warming
Alexander, K.	Online	A-Z Cleantech	Researchers discover how abrupt global warming event triggered highly corrosive deep water current.
Alexander, K.	Online	Phys.org	Solving corrosive ocean mystery reveals future climate.
Alexander, L.	Newspaper	The Age	An inconvenient question: will climate change mean worse storms for NSW
Alexander, L.	Online	The Conversation	Explainer: the wild storms that lash Australia's east coast.
Donat, M.	Online	Earth Sky	Warm oceans triggered US Dust Bowl
Donat, M.	Online	Reporting Climate Science	Study: Oceans may have caused Dust Bowl heat
Donat, M.	Online	Laboratory Equipment	Hottest Dust Bowl years linked to warm oceans
Donat, M.	Online	Phys.org	Warm oceans caused hottest dust bowl years.
Donat, M.	Online	Science News	Warm oceans caused hottest Dust Bowl years in 1934/36
Donat, M.	Online	YubaNet	Warm oceans caused hottest Dust Bowl years in 1934/36
Donat, M.	Online	ScienceBlog	Warm oceans caused hottest Dust Bowl years in 1934/36
Donat, M.	Online	Science Codex	Not farming: Warm oceans cause hottest Dust Bowl years in 1934-36
England, M.	Online	SBS World News Radio	Aussie scientists issue new climate change warning
England, M.	Newspaper	SMH	Academy of Science urges Australia to cut emissions to zero by 2050
England, M.	Online	The chronicle	Emissions target needs
England, M.	Online	News Mail	Emissions target needs to be 40% less than 15 years ago
England, M.	Online	The Conversation	The climate 'hiatus' doesn't take the heat off global warming
England, M.	Newspaper	The Australian	UNSW climate team says 20-year warming pause 'a distraction'
England, M.	Newspaper	Business Insider	Science says global warming won't stop despite a slowing in the rise of average temperatures
England, M.	Online	Ohys Org	Heat still on despite warming slowdown
England, M.	Online	International Business News	Global warming slowdown has no effect on projected 5C temperature rise by 2100
England, M.	Online	3 News NZ	Global warming pause irrelevant in the long-term – study
England, M.	Online	Eco Business	Global warming slowdown offers only fleeting relief
England, M.	Newspaper	SMH	Warming hiatus will not stop long-term global climate change
England, M.	Newspaper	The Age	Warming hiatus will not stop long-term global climate change
England, M.	Newspaper	Brisbane Times	Warming hiatus will not stop long-term global climate change
England, M.	Online	accuweather	Latest slow-down in Warming will have Little Impact on Long-Term Warming Projections
England, M.	Online	ZME Science	Global Warming responsible for more extreme weather, yet another research concludes
England, M.	Online	HNGN	Climate Change and Global Warming: Despite Perceived Warming Hiatus, Long-Term Effects Disastrous, Study Suggests
England, M.	online	Yibada	Global Warming Slowdown: 5 Degrees Rise Predicted If Emissions Are Not Controlled
England, M.	Online	Science Codex	Heat still on despite global warming pause
England, M.	Online	Science World Report	Climate Change and Global Warming to Continue Unabated Despite 'Hiatus'
England, M.	Online	Inferse	Scientists project 5°C increase in global warming if emissions are not curbed
England, M.	Online	SBS	Emissions auction hits critics out of park
England, M.	Online	News Quench	New study shows pause in climate change, global warming
England, M.	Online	Summit County Voice	Study: Global warming slowdown just a 'distraction'

England, M.	online	Reporting Climate Science	heat-on-despite-global-warming-pause-say-researchers
England, M.	Online	Global Post	Global warming slowdown will not stop long-term climate change say scientists
England, M.	Newspaper	Herald Sun	Global warming pause a distraction: study
England, M.	Online	News.com,au	NSW storms are a sign of things to come, climate scientist warns
England, M.	Online	environment 360	How Long Can Oceans Continue To Absorb Earth's Excess Heat?
England, M.	Online	Climate central	Looming Warming Spurt Could Reshape Climate Debate
England, M.	Online	weather underground	Are We Entering a New Period of Rapid Global Warming?
England, M.	Online	new scientist	Burst of warming may end lull in rising temperatures
England, M.	Newspaper	SMH	Extreme El Nino and La Nina events to increase in a warming world, researchers say
England, M.	Online	SBS	Aussie scientists issue new climate change warning
England, M.	Online	Climate Central	Heat is piling up in the depths of the Indian Ocean
England, M.	Newspaper	The Guardian	Pause needed in global warming optimism, new research shows
England, M.	Online	Science World Report	Climate change and global warming: Despite perceived warming hiatus, long term effects disastrous, study suggests.
England, M.	Online	Inferse	Scientists project 5C increase in global warming if emissions are not curbed.
England, M.	Newspaper	Empire State Tribune	Climate change scientists says global warming slowdown is just a minor distraction and will peak in 2040
England, M.	Online	Science Codex	Heat on despite global warming pause, say researchers
England, M.	Newspaper	The Australian	UNSW climate team says warming pause 'a distraction'
England, M.	Online	Xinhua News	Global warming slow-down will not stop long term climate change, say scientists
England, M.	Online	International Business Times	Global warming slowdown has no effect on projected 5C warming by 2100.
England, M.	Online	Science Daily	Hiatus on global average temperatures has little affect on projected temperatures in 2100
England, M.	Newspaper	Sydney Morning Herald	Fewer but more intense cyclones predicted, in aftermath of Pam
England, M.	Online	Yahoo News	Cool Pacific Ocean slowed global warming
England, M.	Online	Climate Code Red	Two degress of warming closer than you may think.
England, M.	Online	News.com.au	NSW storms are a sign of things to come, climate scientist warns
England, M.	Online	Nature	Hunting the Godzilla El Niño
England, M.	Online	ABC program	#TalkAboutIt: Climate change sceptics versus the scientists
England, M.	Online	The Telegraph UK	ABC: even worse than the BBC
England, M.	Online	The Australian	Let's pretend warming pause is fake
England, M.	Online	Sheep Central	Bureau confirms El Niño is here – how severe still unknown
England, M.	Online	The Guardian	Liberals' attack on climate science is 'embarrassing', say scientists
England, M.	Online	The Conversation	The rise and rise of the 2015 El Niño
England, M.	Online	ABC News	Push for 'crazy' target to be lifted, as climate change reaches grim milestone - ABC, PM with Mark Colvin. Simon Lauder reports.
England, M.	Online	Nature	Indian Ocean may be key to global warming 'hiatus'
England, M.	Online	Climate Spectator	Open letter: Scientists' Galilee plea to banks
England, M.	Online	National Geographic	States, Nations Announce Commitments Ahead of U.N. Climate Conference
England, M.	Online	The Australian	IPCC is to science what FIFA is to soccer
England, M.	Online	The Australian	Media Watch has a climate change obsession
England, M.	Online	The Australian	RBA's message is thatwe are reaching thelimits of monetary policy
England, M.	Online	The Australian	Ice floats all above board
England, M.	Online	Eco Business	Global warmign slowdown offers only fleeting relief
England, M.	Online	Science World Report	Climate change and global warming to continue unabated, despite hiatus
England, M.	Newspaper	The Australian	Global warming didn't stall, new study shows.
England, M.	Online	Climate News Network	Climate change boosted Australia's 2010 floods
England, M.	Online	CleanTechnica	Long-term ocean warming worsened deadly 201/11 Australian floods
England, M.	Online	Nature News	Year of Paris climate talks likely to be the hottest on record.

England, M.	Online	ABC Online	Global warming and El Nino set to make 2015 the hottest year on record WMO says.
England, M.	Online	ABC Online	Warmer ocean temperatures worsened Queensland's deadly 2011 floods: study.
Evans, J.	Newspaper	Sydney Morning Herald	Sydney's storms get more intense as engineers begin to adjust to climate change
Evans, J.	Online	Yahoo 7 News	Brace yourself Sydney, there's mre wild weather ahead
Evans, J.	Newspaper	The Australian	Climate change planning heats up.
Gibson, P.	Online	Phys.org	Interconnecting distant NZ windfarms could be boon for grid
Liu, Y.	Online	Thomson Reuters Foundation	Despite deforestation, the world is getting greener - scientists
Liu, Y.	Online	Gizmodo	China's great wall of trees is helping reverse deforestation
Liu, Y.	Online	Forbes News	Resurgent vegetation sucks 4bn tonne of carbon from the air.
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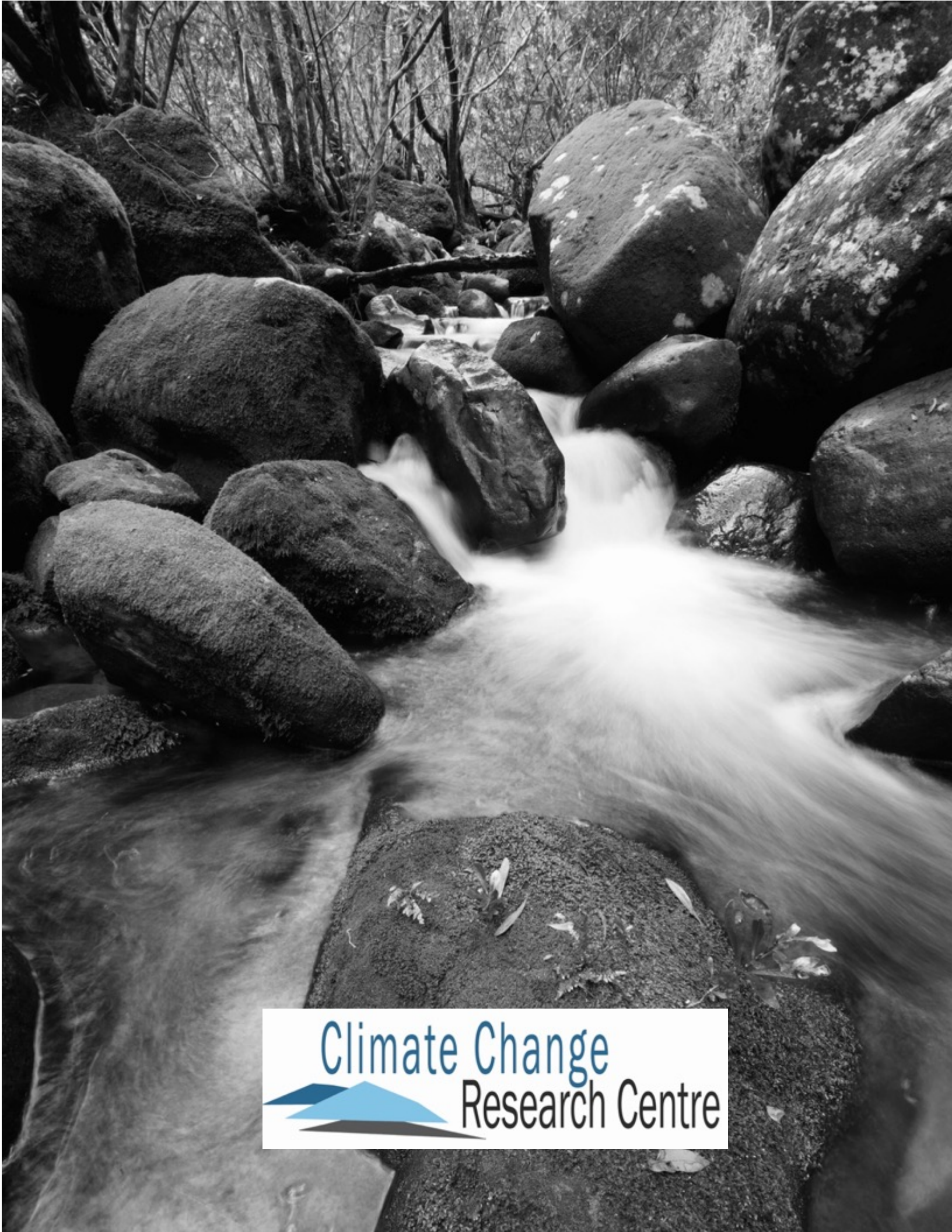
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