New Zealand weather and climate news

MetService

Cold weather power surge 'enough to power 450 Eden Parks'

Metservice meteorologist Angus Hine said last night's temperatures were cold compared to the past few winters, but were far from record-breaking.

http://www.radionz.co.nz/news/national/360576/cold-weather-power-surge-enough-to-power-450-eden-parks

Kiwis warned to expect 'a few more cold nights ahead' - MetService

Prepare for more frosty nights across New Zealand this week, a meteorologist has warned.

While Wednesday night might not be quite as cold as Wednesday morning, Thursday, Friday and Saturday probably will be, MetService meteorologist Angus Hines told Newshub on Wednesday.

https://www.newshub.co.nz/home/new-zealand/2018/06/kiwis-warned-to-expect-a-few-more-cold-nights-ahead-metservice.html

Coldest start in three years for Auckland; central North Island temperatures plunge

Around 5.30am Wednesday, MetService meteorologist Nick Zachar said it was -7 degrees Celsius at Tongariro, -4C on the Desert Road, and in the South Island it was -4C at Springs Junction. Taumarunui got down to -3C

https://www.stuff.co.nz/national/105035281/desert-road-still-closed-early-wednesday-subzero-temperatures

'Extremely cold temperatures for June', says MetService, but the worst is yet to come

MetService says the country has experienced "extremely cold" conditions during the first month of winter - but the worst could be yet to come.

https://www.tvnz.co.nz/one-news/new-zealand/extremely-cold-temperatures-june-says-metservice-but-worst-yet-come

Widespread snowfalls to hit

MetService Meteorologist Sarah Haddon said a cold front was expected to make its way up the South Island on Monday night.

https://www.stuff.co.nz/national/104972622/snow-falls-in-south-closing-roads

MetOcean

Mapping the world's sea floor

“We’ve mapped Mars, the moon and other planets to a higher resolution … than we have mapped our ocean beds.”

As far as New Zealand’s National Hydrographer Alan Greenland is concerned, it is about time that we had better maps for the seventy percent of planet earth that is covered in water. Which is why he is excited about the new global initiative, Seabed 2030, which aims to produce a definitive map of the entire ocean floor in just 12 years.

http://www.radionz.co.nz/national/programmes/ourchangingworld/audio/2018651101/mapping-the-world-s-sea-floor

Discovering the Deep Blue Sea

Research, Innovation, Social Engagement (2018)

The 14th annual National Academies Keck Futures Initiative (NAKFI), “Discovering the Deep Blue Sea: Research, Innovation, and Social Engagement”, brought together 170 marine scientists, professional artists, engineers, biomedical researchers, oceanographers, music professors, and undergraduate design students. The attendees collaborated to find solutions to overarching social and scientific research problems tied to five sub-topics: aquaculture and energy; technology; climate-related change; biodiversity; and communication, adaption, and resilience. This publication summarizes the presentations and discussions from this event.

Can be downloaded here with registration

Extreme weather (and other news) – Australia and Pacific

Climate change and drought: June 2018

21 Jun 2018

Will Steffen, Lesley Hughes, Annika Dean, Martin Rice

Climate Council of Australia

Climate change is likely making drought conditions in southwest and southeast Australia worse

Climate change has contributed to a southward shift in weather systems that typically bring cool season rainfall to southern Australia. Since the 1970s late autumn and early winter rainfall has decreased by 15 percent in southeast Australia, and Western Australia's southwest region has experienced a 15 percent decline in cool season rainfall.

Climate change is also driving an increase in the intensity and frequency of hot days and heatwaves in Australia, exacerbating drought conditions.

Queensland and New South Wales are currently in the grip of severe drought, with drought declared for 16.4 percent of New South Wales and 57.6 percent of Queensland.

Current drought conditions come after a 2016/2017 summer characterised by recordbreaking temperatures, followed by a record dry winter. Rainfall over southern Australia during autumn 2018 was the second lowest on record.

Time spent in drought is projected to increase in the future across southern Australia. Future drying trends in Australia will be most pronounced over southwest Western Australia, with total reductions in autumn and winter precipitation potentially as high as 50 percent by the late 21st Century.

http://apo.org.au/node/179811

Extreme weather (and other news) – Asia and the Middle East, Africa

Japan prepares to beat the heat during 2020 Tokyo Olympics and Paralympics

Japan is preparing measures to prevent heat-related health problems at the 2020 Summer Olympic and Paralympic Games in Tokyo, such as improved temperature forecasts and cooler roads paved with heat-resistant materials.

https://www.japantimes.co.jp/news/2018/06/26/national/japan-prepares-beat-heat-2020-tokyo-olympics-paralympics/#.WzPzCWN9ipo

Extreme weather (and other news) – Americas and Europe

Heatwave returns to Europe

Europe sees record-breaking temperatures, with May being the warmest in more than a century.

https://www.aljazeera.com/indepth/inpictures/heatwave-returns-europe-180627073131406.html

International news and research

NOAA Wants to Remove 'Climate' From Its Mission Statement

Might as well remove 'atmosphere' too.

https://www.sciencealert.com/noaa-wants-to-remove-climate-from-its-mission-statement

Meet the Kiwi who chases storms

So how do you like to spend your holidays?

Is it lounging by the beach with a good book in your hands, or is it sightseeing and exploring the likes of world cities like Barcelona and Buenos Aires?

https://www.stuff.co.nz/travel/kiwi-traveller/104978516/meet-the-kiwi-who-chases-storms

Increase in storms could have 'catastrophic impact' on fishing industry

Potential changes in the frequency and intensity of storms off the coast of the UK and around the world could have a 'catastrophic impact' on the livelihood of fishermen and sustainability of fishing industries, research has shown.

https://www.sciencedaily.com/releases/2018/06/180625130925.htm

Met Office introducing two new weather warnings - what you need to know

Forecasters have confirmed they will bring in a new type of warning for thunderstorms - and another for lightning

https://www.coventrytelegraph.net/news/coventry-news/met-office-introducing-two-new-14825400

Scientists improvise models to better predict storm surges

Researchers at India Institute of Technology, Delhi, have come up with an improvised prediction model that promises to help make more accurate forecast of storm surges due to cyclone and other storms arising on the eastern flank of the country, in Bay of Bengal.

https://www.downtoearth.org.in/news/climate-change/scientists-improvise-models-to-better-predict-storm-surges-60944

National Weather Service outage delays key weather forecasting tools amid severe weather

While severe weather threatened portions of the central and southeastern United States on Monday evening, June 25, 2018, a National Weather Service (NWS) data outage resulted in delays in key weather forecasting tools.

https://www.accuweather.com/en/weather-news/nws-outage-delays-key-weather-forecasting-tools-amid-severe-weather/70005314

Are shipping emissions adding to weather events in China?

In the 1960s, Massachusetts Institute of Technology mathematician and meteorologist Edward Lorenz constructed a model of the weather that showed how a butterfly flapping its wings in South America could potentially affect weather in New York's Central Park.

https://www.acbr.com.au/are-shipping-emissions-adding-weather-events-china

AMT

Comparisons of bispectral and polarimetric retrievals of marine boundary layer cloud microphysics: case studies using a LES–satellite retrieval simulator by Daniel J. Miller, Zhibo Zhang, Steven Platnick, Andrew S. Ackerman, Frank Werner, Celine Cornet, and Kirk Knobelspiesse https://www.atmos-meas-tech.net/11/3689/2018/

Short Summary: Prior satellite comparisons of bispectral and polarimetric cloud droplet size retrievals exhibited systematic biases. However, similar airborne instrument retrievals have been found to be quite similar to one another. This study explains this discrepancy in terms of differing sensitivity to vertical profile, as well as spatial and angular resolution. This is accomplished by using a satellite retrieval simulator – an LES cloud model coupled to radiative transfer and cloud retrieval algorithms.

Estimates of ozone return dates from Chemistry-Climate Model Initiative simulations, Atmos. Chem. Phys., 18, 8409-8438, https://doi.org/10.5194/acp-18-8409-2018, 2018. (Author involvement – Bodecker Scientific)

Abstract. >We analyse simulations performed for the Chemistry-Climate Model Initiative (CCMI) to estimate the return dates of the stratospheric ozone layer from depletion caused by anthropogenic stratospheric chlorine and bromine. We consider a total of 155 simulations from 20 models, including a range of sensitivity studies which examine the impact of climate change on ozone recovery. For the control simulations (unconstrained by nudging towards analysed

meteorology) there is a large spread (±20 DU in the global average) in the predictions of the absolute ozone column. Therefore, the model results need to be adjusted for biases against historical data. Also, the interannual variability in the model results need to be smoothed in order to provide a reasonably narrow estimate of the range of ozone return dates. Consistent with previous studies, but here for a Representative Concentration Pathway (RCP) of 6.0, these new CCMI simulations project that global total column ozone will return to 1980 values in 2049 (with a 1σ uncertainty of 2043–2055). At Southern Hemisphere mid-latitudes column ozone is projected to return to 1980 values in 2045 (2039–2050), and at Northern Hemisphere mid-latitudes in 2032 (2020–2044). In the polar regions, the return dates are 2060 (2055–2066) in the Antarctic in October and 2034 (2025–2043) in the Arctic in March. The earlier return dates in the Northern Hemisphere reflect the larger sensitivity to dynamical changes. Our estimates of return dates are later than those presented in the 2014 Ozone Assessment by approximately 5–17 years, depending on the region, with the previous best estimates often falling outside of our uncertainty range. In the tropics only around half the models predict a return of ozone to 1980 values, around 2040, while the other half do not reach the 1980 value. All models show a negative trend in tropical total column ozone towards the end of the 21st century. The CCMI models generally agree in their simulation of the time evolution of stratospheric chlorine and bromine, which are the main drivers of ozone loss and recovery. However, there are a few outliers which show that the multi-model mean results for ozone recovery are not as tightly constrained as possible. Throughout the stratosphere the spread of ozone return dates to 1980 values between models tends to correlate with the spread of the return of inorganic chlorine to 1980 values. In the upper stratosphere, greenhouse gas-induced cooling speeds up the return by about 10–20 years. In the lower stratosphere, and for the column, there is a more direct link in the timing of the return dates of ozone and chlorine, especially for the large Antarctic depletion. Comparisons of total column ozone between the models is affected by different predictions of the evolution of tropospheric ozone within the same scenario, presumably due to differing treatment of tropospheric chemistry. Therefore, for many scenarios, clear conclusions can only be drawn for stratospheric ozone columns rather than the total column. As noted by previous studies, the timing of ozone recovery is affected by the evolution of N_2O and CH_4. However, quantifying the effect in the simulations analysed here is limited by the few realisations available for these experiments compared to internal model variability. The large increase in N_2O given in RCP 6.0 extends the ozone return globally by $\sim$ 15 years relative to N_2O fixed at 1960 abundances, mainly because it allows tropical column ozone to be depleted. The effect in extratropical latitudes is much smaller. The large increase in CH_4 given in the RCP 8.5 scenario compared to RCP 6.0 also lengthens ozone return by $\sim$ 15 years, again mainly through its impact in the tropics. Overall, our estimates of ozone return dates are uncertain due to both uncertainties in future scenarios, in particular those of greenhouse gases, and uncertainties in models. The scenario uncertainty is small in the short term but increases with time, and becomes large by the end of the century. There are still some model–model differences related to well-known processes which affect ozone recovery. Efforts need to continue to ensure that models used for assessment purposes accurately represent stratospheric chemistry and the prescribed scenarios of ozone-depleting substances, and only those models are used to calculate return dates. For future assessments of single forcing or combined effects of CO_2, CH_4, and N_2O on the stratospheric column ozone return dates, this

work suggests that it is more important to have multi-member (at least three) ensembles for each scenario from every established participating model, rather than a large number of individual models.

https://www.atmos-chem-phys.net/18/8409/2018/acp-18-8409-2018.html

WMO

New trust fund underpins China's Belt and Road meteorological support

The World Meteorological Organization and the China Meteorological Administration have set up a trust fund to underpin regional cooperation on the Belt and Road Initiative.

Read more here

WMO presents top scientific prize to Gordon McBean of Canada

The World Meteorological Organization has presented its top award to Gordon McBean of Canada for his outstanding work in meteorology and climatology and his leadership as a scientific researcher. Mr McBean is currently President of the International Council for Science.

Read more here

Aviation

How much visibility does a pilot need to land safely in fog?

It all depends on the airport's Instrument Landing System (ILS), the ground-based technology that guides an aircraft safely onto the runway when a visual approach is not possible, assuming that the aircraft is equipped with an instrument approach capability and the pilot is suitably qualified.

https://www.stuff.co.nz/travel/news/104974063/how-much-visibility-does-a-pilot-need-to-land-safely-in-fog

Rocket Lab scrubs third attempt for lift off after issues with motor controller

Space-launch firm Rocket Lab has scrubbed its third attempt at launching its second Electron rocket into orbit following issues with the rocket's motor controller.

https://www.stuff.co.nz/business/105039873/rocket-lab-attempts-another-lift-off-this-afternoon

3, 2, 1…liftoff! The science of launching rockets from Australia

Australia's space agency will officially commence operations on July 1 2018.

As inaugural agency head Megan Clarke surveys our national capability in space, many states are putting forward strong cases regarding their existing relationships, human resources and infrastructure.

https://theconversation.com/3-2-1-liftoff-the-science-of-launching-rockets-from-australia-98307

Energy and Mining

Global warming will affect global electricity production

Global warming threatens global electricity production, according to a report released by four organisations on 19 June. As many as 270 power plants could face an increased risk of flooding by 2050. EURACTIV's partner Le Journal de l'environnement reports.

https://www.euractiv.com/section/electricity/news/global-warming-will-affect-global-electricity-production/

Satellites and radar

New radar technology being used by hydrologists

To provide more accurate rainfall amounts to farmers, researchers are using Dual Polarization Radar to estimate how much rain evaporates before hitting the ground.

http://www.deltafarmpress.com/technology/new-radar-technology-being-used-hydrologists

Climate change / global warming / sea level rise

Who shares similar experiences of climate change in a 1.5°C world and beyond?

A new framework to understand how uneven the effects of a 1.5°C world are for different countries around the world has been published today.

https://www.sciencedaily.com/releases/2018/06/180625130922.htm

Journals online

Quarterly Journal of the Royal Meteorological Society

Accepted Articles (Accepted, unedited articles published online and citable. The final edited and typeset version of record will appear in future.)

These Accepted Articles are now available on Wiley Online Library

RESEARCH ARTICLES

Coupling between radiative flux divergence and turbulence near the surface
Pierre Gentine, Gert-Jan Steeneveld, Bert G. Heusinkveld and Albert A.M. Holtslag
Accepted manuscript online: 26 JUN 2018 12:00AM EST | DOI: 10.1002/qj.3333

NOTES AND CORRESPONDENCE

Ozone sensitivity of tropical upper-troposphere and stratosphere temperature in the MetOffice Unified Model
Jiyoung Oh, Seok-Woo Son, Keith Williams, David Walters, Junsu Kim, Martin Willett, Paul Earnshaw, Andrew Bushell, Yoonjae Kim and Joowan Kim
Accepted manuscript online: 26 JUN 2018 12:00AM EST | DOI: 10.1002/qj.3346

RESEARCH ARTICLES

On the Rapid Intensification of Hurricane Wilma (2005). Part IV: Inner-Core Dynamics During the Steady RMW Stage
Nannan Qin, Da-Lin Zhang, William Miller and Chanh-Q Kieu
Accepted manuscript online: 25 JUN 2018 12:00AM EST | DOI: 10.1002/qj.3339

How far in advance can we predict changes in large-scale flow leading to severe cold conditions over Europe?
Laura Ferranti, Linus Magnusson, Frédéric Vitart and David S Richardson
Accepted manuscript online: 25 JUN 2018 12:00AM EST | DOI: 10.1002/qj.3341

Improvements in Ku-band scatterometer wind ambiguity removal using ASCAT-based empirical background error correlations
Jur Vogelzang and Ad Stoffelen
Accepted manuscript online: 25 JUN 2018 12:00AM EST | DOI: 10.1002/qj.3349

Atmospheric blocking and upper-level Rossby wave forecast skill dependence on model configuration
O. Martínez-Alvarado, J. W. Maddison, S. L. Gray and K. D. Williams
Accepted manuscript online: 25 JUN 2018 12:00AM EST | DOI: 10.1002/qj.3326

The generation of kinetic energy in tropical cyclones revisited
Roger K. Smith, Michael T. Montgomery and Gerard Kilroy
Accepted manuscript online: 25 JUN 2018 12:00AM EST | DOI: 10.1002/qj.3332

NOTES AND CORRESPONDENCE

On the approximation of the inverse error covariances of high resolution satellite altimetry data
M. Yaremchuk, J.M. D'Addezio, G. Panteleev and G. Jacobs
Accepted manuscript online: 25 JUN 2018 12:00AM EST | DOI: 10.1002/qj.3336

ADVANCES IN REMOTE SENSING OF RAINFALL AND SNOWFALL

Evaluation of CHIRPS Rainfall Estimates over Iran
R. Saeidizand, S. Sabetghadam, E. Tarnavsky and A. Pierleoni
Accepted manuscript online: 25 JUN 2018 12:00AM EST | DOI: 10.1002/qj.3342

Evaluation of TAPEER daily estimates and other GPM era products against dense gauge networks in West Africa, analyzing ground reference uncertainty
Marielle Gosset, Matias Alcoba, Remy Roca, Sophie Cloché and Guillaume Urbani
Accepted manuscript online: 25 JUN 2018 12:00AM EST | DOI: 10.1002/qj.3335

RESEARCH ARTICLES

Characteristics of monsoonal precipitating cloud systems over the Indian subcontinent derived from weather radar data
Kapil Dev Sindhu and G. S. Bhat
Accepted manuscript online: 23 JUN 2018 12:00AM EST | DOI: 10.1002/qj.3328

Revisiting entrainment relationships for shear-free and sheared convective boundary layers through large-eddy simulations
Cheng Liu, Evgeni Fedorovich and Jianping Huang
Accepted manuscript online: 23 JUN 2018 12:00AM EST | DOI: 10.1002/qj.3330

Laboratory measurements of the sedimentation velocity of hexagonal planar ice crystals
Rodrigo E. Bürgesser and Nesvit E. Castellano
Accepted manuscript online: 23 JUN 2018 12:00AM EST | DOI: 10.1002/qj.3321

Variability of urban surface temperatures and implications for aerodynamic energy exchange in unstable conditions
B. Crawford, C.S.B. Grimmond, A. Gabey, M. Marconcini, H.C. Ward and C. W. Kent
Accepted manuscript online: 23 JUN 2018 12:00AM EST | DOI: 10.1002/qj.3325

==========

Welcome to AMS News You Can Use.

Each week, we send out a sampling of recent news and items of interest in meteorology and related fields, as covered by various media outlets. Searchable archives are available online.

Most Powerful Hurricanes of All Time

24/7 Wall St. - 06/25/2018

season, the frequency of tropical cyclones is rarely an indication of how intense those storms may be when making landfall. Some of the most

WMO steps up action on water

ReliefWeb - 06/25/2018

that it needs to inform government development policies. “The leading role of WMO in operational hydrology is needed more than ever before,

Increase in storms could have 'catastrophic impact' on fishing industry

Phys.org - 06/25/2018

UK are projected to become more frequent and intense over the next two centuries and more dramatic storms are expected in the North Sea and

Could a Global Dust Storm Like the One on Mars Occur on Earth?

Weather Underground - 06/22/2018

the Southwest, according to Ken Waters, Warning Coordination Meteorologist for the National Weather Service in Phoenix, Arizona. Monsoonal

NASA study solves Greenland glacier mystery

UPI.com - 06/22/2018

"Most of the melting happens as the water rises up Tracy's face," said Josh Willis of NASA.

Groundwater Levels Could Trigger Major Earthquakes

LiveScience - 06/22/2018

On Aug. 24, 2014, an earthquake ripped through Northern California's Napa-Sonoma Valley. It was the largest in the San Francisco Bay Area in 25 years, leaving two dead and hundreds injured and causing damage that cost half a billion dollars. When Meredith Kraner, a geophysicist from the University

In the Southwest, ‘drought’ doesn’t tell the whole story

High Country News - 06/22/2018

Why ‘aridification’ is a better term for our new, more parched reality.

What can natural disasters teach the world?

Phys.org - 06/22/2018

since 1983, the El Nino phenomenon had seen super-storms become more frequent and more intense. "Population growth, rising sea levels,

When a Mars Simulation Goes Wrong

The Atlantic - 06/22/2018

crew and mission support are already showing. Last year, when Hurricane Harvey struck Texas and forced the displacement of thousands, NASA

Mars will come closer to Earth in the coming weeks than it has been in 15 years — here's how to see it

Connecticut Post - 06/21/2018

means it covers almost the entire planet, NASA said. "The storm is one of the most intense ever observed on the Red Planet," NASA said in a

West Antarctica's Springy Bedrock Is Some Rare Good News For Its Ice

Earther - 06/21/2018

us depends on if we take action to rein in climate change. The results, published Thursday in Science, concern the Amundsen Sea Embayment,

US emissions of methane – a potent greenhouse gas – are 60% higher than EPA thinks

USA Today - 06/21/2018

Humans are pumping at least 25 percent more methane into the atmosphere than previously thought. Video provided by Newsy Newslook The U.S. oil and gas industry emits 13 million metric tons of methane from its operations each year – nearly 60 percent more than currently estimated by the

Here's what global warming looks like month by month for 137 years

Axios - 06/21/2018

The globe is warmer now than at any time in modern civilization.

CO2 Can Directly Impact Extreme Weather, Research Suggests

Scientific American - 06/21/2018

even if it doesn't solve all the problems. Thomas Stocker, a climate scientist at the University of Bern in Switzerland, also suggests that

Massive atmospheric wave on Venus could explain the planet's weird rotation

Popular Science - 06/21/2018

More than a light Venusian breeze.

Heatwave threats rarely an urban priority, even as risks rise

Reuters US News - 06/21/2018

Such death rates should be easy to reduce, said Erin Coughlan, a climate scientist with the Red Cross Red Crescent Climate Centre, not least

Forecast predicts below-average hurricane activity

Phys.org - 06/21/2018

and former UA professor Elizabeth Ritchie developed the UA's hurricane forecasting model, which has proven to be extremely accurate over

Dust storm on Mars now covers entire planet

The Des Moines Register - 06/20/2018

using telescopes and spacecraft orbiting the red planet. Sometimes the storms are so intense and kick up enough dust that they can be seen

How Jupiter May Have Gifted Early Earth With Water

Smithsonian.com - 06/20/2018

A new model of the solar system suggest we have gas giants to thank for our watery world

The Oxygen Neutral Cloud Surrounding Jupiter's Volcanic Moon

Eos - Earth and Space Science News - 06/20/2018

Japan's Hisaki satellite takes measurements of faint oxygen emissions from Io.

Giant Clams Can Tell The History Of Typhoons And Predict Future Storms

Tech Times - 06/19/2018

The clams have increments on their shells, similar to tree rings, which give scientists an idea of their environment.

Dramatic video captures 'Tsunami from Heaven'

Mother Nature Network - Blog - 06/19/2018

the glacial lake, Maier looked on in astonishment as the storm dumped an intense amount of precipitation on the small region below. "One

In Wyoming wind, a conservative billionaire sees California's future

The Desert Sun - 06/19/2018

factor: Many Wyoming lawmakers reject the overwhelming scientific evidence showing that global warming, primarily caused by human beings,

Global warming, now brought to you by your local TV weathercaster

NBCNEWS.com - 06/20/2018

most of his career, he didn't focus much on global warming. He was skeptical about the science behind it, particularly the notion that human

New Research Could Improve Weather Forecasting for Farmers

Modern Farmer - 06/19/2018

New Research Could Improve Weather Forecasting for Farmers

Cities face dramatic rise in heat, flood risks by 2050, researchers say

AOL.com - 06/19/2018

they will need to do them quickly," Austin said. MORE DROUGHT, LESS WATER The research, carried out by the New York-based Urban Climate

Turbulence isn't just a science problem

The Conversation - 06/19/2018

Making science for people is a series that explores how humanities, arts and social sciences expertise is applied to problems typically corralled into the science and technology space. The first piece in the series is here. Today's article takes a look at turbulence as a question of science – and

How Can Drought Set After So Much Heavy Rain? It's Easier Than You Think

Forbes - 06/19/2018

Southeastern Texas is the perfect example of folks wondering how we can "have a drought again after all that rain."

What are extratropical cyclones?

Mother Nature Network - 06/19/2018

Tropical cyclones may make more headlines, but extratropical cyclones in the Arctic are on the rise.

World Has Only 20 Years to Meet Ambitious 1.5C Warming Threshold

Scientific American - 06/19/2018

"…..regarding the current state of the climate system," writes climate scientist Katarzyna Tokarska of the University of Edinburgh, in a comment

==========

My latest Weather Eye from John Maunder

https://www.sunlive.co.nz/blogs/12225-weather-and-philately.html

==========

Thanks to our regular contributors