



# New Zealand's contribution to Global Climate Observing Systems (GCOS)

Input to reporting requirements for  
New Zealand's third National Communication



New Zealand  
Climate Change  
Programme

Te Hōtaka  
Rerekētanga  
Āhuarangi o  
Aotearoa

# Table of contents

Atmospheric observing systems	1
Ocean observing systems	2
Terrestrial observing systems	2
Observing, data and monitoring system support for developing countries	3
Supplementary guidance to assist in preparation of detailed national reports on systematic observations	4
Meteorological and atmospheric composition	4
Oceanographic observations	8
Terrestrial observations	9
Space-based observing programmes	11
Abbreviations and acronyms	12



Satellite image courtesy of NOAA (National Oceanic and Atmospheric Administration/US Department of Commerce).



## Acknowledgements

**Preparation of the tables** W. Andrew Matthews, National Institute for Water and Atmospheric Research (NIWA)

**Introduction** David Wratt, National Institute for Water and Atmospheric Research (NIWA)



Ministry for the Environment, Wellington  
January 2002

# New Zealand's contribution to Global Climate Observing Systems (GCOS)

New Zealand has built up an archive of systematic atmospheric, oceanic and terrestrial observations. Details of these observations are tabulated in this report made in accordance with the United Nations Framework Convention on Climate Change Reporting Guidelines on Global Climate Change Observing Systems.

## Atmospheric observing systems

**Programmes:** There are two prime sources of New Zealand atmospheric observations relevant to climate change: The routine surface and upper air weather observations undertaken by the Meteorological Service of New Zealand, and dedicated climate observations and atmospheric constituent measurements undertaken by NIWA (the National Institute of Water and Atmospheric Research). NIWA is assisted by many voluntary observers, especially for rainfall monitoring. The Meteorological Service forwards its weather observations to NIWA, where they are archived in the National Climate Data Base along with NIWA's own measurements. The MetService and NIWA both play particular attention to quality control. NIWA's climate monitoring and archiving programme carries ISO9002 certification, and the Meteorological Service has ISO9001 certification.

**Support:** Funding for the core weather observations is from a Ministry of Transport contract to the Meteorological Service, with some extra observations funded out of commercial revenue. Dedicated climate observations are funded by a contract to NIWA from the Foundation for Research, Science and Technology (FRST), which recognises the climate database as a "database of national importance". Support for the climate database and monitoring has been at a constant dollar level for the past four years, and will be renegotiated by FRST in 2001 as part of their 'advancement' process for global environmental processes and change research. Atmospheric constituent measurements are also funded by FRST, as part of specific research programmes.

**National Plans:** NIWA's plans for the national climate network include continuing with gradual automation as finances permit, and NIWA staff regularly review the network in the light of user requirements. Planning for climate and atmospheric constituent measurements takes place as part of the FRST proposal and contracting process. Particular attention is paid to continuity of the 25 station reference climate network.

**Availability and Exchange:** NIWA is developing user-friendly web access to the national climate database, for implementation on a subscription basis during 2001. A subscription service to

recent climate data and maps of interest to farmers has already been established. NIWA staff answer data requests from both New Zealand and overseas. Arrangements and conditions for data provision are consistent with WMO Resolution 40(Cg-XII) on policy and practice for the exchange of meteorological and related data and products. Appropriate weather observations are forwarded to other countries by the Meteorological Service in real time, through WMO (World Meteorological Organization) networks. New Zealand provides climate and greenhouse gas monitoring data to international data centres under the WMO/ICSU (International Council of Scientific Unions) programmes which comprise the Global Climate Observing System.

**Weather and Climate Observations:** New Zealand has nine stations providing data to international data centres as part of the Global Surface Network (GSN) of GCOS, and four stations which report as part of the Global Upper Air Network (GUAN). There are 208 stations<sup>1</sup> that provide 9am climate observations to the national climate database, and 118 of these are automatic stations which also provide information at other times of day. There are currently 654 stations providing daily rainfall into the database. In addition, NIWA maintains satellite data archives for the New Zealand region of NOAA HRPT data (1992 – present), Global Geostationary Meteorological Satellite data products (August 1998 – present) and SeaStar SeaWiFS HRPT data (May 2000 – present).

**Atmospheric Constituents:** New Zealand has two stations providing atmospheric constituent data to international data centres as part of the Global Atmospheric Watch (GAW). Concentrations and isotope ratios in carbon dioxide, methane and nitrous oxide, as well as aerosol properties and non-methane hydrocarbons, are monitored at the Baring Head clean air monitoring station. Some of these gases are also monitored at two other sites, including one in the Antarctic. Surface ozone is monitored at seven stations (including one in Antarctica), column-integrated ozone concentrations are measured at two stations (including one in Antarctica), and a regular balloon-borne sampling programme for vertical profiles of ozone concentrations is operated at one station.

Table 1. Participation in the global atmospheric observing systems.

	GSNN	GUAN	GAW
How many stations are the responsibility of the Party?	10	4	2
How many of those are operating now?	10	4	2
How many of those are operating to GCOS standards now?	9	4	2
How many are expected to be operating in 2005?	10	4	2
How many are providing data to international data centres now?	9	4	2

<sup>1</sup> Of these 208 stations, 165 provide a sufficiently broad suite of climate measurements to be useful for national climate monitoring.

## Ocean observing systems

There are 11 open-coast sea level monitoring gauges operating around the New Zealand coast, and 13 coastal stations at which sea surface temperatures are measured. In addition, 90-year tide gauge records are held for the ports of Auckland, Wellington, Lyttleton and Dunedin, and shorter records for several other ports. Since the 1980's, New Zealand has maintained a network of around seven drifting buoys in the Tasman Sea, and two subsurface floats under the ARGI programme. In collaboration with Australian and United States research institutions, NIWA (New Zealand) maintains three high resolution XBT (Expendable Bathythermograph) sections in the Tasman/Coral Sea area to monitor vertical ocean temperature profiles.

Ocean waves are routinely monitored at five sites around the New Zealand coast. Remote coastal video cameras have been installed for long-term monitoring of beach conditions and erosion at seven sites.

The Ministry of Fisheries contracts out regular surveys of various fish species, in order to set maximum allowable catch limits and quotas. The resulting data sets may also be relevant for assessing climate change impacts on fisheries.

Table 2. **Participation in the global oceanographic observing systems.**

	VOS	SOOP	TIDE GAUGES	SFC DRIFTERS	SUB-SFC FLOATS	MOORED BUOYS	ASAP
For how many platforms is the Party responsible?	3 (Note 1)		11		2		
How many are providing data to international data centres?					2		
How many are expected to be operating in 2005?			12		10		

**Note:** See appendix 1 for explanation of acronyms

**Note 1:** NIWA (New Zealand) in collaboration with CSIRO (Australia) and Scripps Institution (USA) maintain 3 high resolution XBT sections in the Tasman/Coral Sea area.

## Terrestrial observing systems

There are approximately 500 streamflow gauges in operation around New Zealand, and around 300 ground-water monitoring sites. End of summer snowline elevations and photographic images of 46 glaciers from special aircraft flights are available annually since 1979, and the terminus positions of key glaciers in the Southern Alps are available from 1800 to the present.

A soil carbon monitoring system for New Zealand has been developed. The national Land Cover Database (LCDB) developed using SPOT satellite imagery acquired in 1995 and 1996 is planned to be updated every five years. The National Vegetation System databank (NVS) maintained by LandCare Research holds records from approximately 45,000 vegetation survey plots around New Zealand, including 12,000 permanent plots. In addition, Landcare Research maintains five New Zealand long-term ecological research and monitoring sites (LTER), and also monitors the presence or range of self-advective fungal and insect species.

The Ministry of Agriculture and Forestry maintains a planted forest database, and keeps records of carbon absorbed in new planting and lost through logging, fires and vegetation clearance.

Table 3. **Participation in the global terrestrial observing systems.**

	GTN-P	GTN-G	FLUXNET
How many sites are the responsibility of the Party?	Nil	48+ 7	Nil
How many of those are operating now?		48+ 7	
How many are providing data to international data centres now?		48+ 7	
How many are expected to be operating in 2005?		48+ 7	

### Observing, data and monitoring system support for developing countries

The New Zealand Meteorological Service, under a New Zealand Government contract, provides general assistance to Kiribati, Tuvalu, Samoa, Tokelau, Tonga, Niue and the Cook Islands in ensuring that weather and climate observing systems run smoothly and the quality of the observations is maintained. Targeted New Zealand Overseas Development Aid programmes have covered training in technical maintenance and observing practices in the Cook Islands, Tuvalu and the Tokelaus. The Meteorological Service also administers the WMO trust fund which supports upper air observations (part of GUAN) at Tuvalu, Kiribati and Penrhyn, and provides technical support regarding the operation of these stations.

NIWA also assists meteorological services undertaking climate observations in the South West Pacific, through informal advice when requested, by backing up climate records from many of the islands in the New Zealand climate database, and by providing data from this database to them when requested. In early 2000, NIWA ran an APN (Asia-Pacific Network) workshop at which South West Pacific Island countries shared their experience with climate monitoring, and reported on data availability and studies of climate trends. A further APN workshop is planned for November 2001, to help this group analyse their data for climate extremes. NIWA also hosted a CLIPS (Climate Information and Prediction Services) workshop for WMO Regional Association 5 in November 2000. As described earlier in this chapter, NIWA scientists work with staff from various organisations in the Pacific Islands and Australia, to produce the monthly *Island Climate Update*, which summarises recent climatic conditions and provides climate outlooks for the next three months.

## Supplementary guidance to assist in preparation of detailed national reports on systematic observations

### Meteorological and atmospheric composition

Table S1. **National climate monitoring systems for land surface (meteorological) observations.**

Systems	Climate parameters	Total # stns	Appropriate for characterizing national climate?			Time series #stations/platforms (#data digitized)			Are QC procedures adequate?			Metadata available? Total # stations (% digitized)	Continuity # expected operational in 2005
			Fully	Partly	No	>30y	>50y	>100y	Fully	Partly	No		
Stations useful for national climate monitoring purposes (specify parameters observed*)	Air Press	4			yes	1 (1)	1 (1)			yes	4 (100)	4	
	Cld layer	2			yes	2 (2)				yes	2(100)	2	
	Desc Wx	1			yes	1 (1)				yes	1 (100)	1	
	Humidity	60		yes		14 (14)	12 (12)			yes	60 (100)	60	
	Prec Liq	59		yes		12 (12)	12 (12)	4 (4)		yes	59 (100)	59	
	Radiation	25			yes	3 (3)				yes	25 (100)	25	
	Sunshine	21		yes		4 (4)				yes	21 (100)	21	
	Sfc air TT	65		yes		14 (14)	11 (11)	2 (2)		yes	65 (100)	65	
	Visib	10			yes	2 (2)				yes	10 (100)	10	
	Wind-run	34			yes	8 (8)	3 (3)			yes	34 (100)	34	
	Wind	23			yes	1 (1)				yes	23 (100)	23	
Stations reporting internationally	Air Press	31					1 (1)			yes		31	
	Cld layer	8								yes		8	
	Desc Wx	8				1 (1)				yes		8	
	Humidity	31				1 (1)				yes		31	
	Prec Liq	31					1 (1)			yes		31	
	Sfc air TT	31				1 (1)				yes		31	
	Visib	8				1 (1)				yes		8	
	Wind	30								yes		30	

Table S1. continued

Systems	Climate parameters	Total # stns	Appropriate for characterizing national climate?			Time series #stations/platforms (#data digitized)			Are QC procedures adequate?			Metadata available? Total # stations (% digitized)	Continuity # expected operational in 2005
			Fully	Partly	No	>30y	>50y	>100y	Fully	Partly	No		
CLIMAT Reporting Stations	Air Press	9				2 (2)	7 (7)			yes		9	
	Cld layer	2				2 (2)				yes		2	
	Desc Wx	1				1 (1)				yes		1	
	Humidity	10				3 (3)	6 (6)			yes		10	
	Prec Liq	9				1 (1)	6 (6)	1 (1)		yes		9	
	Radiation	8				5 (5)				yes		8	
	Sunshine	1				1 (1)				yes		1	
	Sfc air TT	9				2 (2)	5 (5)	1 (1)		yes		9	
	Visib	3				2 (2)	1 (1)			yes		3	
	Wind-run	8								yes		8	
	Wind	8				2 (2)	2 (2)			yes		8	
Reference Climate Stations	Air Press	26		yes		9 (9)	8 (8)	3 (3)		yes	26 (100)	26	
	Cld layer	8			yes	7 (7)				yes	8 (100)	8	
	Desc Wx	6			yes	6 (6)				yes	6 (100)	6	
	Humidity	44		yes		11 (11)	18 (18)	1 (1)		yes	44(100)	44	
	Prec Liq	45		yes		5 (5)	21 (21)	9 (9)		yes	45(100)	45	
	Radiation	31			yes	10 (10)				yes	31 (100)	31	
	Sunshine	8			yes	1 (1)	6 (6)			yes	8 (100)	8	
	Sfc air TT	48		yes		7 (7)	19 (19)	7 (7)		yes	48 (100)	48	
	Visib	14			yes	9 (9)	2 (2)			yes	(14 100)	14	
	Wind-run	32			yes	2 (2)	3 (3)	1 (1)		yes	32 (100)	32	
	Wind	29			yes	9 (9)	2 (2)			yes	29 (100)	29	

**Note for Systems:** Stns Useful for climate monitoring are additional station to those listed in the other 3 categories. Stations Reporting Internationally, CLIMAT and Reference Climate Stations may have stations included in more that one category. For CLIMAT and REF earlier stations have been checked and periods include early data.

**Note for Time Series** (Data Digitized): All monthly data done, much daily data still on forms.

**Note for Metadata Available:** Only basic metadata digitized, some information about instrumentation digitized

**Note for Continuity:** We do not anticipate changes in instrumentation. We do not anticipate a change in the number of stations.

Data is held in the National Climate Database, NIWA, Wellington.

Table S2. Available homogeneous data sets for land surface (meteorological) observations.

Data Set Name	Variable	# Stations or grid resolution	Describe period	References
Individual Station files	Monthly rainfall	25	Site dependant	NIWA Climate Database, NIWA, Wellington
Individual Station files	Monthly mean temperatures	25	Site dependant	NIWA Climate Database, NIWA, Wellington

Table S3. National climate monitoring systems for upper air observations (meteorological).

Systems useful for national climate monitoring purpose	Total # Stns or platforms	Appropriate for characterizing national climate?			Time Series #stations/platforms (# data digitized)				Are QC procedures adequate?			Metadata available? Total # stations (% digitized)	Continuity? # expected operational in 2005
		Fully	Partly	No	>5y	>10y	>30y	>50y	Fully	Partly	No		
Radiosonde stations	5	yes				2 (2)	3 (3)		yes			5 (100)	5
Wind-only stations	6	yes			4 (4)	2 (2)			yes			6 (100)	6
Stations reporting Internationally	8				1 (1)	4 (4)	3 (3)		yes				8
CLIMAT TEMP reporting stations	4					1 (1)	3 (3)		yes				4
ASAP stations													
Profilers*													
Aircraft (land locations)*	3*												3
GPS*													
Others (eg satellite-based)*													
Total Upper Air Network		yes											

**Notes:**

Aircraft (land locations) are Aircraft Meteorological Data Relay (AMDR) stations and have been operating for only 2 years.

Climat Temp stations are also recorded in "Radiosonde Stations"

Stations reporting internationally are a subset of the "Radiosonde Stations" plus the "Wind-only" stations.



Table S4. Available homogeneous data sets for upper air observations (meteorological).

Data Set Name	Variable	# Stations or grid resolution	Describe period	References
None				
None				
None				

Table S5. National climate monitoring systems for atmospheric constituents.

Components	Total # stations or platforms	Appropriate for characterizing national climate?			Time series #stations/platforms (# data digitized)				Are QC procedures adequate?			Metadata available? Total # stations (% digitized)	Continuity? # expected operational in 2005
		Fully	Partly	No	>10y	>20y	>30y	>50y	Fully	Partly	No		
CO <sub>2</sub> Stations	1	yes			1 (1)				yes			x	1
Ozone (surface)	7 (note 1)		yes		-				6	1		6 (86)	6
Ozone (column)	2 (note 1)	yes			2 (2)				yes			2 (100)	2
Ozone (profile)	1	yes			1 (1)				yes			1 (100)	1
Atmospheric Water Vapor	6		yes		-				yes			6 (100)	6
Other Greenhouse Gases	3 (note 1+2)	yes			3 (3)				yes			2 (66)	3
Aerosol Measurements	2		yes		1 (1)				1	1		1 (50)	21

**Note 1:** One Station at Scott Base, Antarctica

**Note 2:** At one site, N<sub>2</sub>O and CH<sub>4</sub> only

Table S6. Available homogeneous data sets for atmospheric constituents.

Data Set Name	Variable	# Stations or grid resolution	Describe period	References
NIWA Assimilated data set	Ozone	Global daily zonal means – 2° latitude	Nov. 1978 –Dec. 2000	Bodeker et al (accepted 2001) JGR

**Reference** Bodeker, Scott, Kreher and McKenzie (accepted 2001) Global Ozone Trends in potential vorticity coordinates using TOMS and GOME intercompared against the Dobson Network: 1978 –1998, Journal of Geophysical Research.

## Oceanographic observations

Table S7. National climate monitoring systems for oceanographic observations.

Network component	Total # stns	Appropriate for characterizing national/regional climate?			Time series #stations/platforms (#data digitized)			Are QC procedures adequate?			Metadata available? Total # stations (% digitized)	Continuity # expected operational in 2005
		Fully	Partly	No	>30y	>50y	>100y	Fully	Partly	No		
Sea Level e.g., tide gauges	11	yes			8 years to date			yes			11 (100)	12
SST (coastal stations)	13	yes			yes			yes			13 (100)	13
Meteorological observation from drifting buoys (e.g., temperature, precipitation, pressure)	7				15 years to date			yes			7 (see note 1)	7
Sub-Surface Profiles												
Ocean Circulation	Research mode											
Carbon Fluxes	Research mode											
Energy Fluxes	Research mode											

**Note 1:** Data from drifting buoys not held in National Climate Database

Table S8. Available homogeneous data sets for oceanographic observations.

Integrated Data Sets Name and Brief Description	Variable	Platforms and/or grid resolution	Describe period	References
NIWA SST Archive (NSA)	SST (validated)	Retrieved from NOAAs 11, 12, 14, 15, 16. at 1.1 km resolution over a 3504 x 3504 grid	1992 to present	Uddstrom, M.J. and Oien, N.O. 1999: On the use of high resolution satellite data to describe the spatial and temporal variability of sea surface temperatures in the New Zealand Region. Journal of Geophysical Research (Oceans) <b>104</b> , C9, 20729 – 20751.
NSA Climatology	SST Monthly Means and Anomalies	3504 x 3504 by 1.1 km resolution	January 1992 to present	As above.
Drifting Buoy Archive	MSLP, SST, Air Temp (some u, v)	Meteorological drifters within 4000km of Wellington	January 1992 to present	As above.

## Terrestrial observations

Table S9. National climate monitoring systems for terrestrial observations.

Systems useful for national climate monitoring	Total # stations	Appropriate for characterizing national climate?			Time Series # stations/platforms (#data digitized)			Are QC procedures adequate?			Metadata available? Total # Stations (% digitized)	Continuity? # expected operational in 2005
		Fully	Partly	No	>30y	>50y	>100y	Fully	Partly	No		
River discharge (streamflow gauges)	500+ (see Note 1)	40	200+		80 (80)	50 (50)		Yes (Note 2)			yes	yes (100%)
Ground water storage (e.g., boreholes)	300+	50+	200+		50 (50)	30 (30)			yes		50%	90%
Snow	7 (see note 3) 46 indicator glaciers	yes	yes		7 (7) Since 1979			yes	yes		Photographic images	7
Glaciers	48 (see note 4) 46 indicator glaciers	yes	yes			3 (3) Since 1979		yes	yes		48 (48) Photographic images	48 46 indicator glaciers
Permafrost												
Ice	See glaciers above											
FluxNet												
Radiation	Research mode											
Soil	(see note 5)											

**Note 1:** Reference: Pearson, C.P., 'Changes to New Zealand's National Hydrometric Network in the 1990s', *Journal of Hydrology (NZ)*, **37**(1): 1-17, 1998.

**Note 2:** Reference: Hudson, H.R., McMillan, D.A., Pearson, C.P., 'Quality assurance in hydrological measurement', *Hydrological Sciences - Journal - des Sciences Hydrologiques*, **44**(5), 1999.

**Note 3:** Snow observations mainly of skifields of snow depth, water equivalent and density. Not included are snow estimates made from modelling and satellite analysis. Modelling data of snow covered area and total water stored as snow is available for 1930 to 1998. Satellite observations of snow covered area are available for 1985 to 2000.

**Note 4:** Data for New Zealand glaciers is available from 3 sources:

- End of summer snowline elevations (a surrogate for massbalance) for the period 1978–2001
- terminus position of key glaciers in the Southern Alps available from 1800–2001
- photographic images of 46 glaciers made each year from special aircraft flights from 1979 to the present.

**Note 5:** A soil carbon monitoring system for New Zealand using country-specific land use and soil carbon information has been developed. The system pre-stratifies the country by soil type, climate, and land-use. Soils were placed in six IPCC soil categories; Podzols were added as they are widespread throughout New Zealand. Temperature was stratified into two categories, each spanning 7°C. Moisture categories were based on water balance, and included five categories. Temperature and moisture stratification was based on the USDA Soil Classification system. Land-use (ten categories) was based on 1980's survey data initially, but now uses the national Land Cover Database (LCDB) developed using SPOT satellite imagery for New Zealand acquired in 1995/1996. Overall, 39 combinations of these three factors (cells) described 93% of the New Zealand landscape. Geo-referenced soil carbon data (carbon concentration and bulk density) was used to quantify average soil carbon for each of the 39 cells. Aggregating the polygons gave an estimated 1990 soil carbon baseline of  $1152 \pm 44$ ,  $1439 \pm 73$ , and  $1602 \pm 167$  Mt C (mean  $\pm$ SD) for the 0-0.1, 0.1-0.3, and 0.3-1.0m depth increments. The system is designed to quantify equilibrium changes in soil C associated with land-use change. Land use is planned to be updated from new LCDB's produced every five years.

Table S10. National climate monitoring systems for ecological observations

	Total # stations	Appropriate for characterizing national climate?			Time Series # stations/platforms (#data digitized)				Are QC procedures adequate?			Metadata available? Total # stations (% digitized)	Continuity? # expected operational in 2005
		Fully	Partly	No	>30y	>50y	>100y	>300y	Fully	Partly	No		
Phenological	see note "Phenological"												
Biomass Change	see note "Vegetation"												
Vegetation Type	12,000 see note "Vegetation"		yes			1200 (1200)			yes			1200 (100)	1200
Land Cover	12,000 see note "Vegetation"		yes			1200 (1200)			yes			1200 (100)	1200
Fire Distribution													
Land Use Change	see note "Forest"												
PaleoClimate	60		yes				60		yes			60 (50)	60 records
Forest Catchment	see note "Forest"		yes		1 (1)				yes			1 (100)	1

**Note Phenological:** Range of phenological series: native plant flowerings; shellfish numbers and depths; penguin numbers etc. Not yet in systematic data base.

**Note Forest:** Purukohukohu Catchment experiment in Puruki catchment from 1968 with soil type and chemistry, biomass productivity, hydrology and rainfall for 3 land use types: (1) native forest, (2) managed pasture, (3) managed pine forest. Measurements through full forest rotation and now in second cycle. **Reference:** Beets, P.N. and Brownlie, R.K., 'Puruki experimental catchment; site, climate, forest management and research', *NZ Journal of Forest Science*, **17**, 137-160, 1987.

**Note Vegetation:** The National Vegetation Survey Databank (NVS – 'Nivs') is a physical archive and computer databank containing records from approximately 45,000 vegetation survey plots, including data from over 12,000 permanent plots. NVS provides a unique record, spanning more than 50 years, of indigenous and exotic plants in New Zealand's terrestrial ecosystems, from Northland to Stewart Island and the Kermadec and Chatham islands. A broad range of habitats are covered, with special emphasis on indigenous forests and grasslands. The Permanent Plot Data in the archive are from where fixed area plots or transects have been established, and the vegetation has been measured precisely (e.g. tagged trees, sapling and seedling counts, species lists). Assessments of these 12,000 permanent plots in NVS provides the base for monitoring vegetation changes as well as the effects of management. Nearly all follow standard methods, e.g. in forests all trees within a fixed area (usually 400m<sup>2</sup>) are permanently tagged to allow repeat measurements.

- Most forest plots contain permanently marked seedling subplots to determine changes in seedling and herbaceous composition with time.
- Most are along objectively located transects.
- More than 80% have NZMS grid references (for forest plots, >95%).

**Reference** [www.landcare.cri.nz/science/nvs/](http://www.landcare.cri.nz/science/nvs/)

Table S11. Available homogeneous data sets for sustained terrestrial and ecological observations.

Data set name	Variable	# Stations or grid resolution	Describe period	References
The National Vegetation Survey Databank	tree diameters	12,000	Regular measurement	<a href="http://www.landcare.cri.nz/science/nvs/">http://www.landcare.cri.nz/science/nvs/</a>
The National Vegetation Survey Databank	seedling density	12,000	Regular measurement	<a href="http://www.landcare.cri.nz/science/nvs/">http://www.landcare.cri.nz/science/nvs/</a>
The National Vegetation Survey Databank	plant species composition	12,000	Regular measurement	<a href="http://www.landcare.cri.nz/science/nvs/">http://www.landcare.cri.nz/science/nvs/</a>

## Space-based observing programmes

New Zealand researchers are actively involved with a range of climate change satellite projects with collaborators in the USA, Europe and Japan. Of particular importance is the role New Zealand plays in the validation, and on going calibration, of these satellite experiments through co-relative measurements made in New Zealand and Antarctica. Understanding the internal drift in satellite instrumentation is vital if satellite data is to be used for credible trend analysis.

In addition, the National Institute of Water and Atmospheric Research (NIWA) holds three satellite data archives:-

- NOAA HRPT data (in satellite data stream format) 1992 – present, for NOAAs 10, 11, 12, 14, 15, 16.
- Geostationary Meteorological Satellite (GMS) data products (imagery), August 1998 to present.
- SeaStar SeaWiFS HRPT data (in satellite data stream format) May 2000 to the present.

NIWA has developed a 1km resolution collocation archive of meteorological radar (three radars), Advanced Microwave Sounder Unit (AMSU) (20 spectral intervals), High Resolution InfraRed Sounder (HIRS) (20 spectral channels), Advanced Very High Resolution Radiometer (AVHRR) (5/6 channels), SST, cloud mask and cloud-type, for all data derived from NOAA15 (from August 1998) and NOAA16 (from April 2001). This is called the NIWA ATOVS Collocation Archive (NACA) and is being used to develop algorithms that may be used to monitor the hydrological cycle over area of radius 2000 km from Wellington (see Korpela, A.V., and Uddstrom, M.J., 2001: The use of ATOVS, AVHRR and radar data in the development and validation of rain-rate algorithms. In the Technical Proceedings of the Eleventh International ATOVS Study Conference, Budapest, Hungary, 20 – 26 September, 2000. 12 pp).

NIWA has developed a cloud-type and amount algorithm that will be used during 2001/02 to derive a cloud climatology (at 1 km resolution) over a region of 4672 x 4976 km (centred on New Zealand) and for the period 1992 to the present (Uddstrom, M.J., J.A. McGregor, W.R. Gray and J.W. Kidson: 2001: A high resolution analysis of cloud amount and type over complex topography. *Journal of Applied Meteorology* **40**, 16-33).

NOAA16 AVHRR data will be used to derive high resolution (1 km) daily and weekly snow-cover analyses for the New Zealand region (beginning from April 2001), using a Bayesian method based on Uddstrom M.J. and W.R. Gray, 1996: Satellite cloud classification and rain rate estimation using multi-spectral radiances and measures of spatial texture. *Journal of Applied Meteorology*, **35**, 839 – 858.

Glaciers in the Southern Alps are also monitored as part of the international satellite project GLIMS (Global Land Ice Mapping from Space).

## Abbreviations and acronyms

<b>APN</b>	Asia-Pacific Network	<b>LCDB</b>	Land Cover Data Base
<b>ASAP</b>	Automated Shipboard Aerological Programme	<b>LTER</b>	Long Term Ecological Research
<b>ATOVS</b>	Advanced TIROS Operational Vertical Sounder	<b>NACA</b>	NIWA ATOVS Collocation Archive
<b>AVHRR</b>	Advanced Very High Resolution Radiometer	<b>NIWA</b>	National Institute for Water and Atmospheric Research (New Zealand)
<b>CLIPS</b>	Climate Information and Prediction Services	<b>NOAA</b>	National Oceanic and Atmospheric Administration (USA)
<b>FLUXNET</b>	Global Terrestrial Network – Carbon	<b>NSA</b>	NIWA SST Archive
<b>FRST</b>	Foundation for Research, Science and Technology	<b>NVS</b>	National Vegetation System
<b>GAW</b>	Global Atmosphere Watch of WMO	<b>NZMS</b>	New Zealand Map Series
<b>GCOS</b>	Global Climate Observing System	<b>SFC</b>	Surface
<b>GLIMS</b>	Global Land Ice Mapping from Space	<b>SOOP</b>	Ship of Opportunity Programme
<b>GMS</b>	Geostationary Meteorological Satellite	<b>SST</b>	Sea Surface Temperature
<b>GOOS</b>	Global Ocean Observing System	<b>Sub-SFC</b>	Sub-surface
<b>GSN</b>	GCOS Surface Network	<b>TIROS</b>	Television Infrared Observation Satellite
<b>GTN-G</b>	Global Terrestrial Network – Glaciers	<b>UNEP</b>	United Nations Environment Programme
<b>GTN-P</b>	Global Terrestrial Network – Permafrost	<b>UNESCO</b>	United Nations Educational, Scientific and Cultural Organization
<b>GTOS</b>	Global Terrestrial Observation System	<b>USDA</b>	United States Department of Agriculture
<b>GUAN</b>	GCOS Upper Air Network	<b>VOS</b>	Volunteer Observing Ship
<b>HIRS</b>	High Resolution Infrared Sounder	<b>WCRP</b>	World Climate Research Programme
<b>ICSU</b>	International Council for Science	<b>WHYCOS</b>	World Hydrological Cycle Observing System
<b>IGBP</b>	International Geosphere-Biosphere Programme	<b>WMO</b>	World Meteorological Organization
<b>IGOS</b>	Integrated Global Observing Strategy	<b>WWW</b>	World Weather Watch of WMO
<b>IOC</b>	Intergovernmental Oceanographic Commission of UNESCO		

