

# The Development of an Enhanced Tropical Cyclone Tracks Database for the Southwest Pacific from 1840-2009

Briefing for the “3<sup>rd</sup> ACRE Workshop”

Baltimore, Maryland; 5-November-2010

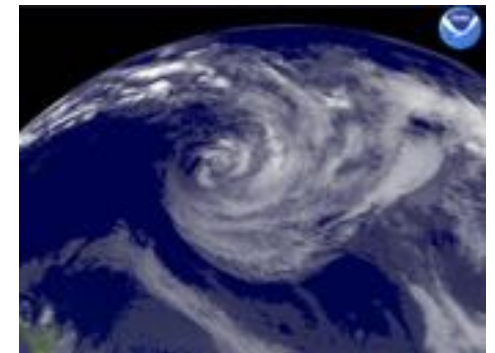
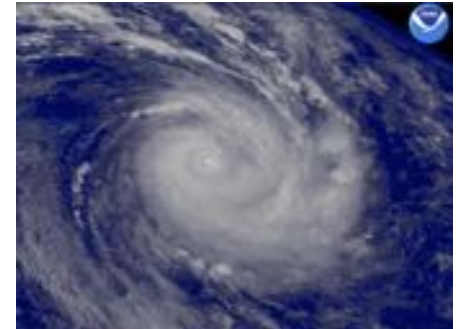
Presented by: **Howard J. Diamond, U.S. GCOS Program Manager at NCDC and Director, World Data Center for Meteorology**



# Agenda

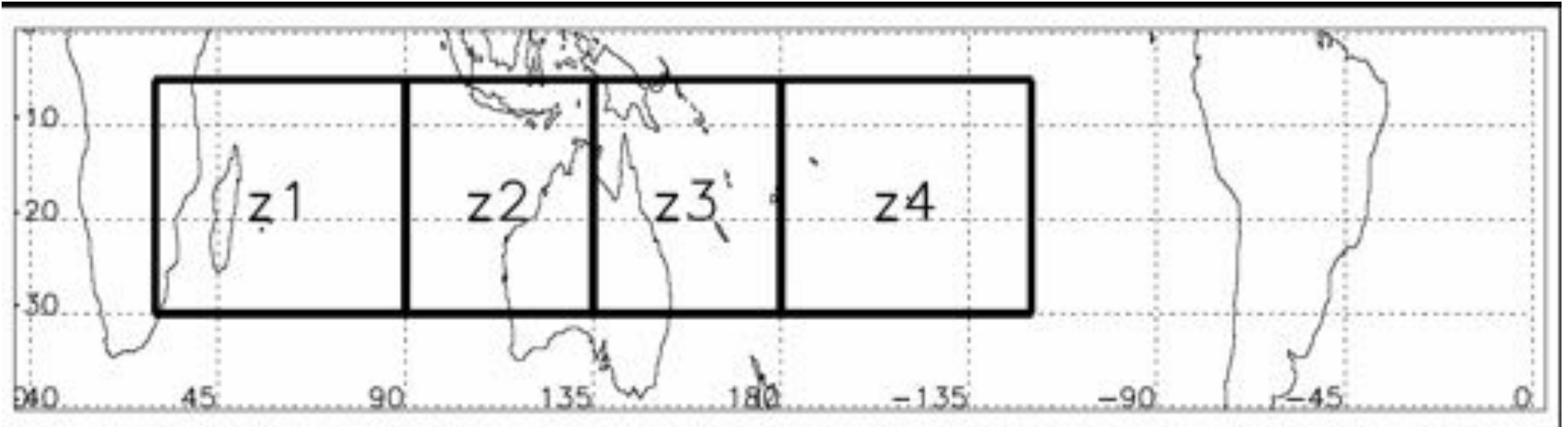
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- ▶ Area of Study
- ▶ Limitations
- ▶ Data Sources
- ▶ Collaborative Institutions
- ▶ Methodology
- ▶ International Best Tracks Archive for Climate Stewardship - IBTrACS

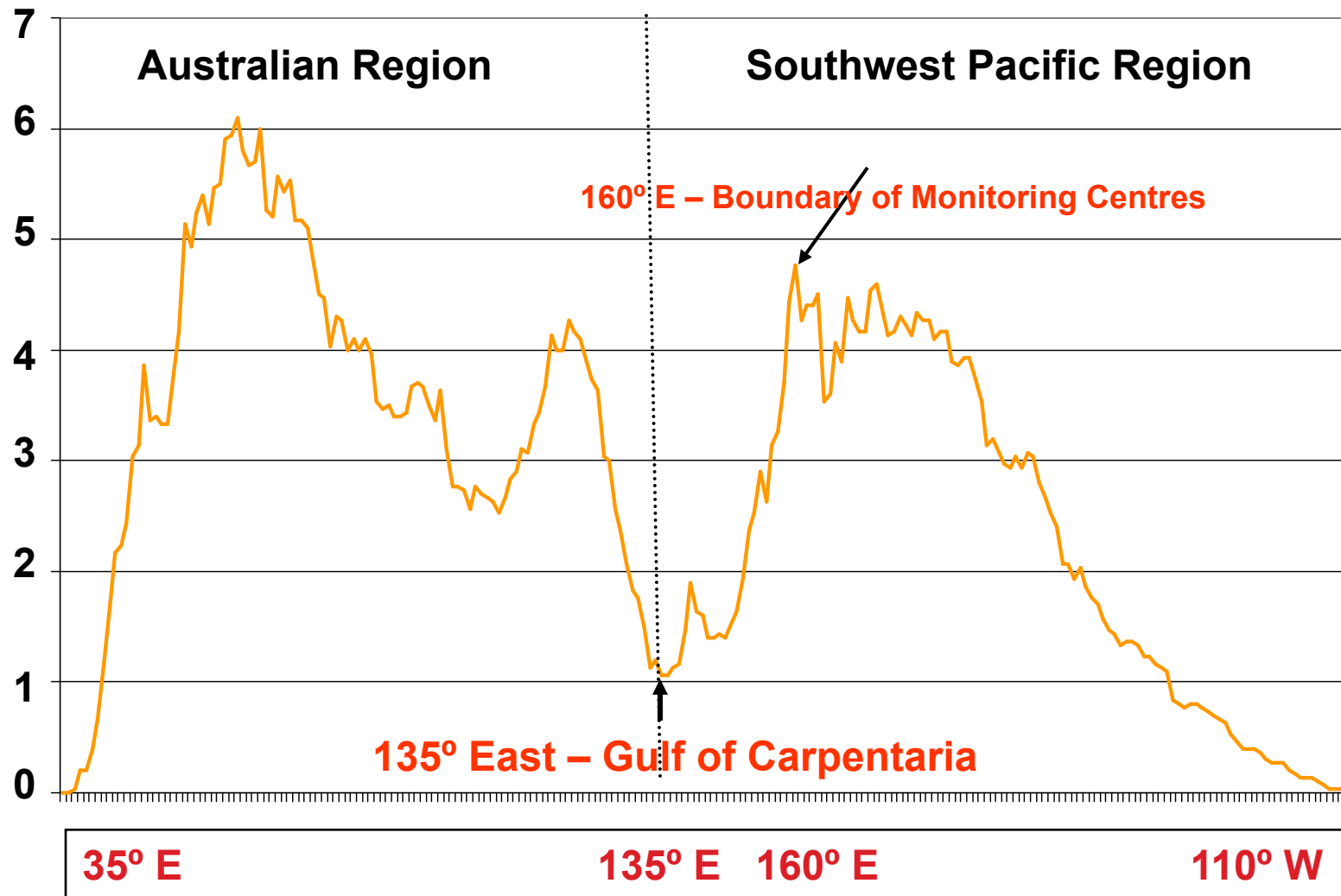


# Area of Study

- Latitude 5-40° S; Longitude 135° E; including the Gulf of Carpentaria (Zones Z3 and Z4)



# Selection of Area of Study Based on Climatology



**Average annual profile of tropical cyclone longitude crossings for the Southern Hemisphere (Natural Break at 135° East) – Kuleshov, 2006**



# Limitations

- **Data, Data, Data!**
- **Reliable satellite data with TC track and intensity information is relatively new**
- **Satellite era essentially begins in 1969; but reliable intensity information begins in the 1982-83 timeframe**
- **A good % of the data that does exist is not climate quality (e.g., homogeneous); this presents problems in drawing historical relationships to correlating changes to what is happening today**
- **Possible discontinuities in the record from different monitoring centre procedures involved in classification of TCs**



# Data Sources

- **Satellite Data Record begins in 1969**
- **Australian Bureau of Meteorology TC Database**
- **NZ Met Service and NIWA TC Databases**
- **Paper track and intensity data prior to 1969**
  - **NZ Met Service and New Caledonia**
  - **Solomon Islands**
  - **Cook Islands**
  - **Fiji**
  - **Others?? Looking for any non-digital TC data sources that can be included (e.g., tracks, intensity, etc. prior to 1969)**
- **Other data related to TCs**
  - **Identification of TCs along the South Pacific Convergence Zone; looking to identify storms that might not have been identified before—e.g., either as a TC itself, or Cat 3-5 storms not previously identified**
  - **Teleconnections (e.g., El Nino/La Nina)**
  - **Extreme precipitation events**
  - **Sea Surface Temperature (SST)**

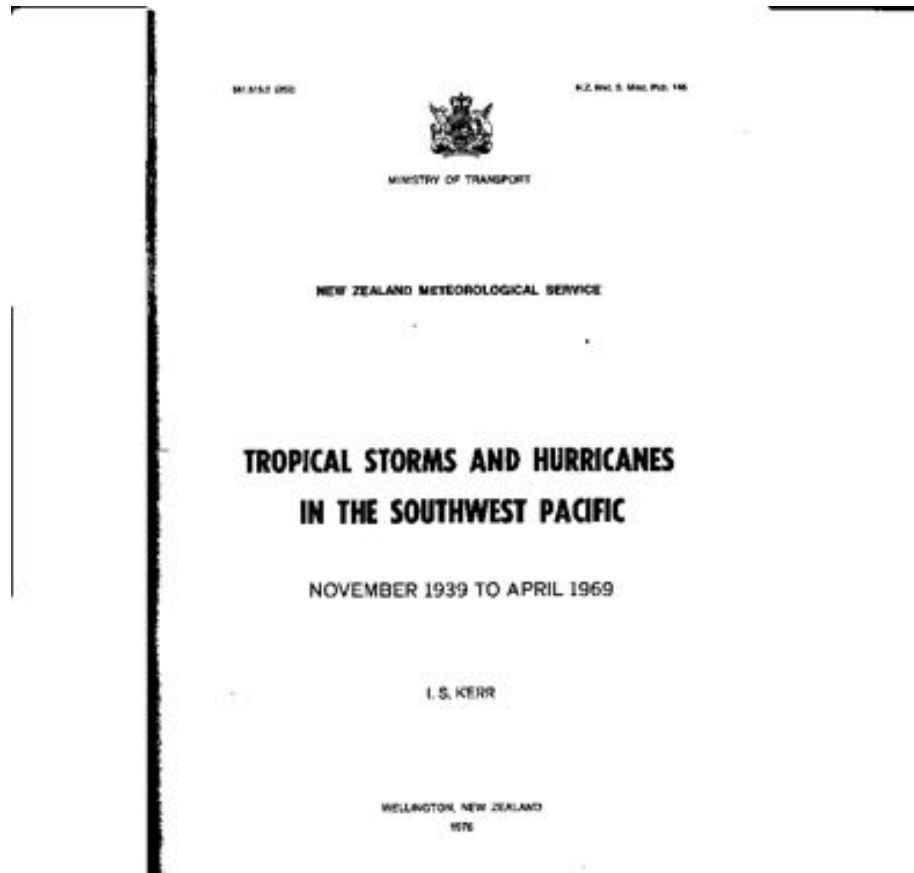


# Collaborative Institutions

- Australian Bureau of Meteorology
- International Pacific Research Center
- Regional Meteorological Service Directors
  - Cook Islands Meteorological Service
  - Fiji Meteorological Service
  - MeteoFrance in French Polynesia and New Caledonia
  - Samoa Meteorological Service
  - Solomon Islands Meteorological Service
  - Tongan Meteorological Service
  - Vanuatu Meteorological Service
- NZ Meteorological Service
- NZ National Institute of Water and Atmosphere (NIWA)
- Secretariat of the Pacific Regional Environment Programme
- South Pacific Applied Geosciences Commission
- University of Guam
- University of Hawaii
- University of Melbourne



# NZ Met Service





# NZ Met Service

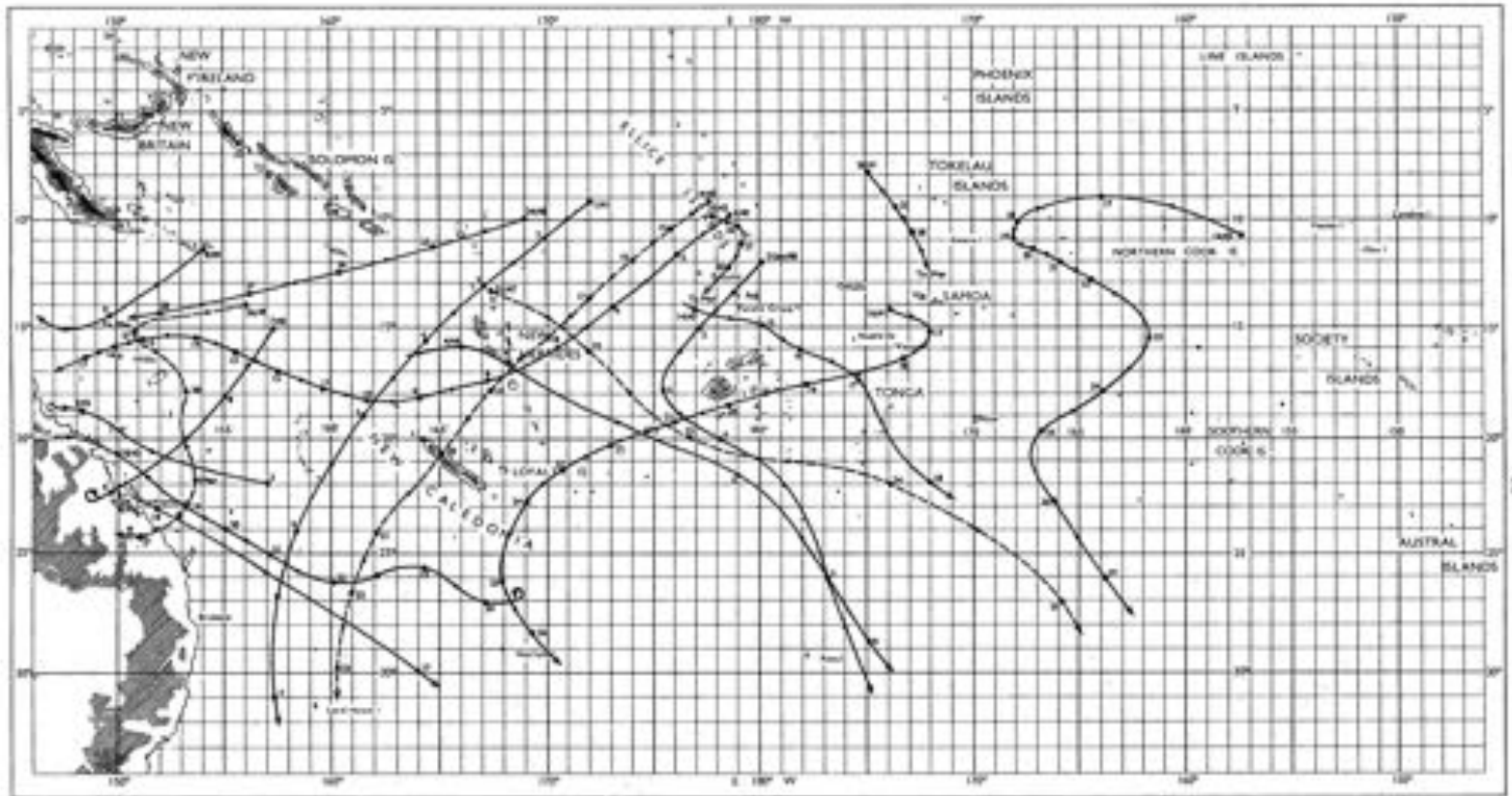


CHART 13 Tracks of tropical storms and hurricanes  
February 1940 to 1949 inclusive.

**Beginning**

- Position of centre at 0000 G.M.T. 5th (month of chart) 1958
- Position of centre at 1200 G.M.T. 5th.
- Position of centre at 0000 G.M.T. 6th.

**KEY**

- End
- Subsequent history unknown or continues south of 30°S.
- ⊙ Filled or absorbed in extra-tropical trough.
- Track continued on next chart.



# New Caledonia

NOUVELLE-CALÉDONIE ET DÉPENDANCES

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SERVICE DE LA MÉTÉOROLOGIE

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LES

CYCLONES TROPICAUX  
EN NOUVELLE-CALÉDONIE

AU COURS D'UN SIÈCLE (1852 - 1951)

PAR

J. GIOVANELLI

Ingénieur en Chef de la Météorologie

Chef du Service

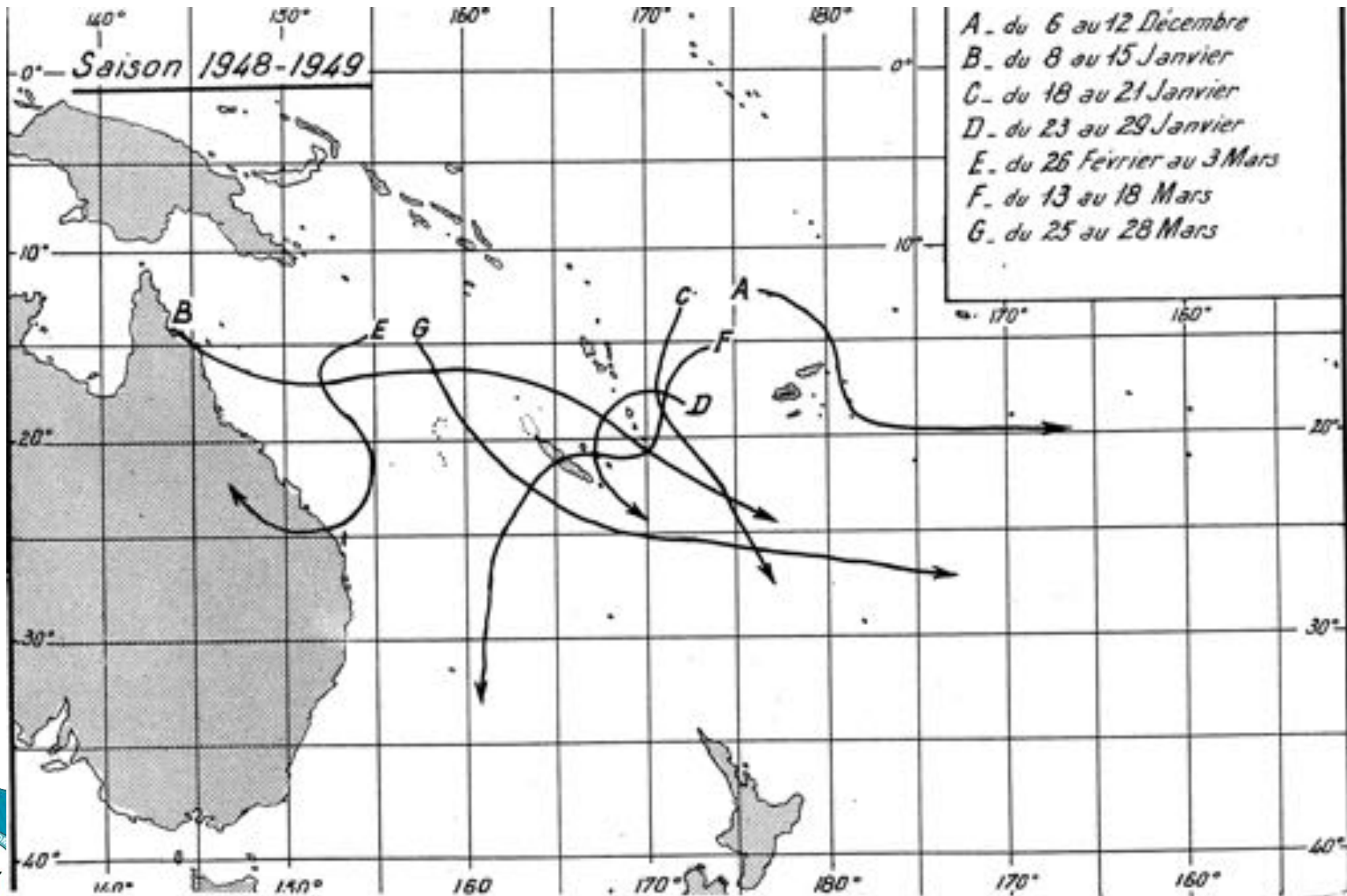
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Nouméa avril 1952

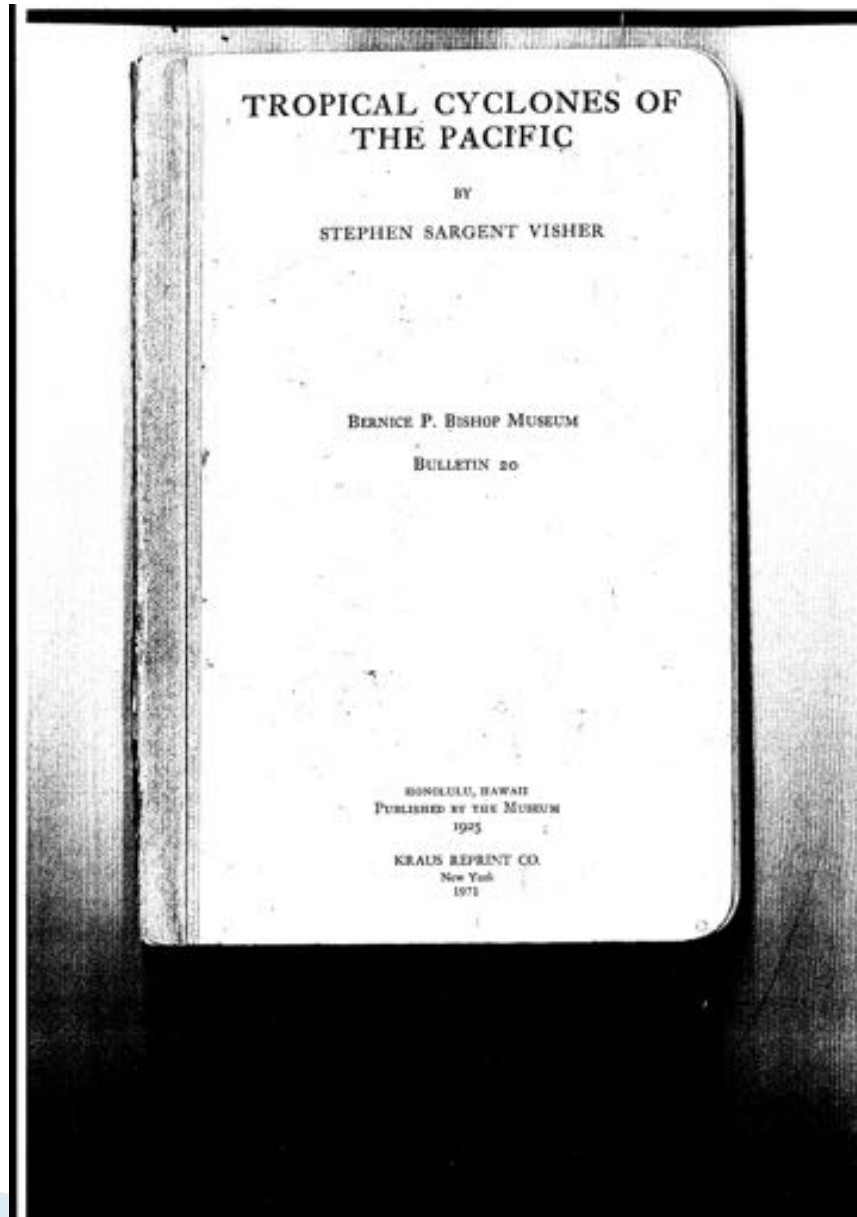
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# New Caledonia



# Visher, 1925



# Visher, 1925

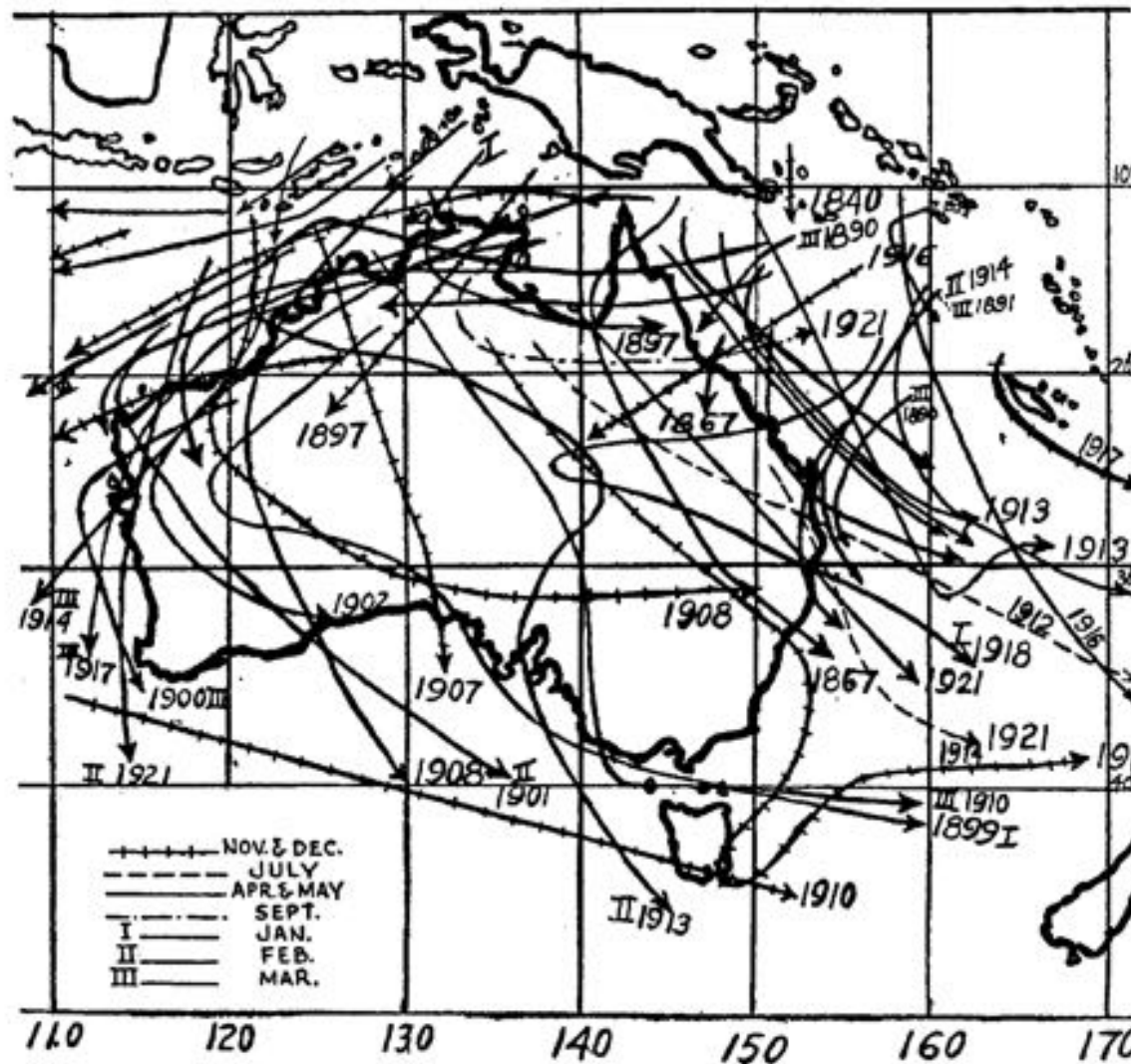
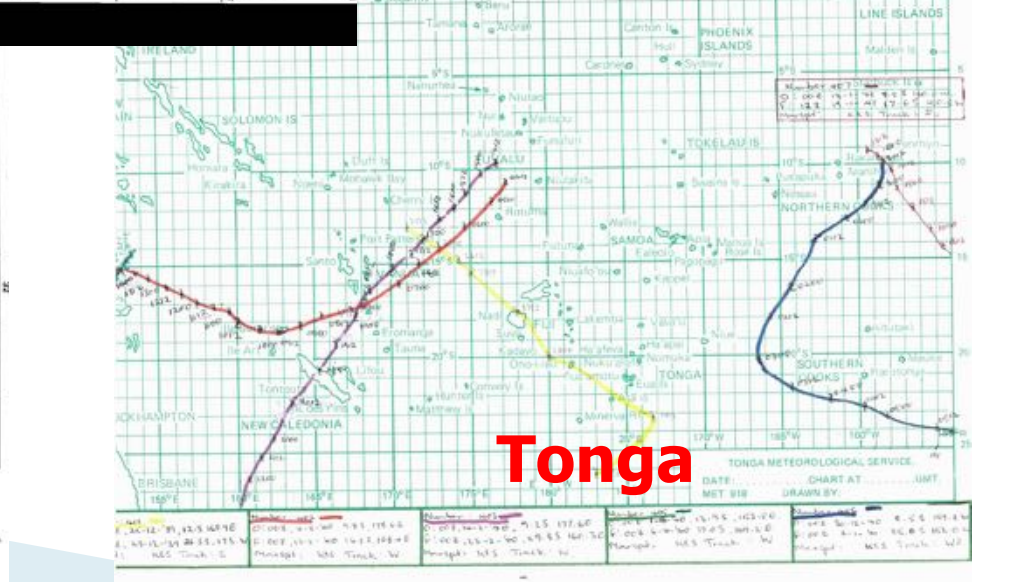
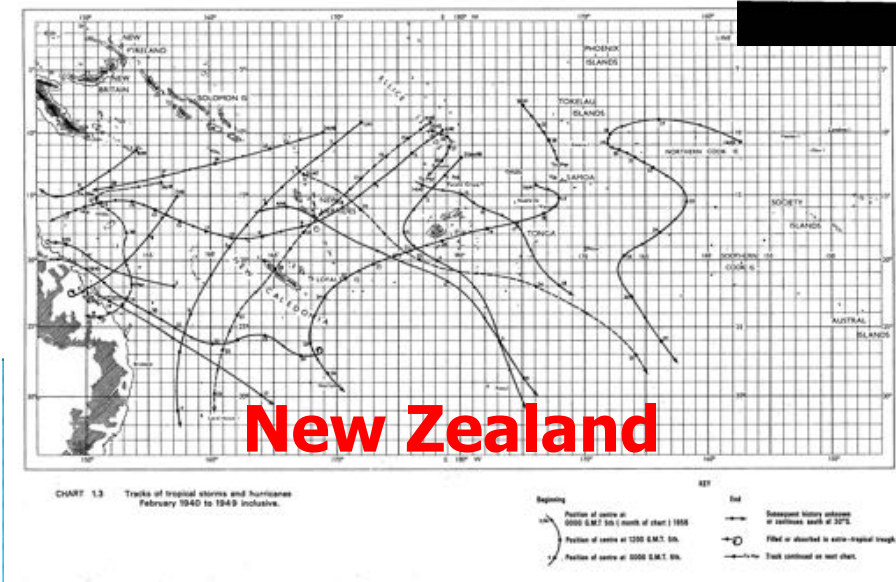
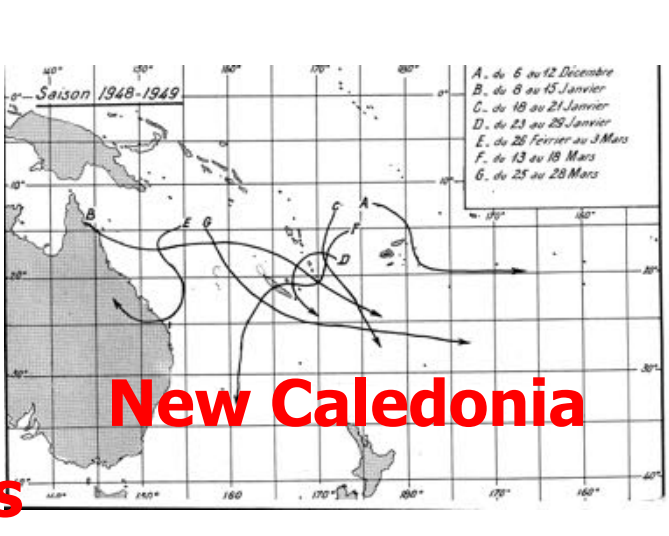
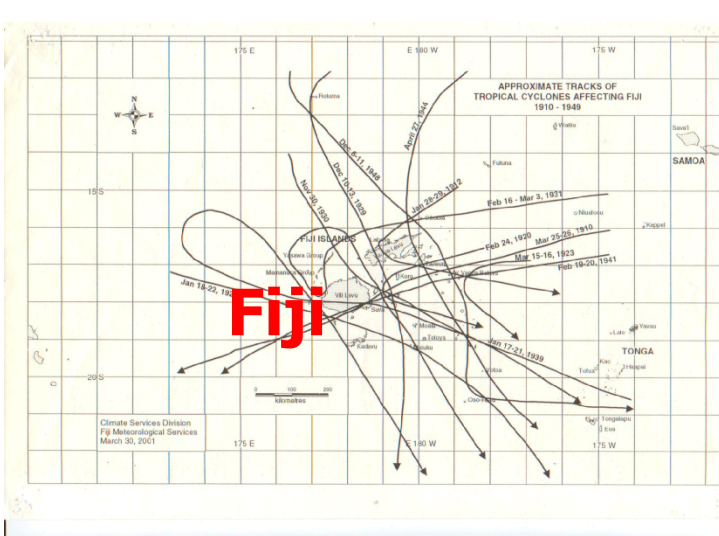


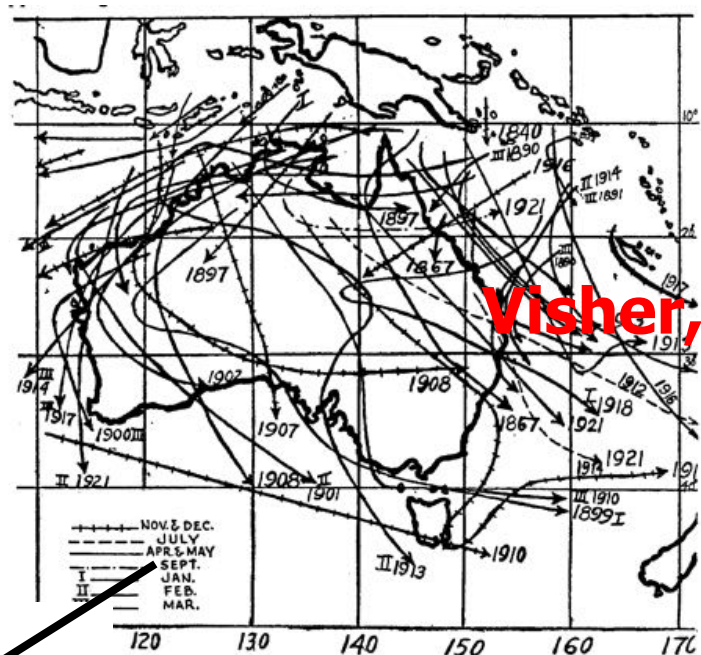
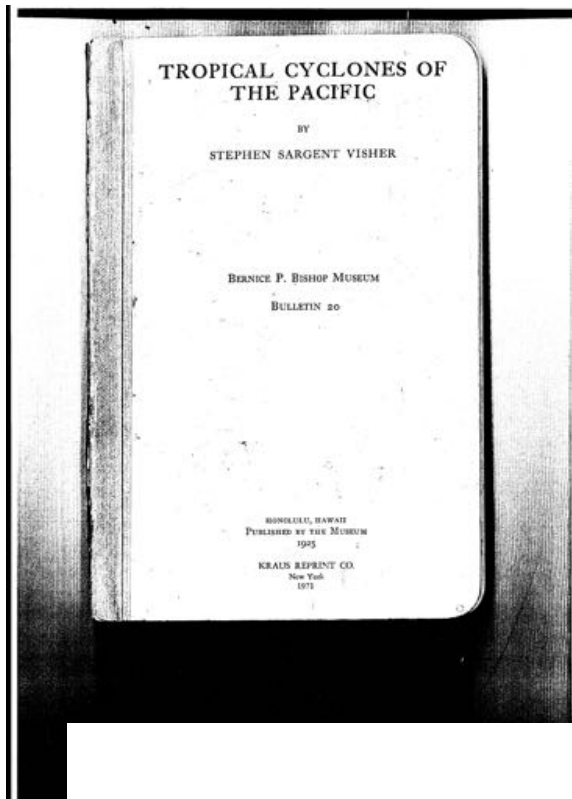
FIGURE 16.—Map showing tracks of representative Australian hurricanes. (Traced from Australian Daily Weather Maps.)



# Adding New Data – SW Pacific Basin: Digitization via ArcGIS is now Complete and will be Added to the Database Soon

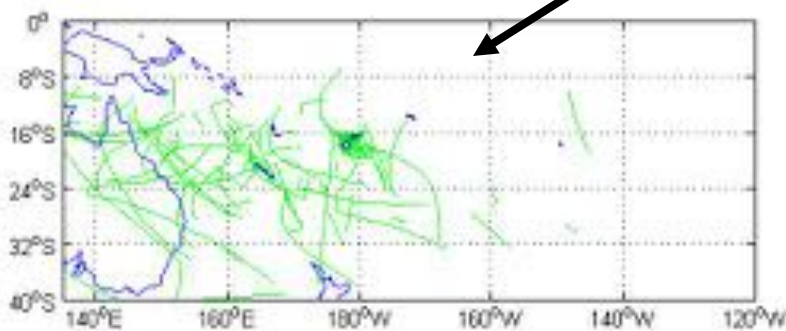


# More Paper Data – Dating Back into the 1800s

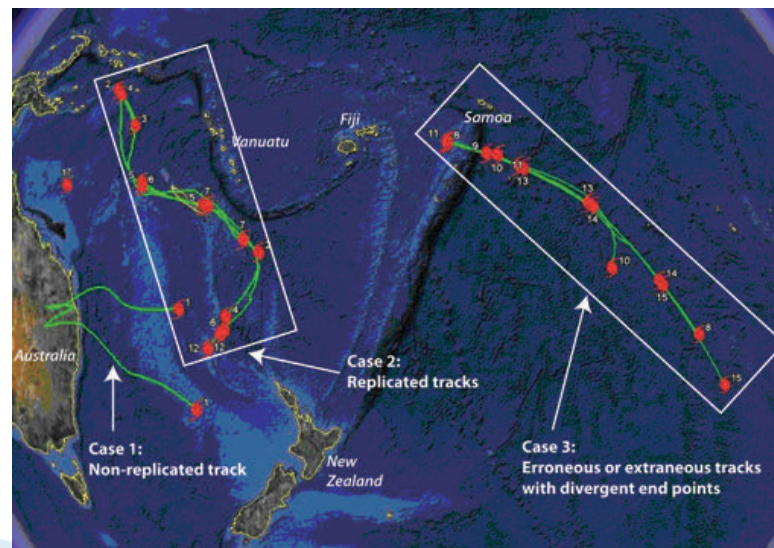


Visher, 1925

i.—Map showing tracks of representative Australian hurricanes. (Traced an Daily Weather Maps.)



Tracks now in Digital Form

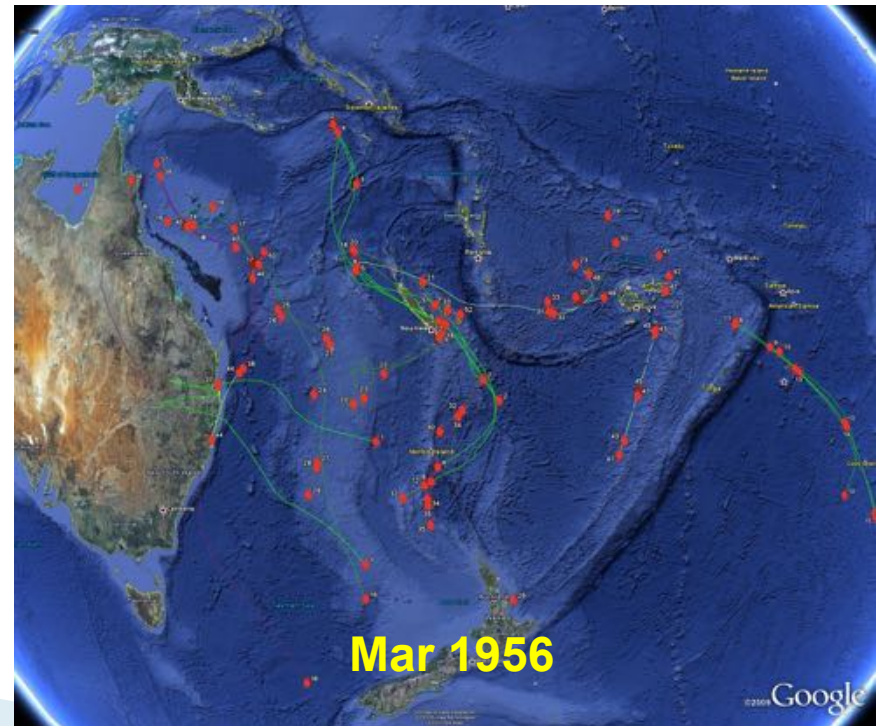
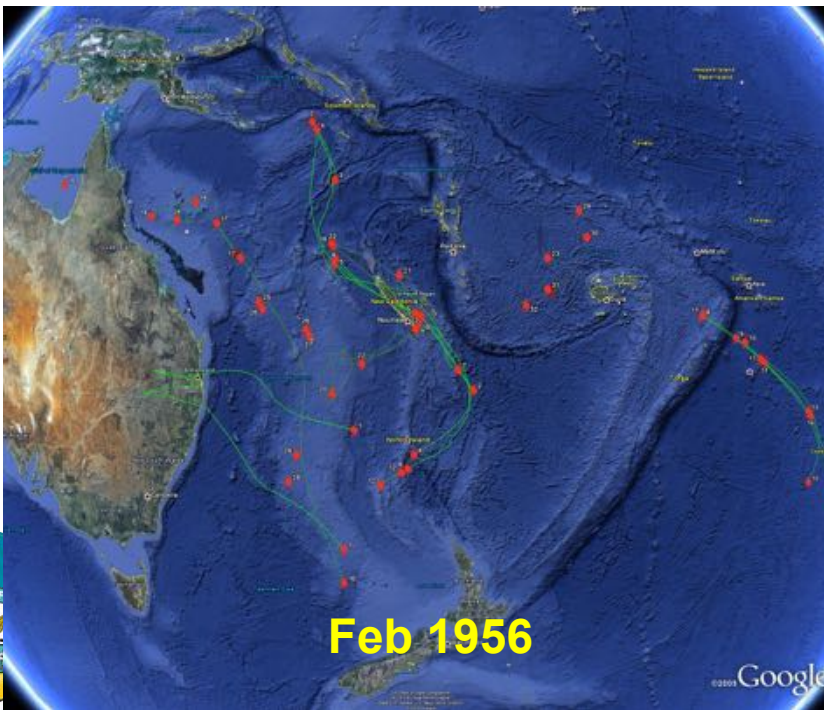
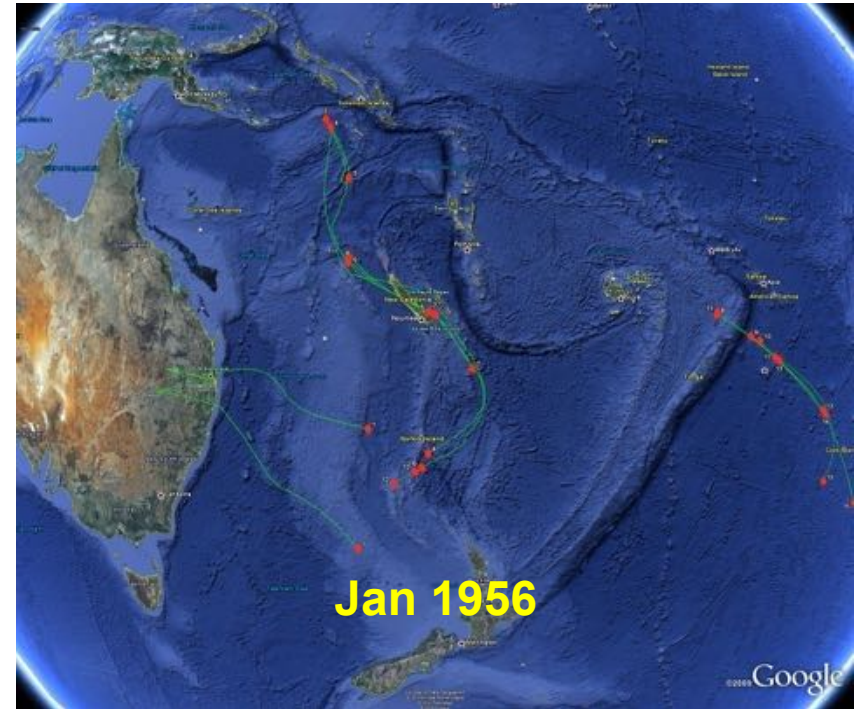
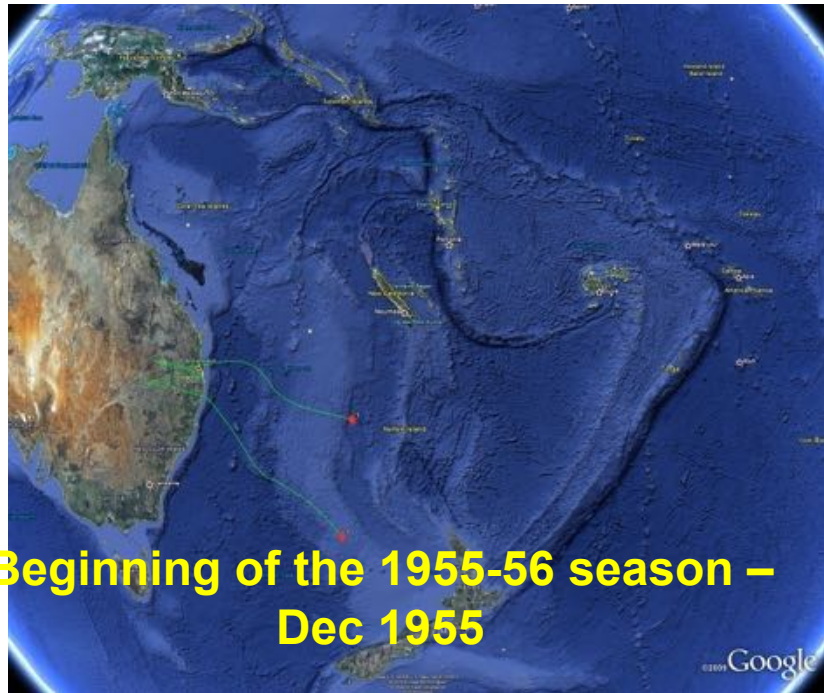


# Quality Assurance Methodology using GrIT

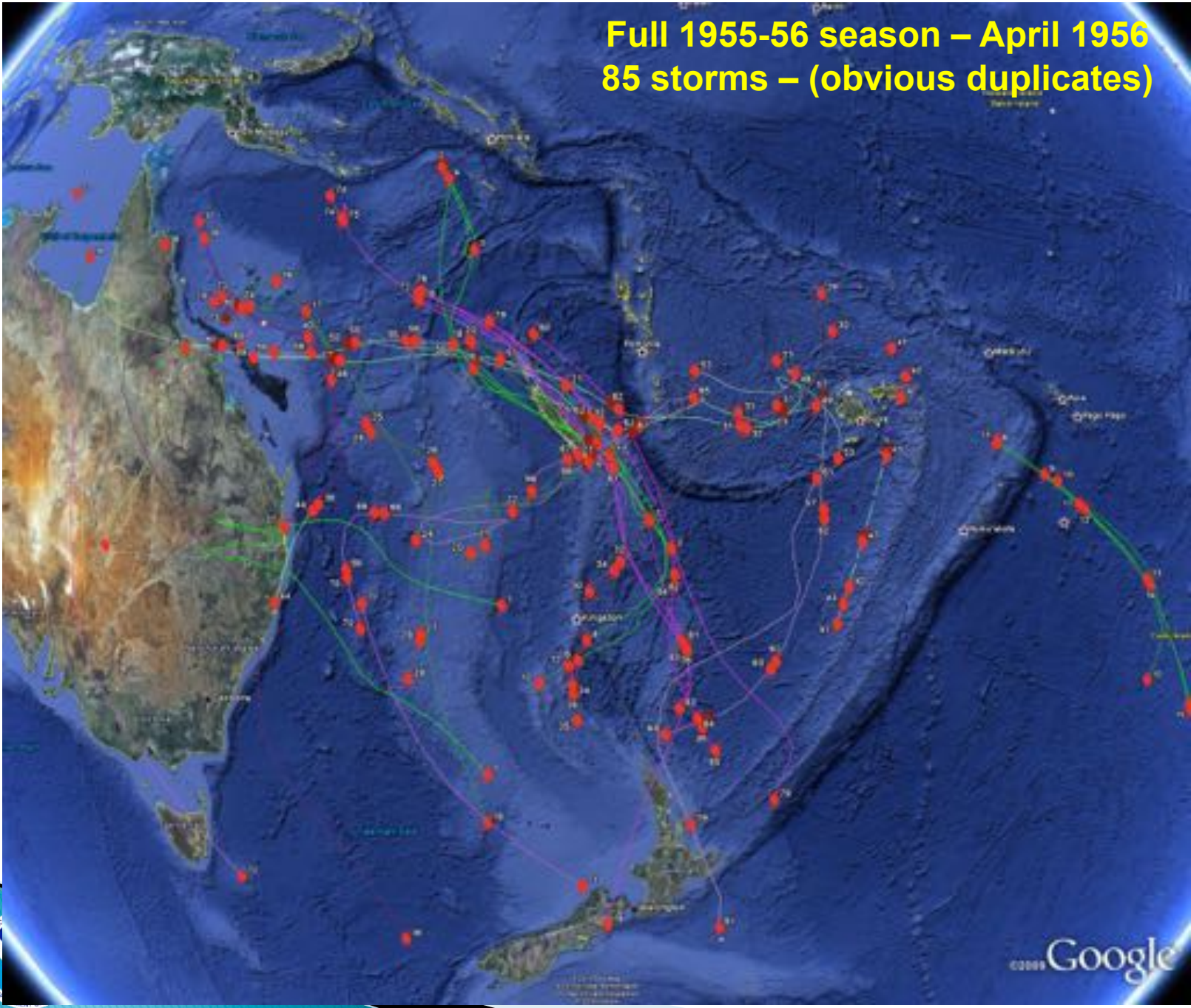
- GrIT – Graphical Interpretation of Tracks
- Method was developed by Diamond, Lorrey, et al (paper in preparation for IJC) in order to take advantage of freely available Google Earth™ software on the Internet
- It uses a set of objective and subjective criteria to aid in quality controlling the data
- It takes advantage of the most advanced computer known to exist – The Human Brain
- There are three cases of tropical cyclone track morphology variants that can be identified using GrIT.
  - (a) non-replicated tracks – single storms
  - (b) replicated tracks - having similar spatial and temporal characteristics (start and stop) within a 7-day window
  - (c) erroneous or extraneous tracks with divergent points
- Independent analysis and consultation by at least 3 independent persons to compare GrIT analysis results







Full 1955-56 season – April 1956  
85 storms – (obvious duplicates)





NOAA Satellite and Information Service  
National Environmental Satellite, Data, and Information Service (NESDIS)

National Climatic Data Center  
U.S. Department of Commerce

# World Data Center for Meteorology, Asheville

ICSU

DOC > NOAA > NESDIS > NCDC

Search Field  Search NCDC

- Introduction  
About WDC
- Data  
Available Data  
Data Exchange Policy  
Data Search  
Climate of the World
- Climatic Research Support
- IBTrACS: tropical cyclones best track data
- International Polar Year (IPY)
- METAR
- Links
- Facilities
- Contact

## Introduction

World Data Center(WDC) for Meteorology, Asheville is one component of a global network of discipline subcenters that facilitate international exchange of scientific data. Originally established during the International Geophysical Year (IGY) of 1957, the **World Data Center System** now functions under the guidance of the International Council of Scientific Unions (ICSU).

The WDC for Meteorology, Asheville is maintained by the **U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA)** and is collocated and operated by the National Climatic Data Center (NCDC).

In accordance with the principles set forth by ICSU, WDC for Meteorology, Asheville acquires, catalogues, and archives data and makes them available to requesters in the international scientific community. Data are exchanged with counterparts, WDC for Meteorology, Orlinsk and WDC for Meteorology, Beijing as necessary to improve access. Special research data sets prepared under international programs such as the IGY, World Climate Program (WCP), Global Atmospheric Research Program (GARP), etc., are archived and made available to the research community. All data and special data sets contributed to the WDC are available to scientific investigators without restriction.



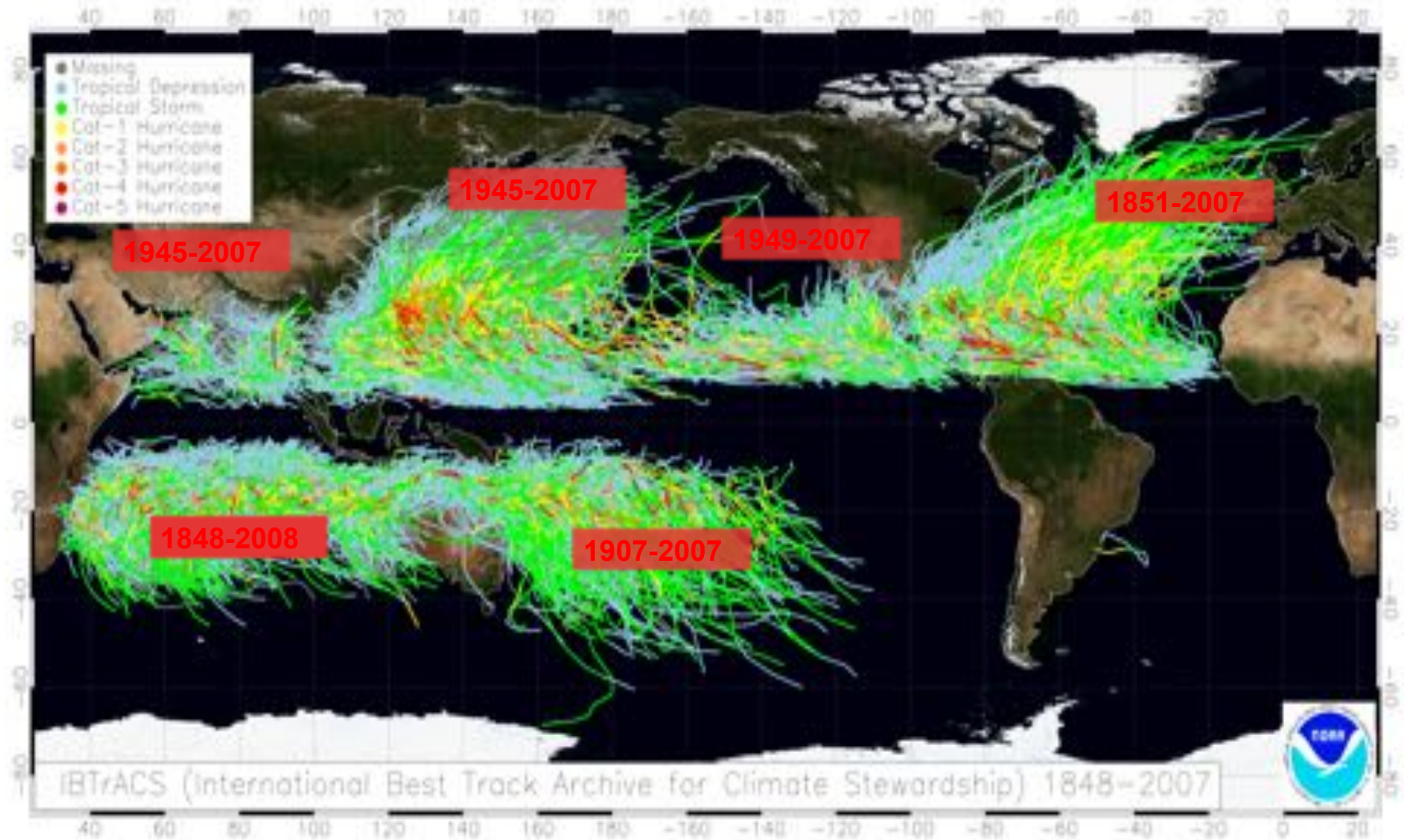
Photo courtesy Grant Geoghegan/NCDC

# What is IBTrACS?

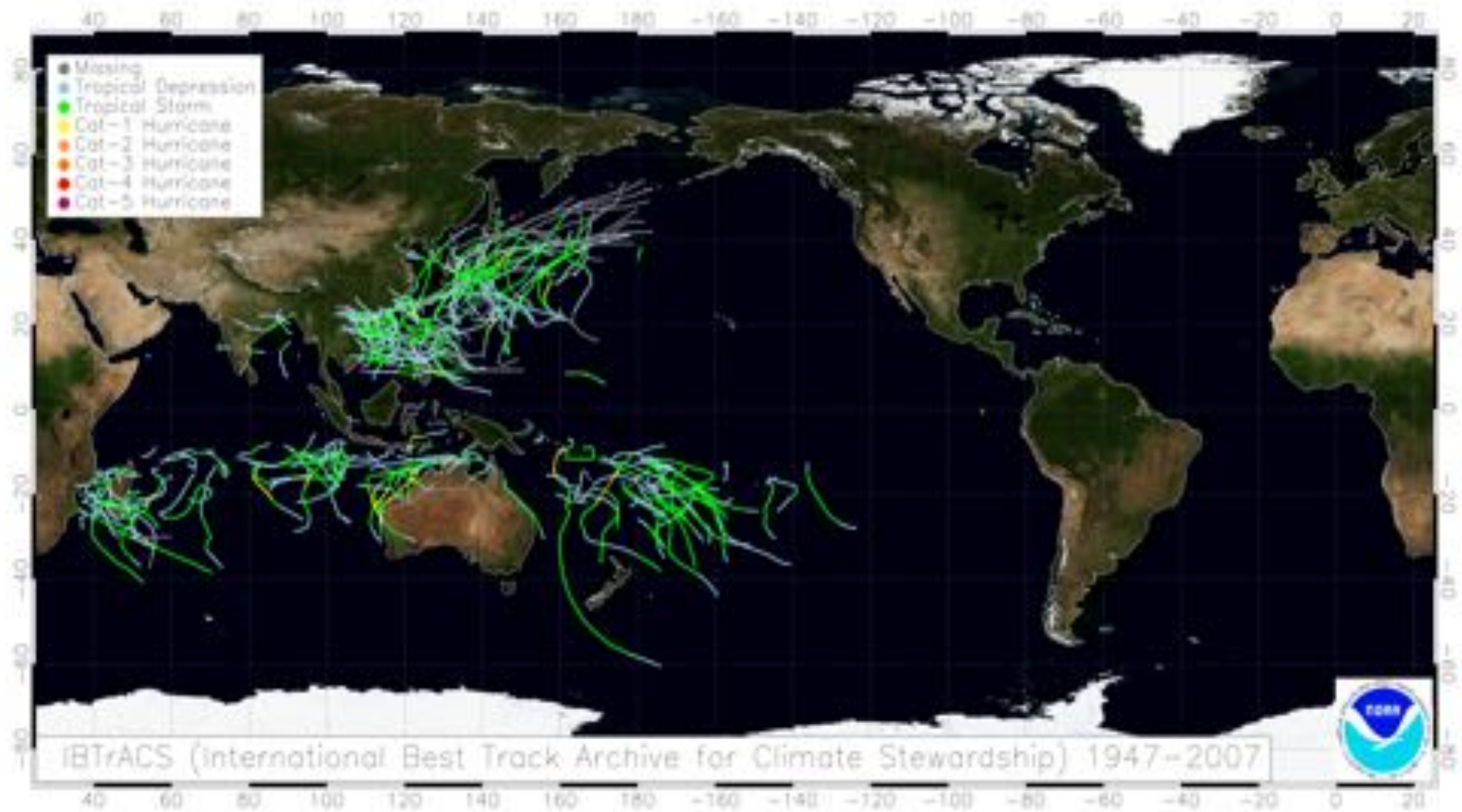
- ▶ First publicly available global tropical cyclone best track dataset.
  - Users no longer need to get or merge data from disparate sources.
- ▶ Utilizes complex merging techniques.
  - Accounts for inherent differences in best track datasets.
- ▶ Includes quality control
  - Position, time, wind, and pressure
- ▶ Averages positions and intensities from all available agencies.
  - Impossible to determine which agency was “correct” without a global reanalysis.
- ▶ Provides full range of reported values for intensity and position every 6 hours.
- ▶ The most comprehensive global best track dataset available.



# IBTrACS TC Map 1848-2008



# Storms unique to IBTrACS (1947-2007)



**NET GAIN: 150+ tropical cyclones!**

# Why use IBTrACS?

- ▶ Combines data from 12 best track datasets
  - Scalable to include new datasets
- ▶ Includes quality flags, statistical variance, and range of values for wind and pressure
- ▶ Contains the most complete set of cyclones available
- ▶ Routinely updated
- ▶ Data is provided in numerous formats:
  - NOAA Tape, WMO, cXML, CSV, WFS, GIS
- ▶ Cross-referenced storm look-up table





# IBTrACS Web Site

<http://www.ncdc.noaa.gov/oa/ibtracs>

NOAA Satellite and Information Service  
National Environmental Satellite, Data, and Information Service (NESDIS)

National Climatic Data Center  
U.S. Department of Commerce

Some NCDC systems are temporarily unavailable. This message will be removed when all systems are back online.

World Data Center for Meteorology, Asheville

ICSU

NCDC > WDC-Meteorology > IBTrACS

**IBTrACS**

Introduction  
IBTrACS Data  
Status  
Parameters  
Formats & samples  
Access  
GIS & HTML  
Data Summary  
Statistics  
Images  
Track maps  
Processing  
Merging storms  
Merging data  
Quality control  
Data Sources  
FAQ  
Bibliography  
Contact

**News**  
Corrected version v01cor-r01 fixes some bugs found in v01r01.

**Vision**  
Providing tropical cyclone best track data in a centralized location to aid our understanding of the distribution, frequency, and intensity of tropical cyclones worldwide.

**Introduction**  
The intent of the IBTrACS project is to overcome data availability issues, and to freely disseminate this new global dataset. This was achieved by working directly with all the Regional Specialized Meteorological Centers and other international centers and individuals to create a global best track dataset, merging storm information from multiple centers into one product and archiving the data for public use.

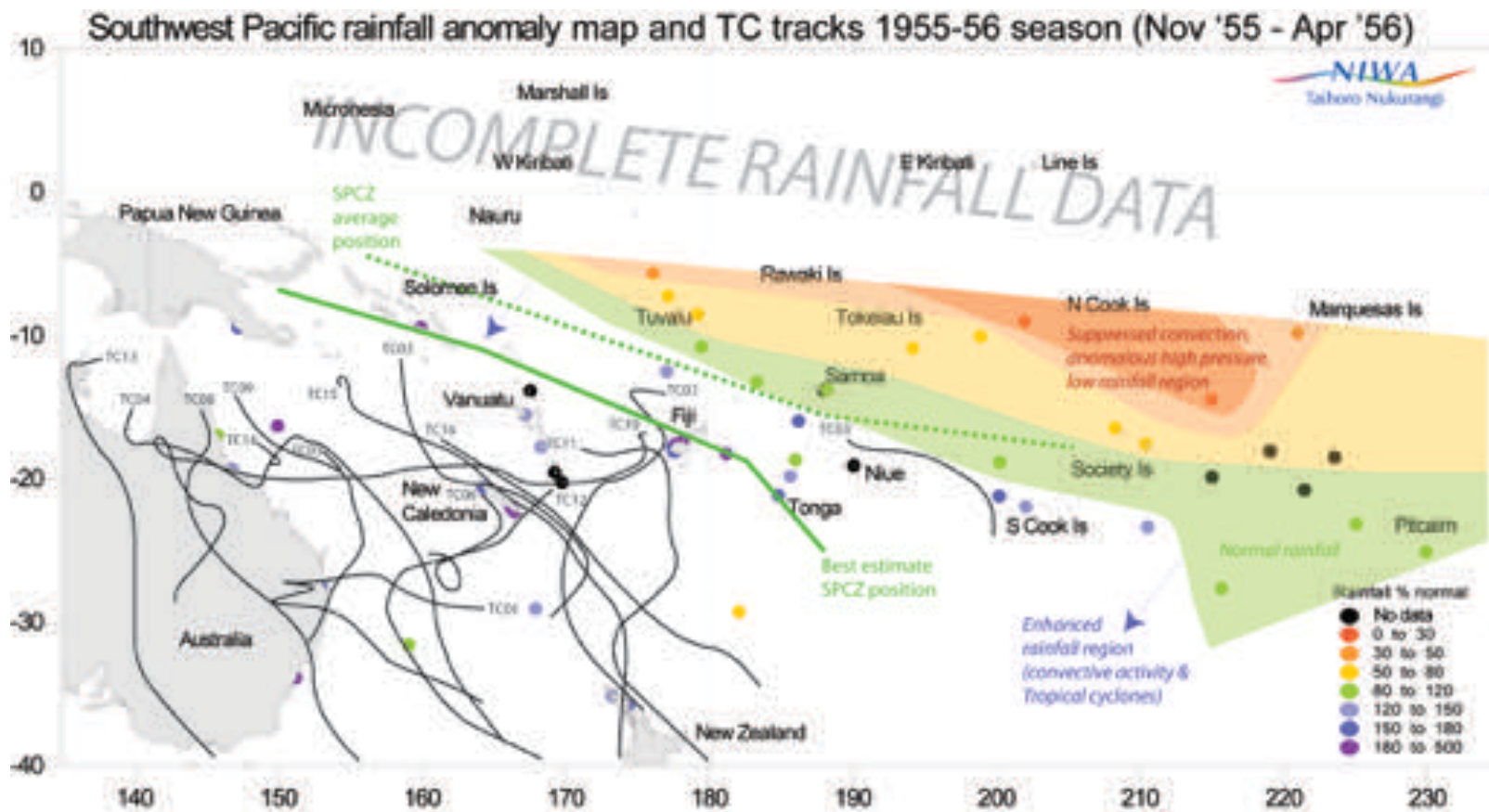
One of the goals of the project is for the data processing methods to remain open, such that desired user feedback on data quality is more easily collected. Also, data provenance is completely recorded so all observations and corrections, either through rigorous quality control or user feedback, may be tracked. Data are then provided in various formats given the diversity of the tropical cyclone (TC) data user community.

IBTrACS  
International Best Track Archive for Climate Researching

IBTrACS brochure (52-PAGE PDF)



# South Pacific Rainfall Atlas (SPRAT) – An Application of IBTrACS to Research



The WDC site can be accessed at: [http:// wdca-meteorology.org](http://wdca-meteorology.org)

The screenshot shows a Mozilla Firefox browser window displaying the WDC Home Page. The address bar shows the URL <http://www.ncdc.noaa.gov/oa/wdc/index.php>. The page header includes logos for NOAA Satellite and Information Service, National Climatic Data Center, and the U.S. Department of Commerce. The main banner features the text "World Data Center for Meteorology, Asheville" and the ICSU logo. Below the banner is a navigation menu with "DOC", "NOAA", "NESDIS", and "NCOG" links, a search field, and a "Search NCDC" button. The left sidebar contains a list of links: Introduction, Data Access, International Climate Related Datasets, Data Search, Climate of the World, World Weather Records, Climatic Research Support, International Best Tracks Archive for Climate Stewardship (IBTrACS), and International Polar Year (IPY). The main content area has an "Introduction" section with the following text: "The World Data Center (WDC) for Meteorology, Asheville is one component of a global network of discipline subcenters that facilitate international exchange of scientific data. Originally established during the International Geophysical Year (IGY) of 1957, the World Data Center System now functions under the guidance of the International Council of Scientific Unions (ICSU). The WDC for Meteorology, Asheville is maintained by the U.S. Department of Commerce (DOC), National Oceanic and Atmospheric Administration (NOAA) and is collocated and operated by the National Climatic Data Center (NCDC) in Asheville, NC, USA. In accordance with the principles set forth by ICSU, WDC for Meteorology, Asheville acquires, catalogues, and archives data and makes them available to requesters in the international scientific community. Data are exchanged with counterparts, WDC for Meteorology, Obninsk and WDC for Meteorology, Beijing as necessary to improve access. All data and special data sets contributed to the WDC are available to scientific investigators without restriction." To the right of the text is a photograph of a cloudy sky. At the bottom of the page, there is a caption: "Photo courtesy Grant Gooder/WDC". The browser's taskbar at the bottom shows the Windows Start button, several open applications, and the system clock displaying 7:41 AM.



**GOSIC**  
 Global Observing Systems Information Center

Home About GOSIC GCOS GOOS GTOS Data Registry Search Publications Acronyms Contact Info

Facilitating Access to Global Observing System Data and Information

The GOSIC Portal can be accessed at: [http:// GOSIC.ORG](http://GOSIC.ORG)

*The GOSIC Portal provides convenient, central, one-stop access to data and information identified by the Global Climate Observing System (GCOS), the Global Ocean Observing System (GOOS) and the Global Terrestrial Observing System (GTOS) and their partner programs, such as the Global Atmosphere Watch (GAW) and regional observing systems, such as the GOOS Regional Alliances (GRA). [More information on the GOSIC and the GOSIC Portal](#)*

<p><b>How do I find Climate Datasets Quickly?</b></p>	<ul style="list-style-type: none"> <li>• <a href="#">Search Data by GCOS Essential Climate Variables</a> (e.g. Temperature, Precipitation, Sea Surface Temperature, etc.)</li> <li>• <a href="#">Search Global Observing Data on the GOSIC Portal</a></li> <li>• <a href="#">Search using Data Access Matrices</a> (provides quick access to data download by variable, theme or program)</li> <li>• <a href="#">Text Search</a> (in the process of being updated)</li> </ul>
<p><b>Access to Observing System Data, Metadata and Information</b></p>	<ul style="list-style-type: none"> <li>• <a href="#">GCOS - Global Climate Observing System</a></li> <li>• <a href="#">GAW - Global Atmosphere Watch</a></li> <li>• <a href="#">GTOS - Global Terrestrial Observing System</a></li> <li>• <a href="#">GOOS - Global Ocean Observing System</a></li> <li>• <a href="#">GRA - GOOS Regional Alliances</a></li> <li>• <a href="#">Global Observing Systems Metadata</a></li> <li>• <a href="#">Maps and Google Earth/3D Products</a></li> <li>• <a href="#">Publications</a> (search by observing system, year or title keyword/cross referenced by GCOS, GOOS, GTOS, GAW, WMO and UN ID) (1985 to present)</li> <li>•  <a href="#">GOSIC on the GEO Portal</a></li> </ul>

# Thank you – Any Question??

Large climate scientist seeing what the true power of a TC can do.

Large piece of coral moved by TC Heta in Niue in 2004.

Howard J. Diamond,  
Program Manager, U.S. GCOS and NOAA IPRC  
[\[http://www.ncdc.noaa.gov/oa/usgcos/index.htm\]](http://www.ncdc.noaa.gov/oa/usgcos/index.htm)  
Director, World Data Center for Meteorology, Asheville  
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