

Advances in Climate Analysis and Monitoring: as Reflected in and Inspired by the CD&P Workshops

(Or 40 Workshops in 30 minutes)

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40th CD&P Workshop, Denver, CO, 26-29 October 2015

OUTLINE

I. Background and purpose of the Workshops

II. Themes – Evolution in:

- Data and data Access
- Analysis and Display
- Understanding of the climate system

III. Brief Examples or Comments from selected Workshops (1, 7, 10,....30, 35)

IV. Closing Remarks

The State of Climate Science in 1950

“...climatology as presently practiced is primarily a statistical study without the basis of physical understanding, which is essential for progress

...there has been a woeful tendency to use of the bones of bare statistics and mean values without the flesh of physical understanding.”

C. S. Durst, In “Climate – the Synthesis of Weather” in the Compendium of Meteorology (1951)

What was the State of Climate Science in 1976 ?

QC
980
.C3
1st
(1976)



Proceedings of the NOAA Climate Diagnostics Workshop

World Weather Building
Washington, D.C.
November 4-5, 1976

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

Fig 3

The WS was to include:

- Current Awareness
 - In-depth Studies of particular events
 - Statistical diagnostic calculations
 - Synoptic approaches
 - Observational studies
- AND
- “To share and dispute views in a forum that will be listened to.”

First talk “Estimates of the Global Change in Temperature, Surface to 100 mb between 1958 and 1975” by Angell and Korshover

Other familiar topics:

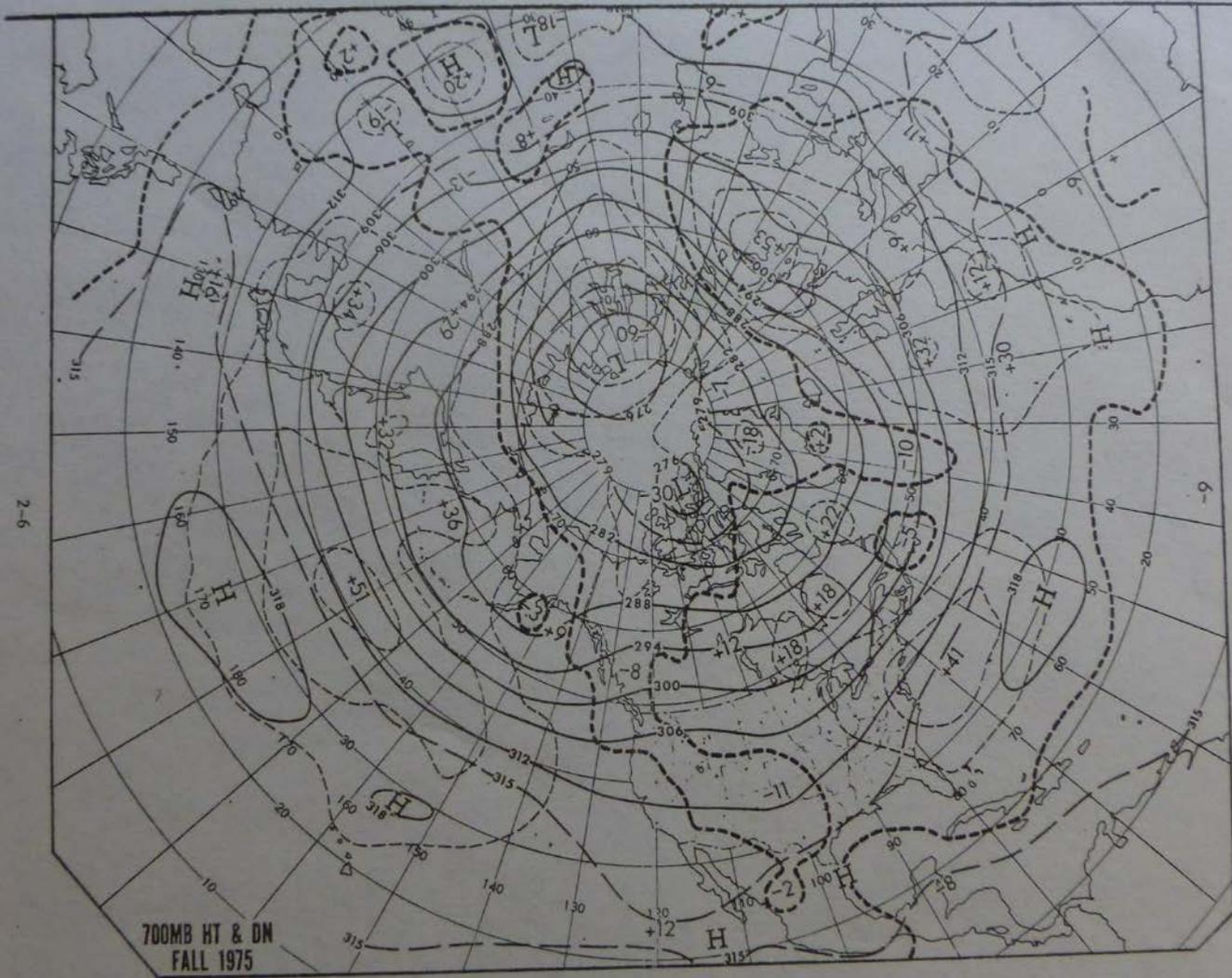
Review of recent seasonal climate anomalies

Recent droughts in Australia, Europe, the Great Plains AND California

Improved method for “following and predicting...El Nino”

Ocean warming in the Eastern Pacific during 1976

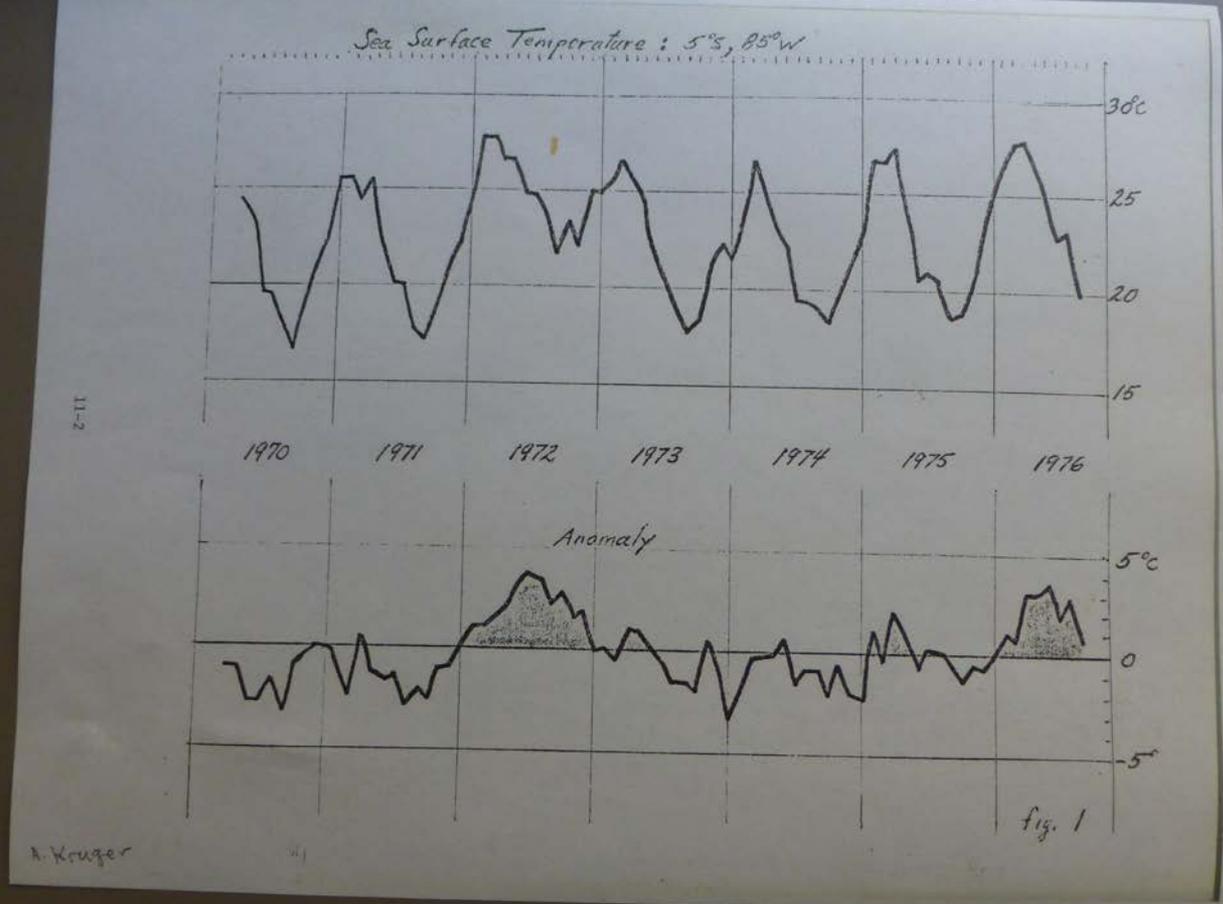
The Winter Outlook



Data from NMC twice daily analysis. Note the lack of data south of 20 deg latitude.

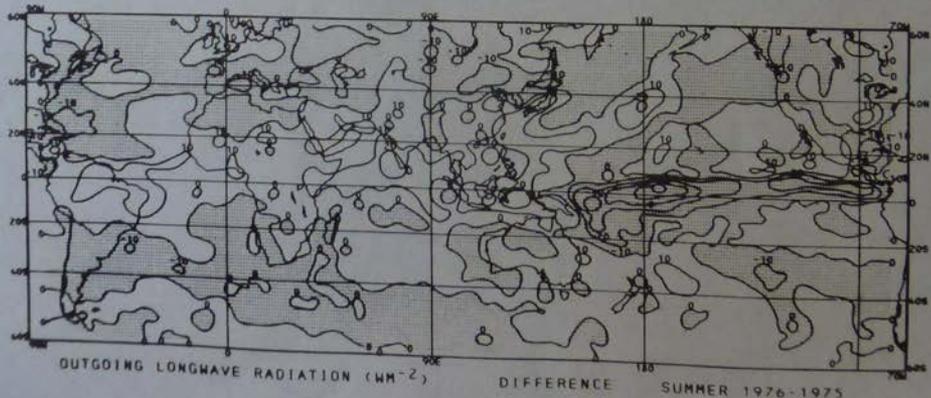
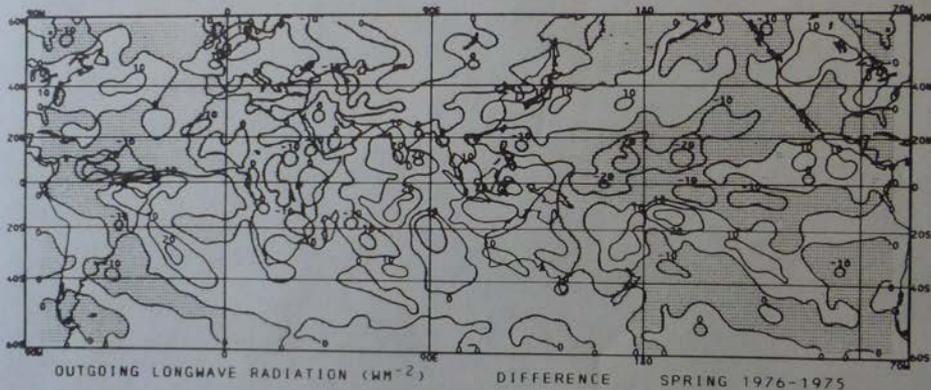
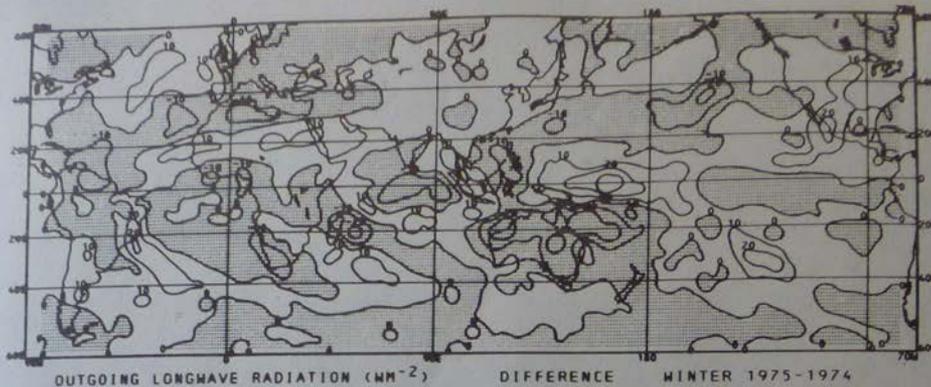
These data were used to compute teleconnection patterns used in monthly and (experimental) seasonal forecasts.

From: "Survey of seasonal Anomalies Fall 1975 through Spring 1976 – A. J. Wagner
1st Climate Diagnostics WS.



Sea surface temperature and anomaly at 5 deg South and 85 deg W. This hand-drawn time series is for a location that would fall in the current "NINO12" area.

From "Circulation over the tropics and ocean warming in the Eastern Pacific during 1976" A. F. Kruger (His Fig 1)



7-10 Radiation Budget Variations (1975-1976)
 compared to 1974-1975 - Jay S. Winston
 OLR negative anomalies are shaded

“Outgoing Longwave Radiation Variations (1975-1976) compared to (1974- 1975). Negative OLR anomalies are shaded.”

J. S. Winston who noted that the eastward shift in negative OLR anomalies was consistent with “warming” in the equatorial Pacific.

WHERE DID CLIMATE SCIENCE STAND IN 1976?

DATA: Data sets were often not timely and access limited with data often held by individual PIs or their institutions. Almost no satellite or numerical model based climate data. Almost no Southern Hemisphere data.

ANALYSIS AND DISPLAY: Anomalies based on sparse data. Because historical data were not readily available some analyses limited to year-to-year differences. Display B&W transparencies, often drafted from hand analyses.

UNDERSTANDING: Some awareness of ENSO but not global impacts. Other coherent climate patterns were not mentioned.

Based on the first Workshop climate science had indicated only modest progress away from the “bones of bare statistics”.



Proceedings of the Sixth Annual Climate Diagnostics Workshop

Lamont-Doherty Geological Observatory
Columbia University
Palisades, New York

October 14-16, 1981

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

The first 3 Workshops were organized primarily as a part of efforts to initiate a U.S. National Climate Program.

The Climate Analysis Center assumed that role from 1979 forward.

The Workshops became a traveling road show with co-sponsors mainly from the academic community.

1976 Camp Springs, MD 4-5 Nov (Listed as Washington, DC)

1977 La Jolla, CA (Scripps) 18-20 Oct

1978 Miami, Fl, (U of Miami, CIMAS) 31 Oct – 2 Nov

1979 Madison WI, (U of WI) 16 -18 Oct

1980 Seattle, WA (U of WA) 22-24 Oct

1981 Palisades, NY (LDGO, Columbia U) 14-16 Oct.



Proceedings of the Seventh Annual Climate Diagnostics Workshop

National Center for Atmospheric Research
Boulder, Colorado

October 18-22, 1982

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

This WS needs to be included if only because it embodied the original charge of the Workshops to "...share and dispute..." The most interesting discussions occurred in the hallways and corridors of the NCAR Mesa lab. The Topic on every mind was "Do we have an El Nino?"

Only one paper did not equivocate, it stated. "It is predicted that no moderate or strong El Nino event will occur in 1983 and it is unlikely that such a potential can develop before 1984..."

DATA: 1982 WS 7

How did the Workshop miss, what was up to that time, the largest warm ENSO episode of the century?

-The satellite SST estimates missed because of the contamination from eruption of the El Chichon volcano. This notwithstanding that there were 9 Workshop papers on El Chichon. The *in situ* analysis missed because it rejected the 3 and 4 standard deviation water temperature data in the Eastern Pacific as unrealistic.

-The analysis of the low level equatorial winds based on NMC analysis were suspect because of slow positive trend in the data (This slow trend was the first evidence suggesting the need of a Climate Data Assimilation System -CDAS).

-There were no satellite estimates of equatorial precipitation and reports from weather stations in Ecuador and Peru were spotty to non-existent.

-This Workshop pointed out the need for improved climate monitoring including the need for more reliable station, satellite, and model data.

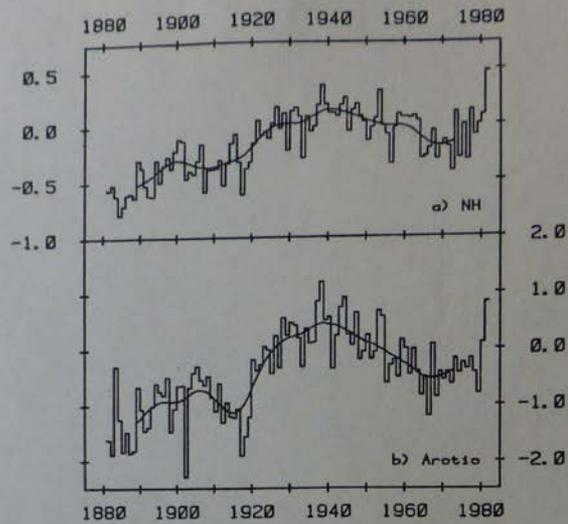


Figure 1: Annual surface air temperature for (a) the Northern Hemisphere (0-85°N) and (b) Arctic regions (65-85°N), expressed as departures, in degrees C, from the 1946-60 reference period. The curve shows the data after application of a binomial filter designed to suppress fluctuations on time scales less than 20 years.

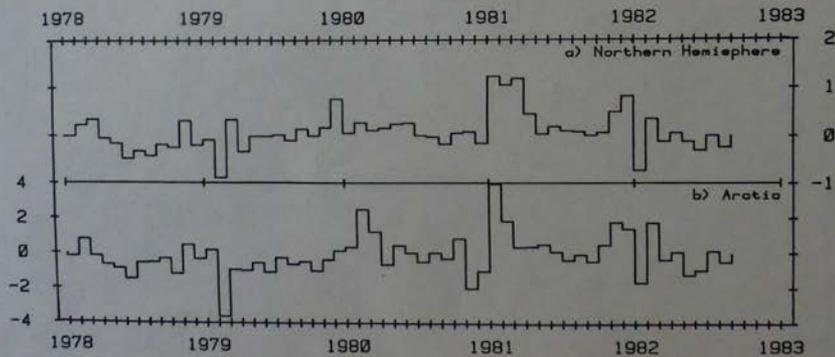


Figure 2: Monthly surface air temperatures for the period January 1978 to August 1982: (a) Northern Hemisphere; (b) Arctic regions. The data are expressed as departures, in degrees C, from the appropriate monthly mean for the period 1946-60.

Also presented were time series of Northern Hemisphere and Arctic surface temperature anomalies from the 1946 to 1960 base period. (P. Jones et al). The monthly anomalies for 1978 through August of 1982 were also presented.

I believe that most WS attendees viewed these plots as interesting but not central to the climate issues of the day.

Nonetheless the CAC started to update its own version of these time series in real time. In the summer of 1988 the CAC “preliminary” station data were being used by the Hansen and Lebedeff analysis.

**PROGRAMME ON LONG-RANGE
FORECASTING RESEARCH**

**LONG-RANGE
FORECASTING
RESEARCH
REPORT
SERIES**

No. 6 VOLUME I

**PROCEEDINGS
OF THE FIRST WMO WORKSHOP ON
THE DIAGNOSIS AND PREDICTION
OF MONTHLY AND SEASONAL
ATMOSPHERIC VARIATIONS
OVER THE GLOBE
[COMBINED WITH
NOAA'S TENTH ANNUAL
CLIMATE DIAGNOSTICS WORKSHOP]**

(COLLEGE PARK, U.S.A.,
29 JULY - 2 AUGUST, 1985)



WMO/TD - No. 87

The 10th WS the only one held in the (boreal) summer (29 Jul – 2 Aug, 1985) and the only one Joint with WMO.

This international workshop was an index of the extent to which climate research was moving from a backwater to one of the cutting edge topics.

Brief comments on Workshops 11 through 15

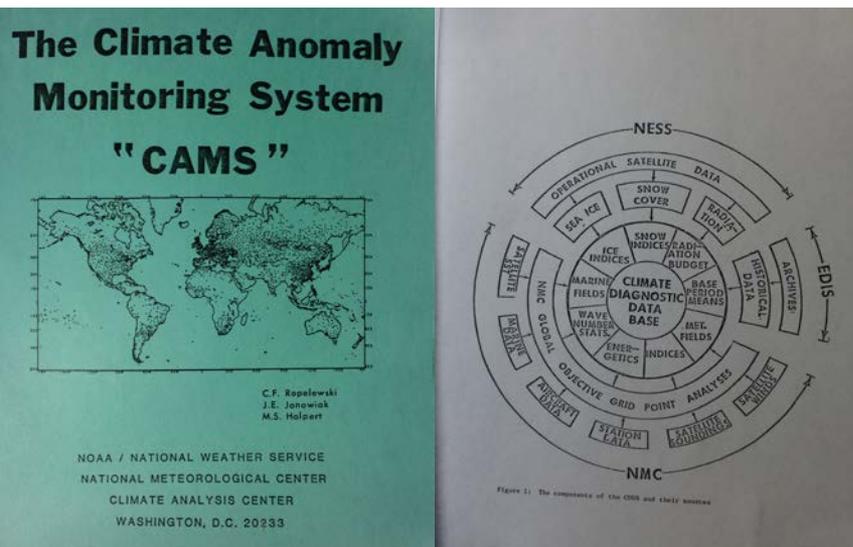
	A	U	P	W
WS 11 – 1986 Champaign IL (ISWS)	96	47	3	8
WS 12 – 1987 Salt Lake City (Univ of Utah)				
WS 13 – 1988 Cambridge MA (AER) First and only private company co-sponsor				
WS 14 – 1989 La Jolla (Scripps) – Loma Prieta Earthquake				
WS 15 – 1990 Asheville, NC (NCDC)	139	59	4	14

It was during this period that the Workshops introduced registration fees. Up until this time co-sponsors “passed the hat” to cover coffee breaks with a separate charge for the banquets.

Some discussions with the AMS to consider the possibility of integrating the Workshops into the Society’s Specialty Meeting schedule.

DATA:

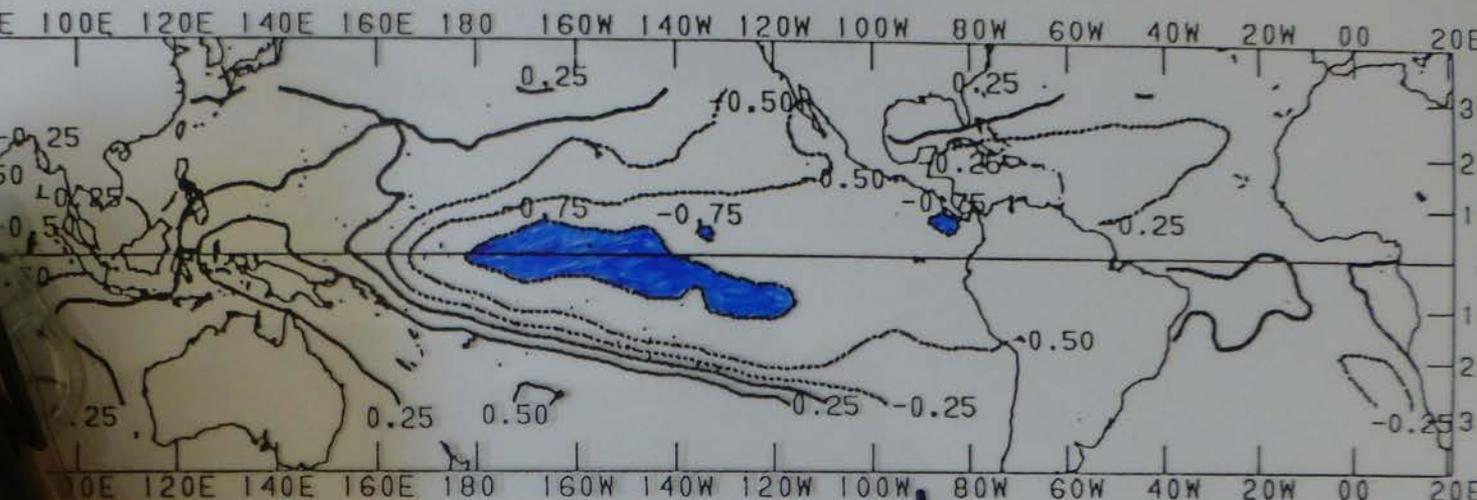
The CDDDB, CAMS, Blended SST, COADS, Satellite Precipitation estimates, NDVI, and several other climate data sets became more widely available. "Global" data begin to include, not only, the tropics, but also the Southern Hemisphere. The internet was not yet fully developed so that data access and exchange was still somewhat cumbersome.



ANALYSIS AND DISPLAY:

Journal of Climate

ROPELEWSKI ET AL.



1-NINO3-1

ANNUAL CORRELATION

1 3.9 1

between the Tahiti-Darwin Southern Oscillation index and the SST anomaly for 3-month periods from the 1950-79 period. Negative correlations are dashed. The contour interval is 0.25.

EOF analysis and its variants became part of a climate researcher's tool kit. The 80's became the "hay day" of the transparencies and hand-crafted "Sharpie" color graphics



UNDERSTANDING:

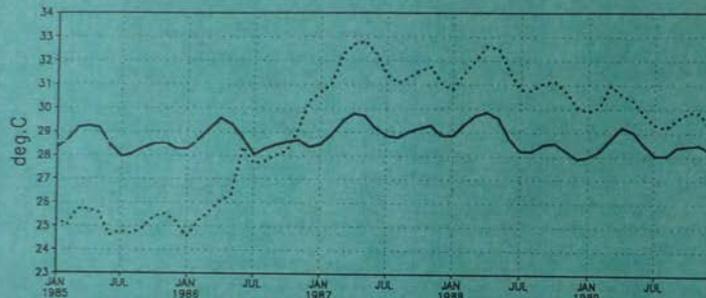
ENSO and its teleconnections became widely studied, better understood, and the default “usual suspect” for every observed climate anomaly whether merited by strong evidence or not. The search for “other” coherent climate phenomena and their influence grew.



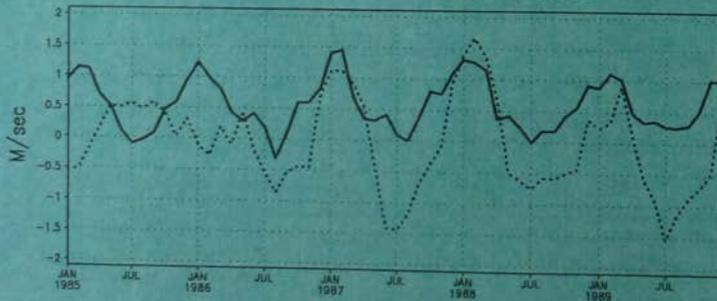
Proceedings of the Nineteenth Annual Climate Diagnostics Workshop

College Park, Maryland

November 14-18, 1994



Reanalysis versus Climate Diagnostics Data Base
Reanl-continuous : CDDB-dotted



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Weather Service
Climate Analysis Center / NMC

The NCEP/NCAR reanalysis was introduced to the CDWS in a series of papers including the a figure on the cover of the proceedings.

The main point being that as useful as the CDDDB was in supporting a large body of research these data contained a number of artifacts relating to changes in the NMC model, data assimilation, or in the data themselves. The Reanalysis would address the first two concerns.



Proceedings of the Twentieth Annual Climate Diagnostics Workshop

Seattle, Washington

October 23-27, 1995



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Weather Service
Climate Prediction Center / NCEP

The 20th Climate Diagnostic Workshop, 1995, was the last Workshop identified by that name.

The 20 Workshops were held in the 15 different locations indicated by the dots on the map, all in the United States except for the 1983 WS held at the Canadian Climate Center.

All were co-sponsored by academic institutions except the 1988 WS co-sponsored by AER in Cambridge, MA.

It was good run but time for a change, a change one could have predicted.

The Change from CDWS to CD&PWS

By 1995 NMC had become NCEP, the CAC had become the CPC and climate diagnostics had become a widely practiced activity within the climate research community including at the, Climate Diagnostics Center, in Boulder.

For most of its 20 year history the CDWS included sessions on climate prediction. Often, however, prediction was addressed in a half-day session at the end of the workshops and it was common, in the early days for most of the attendees to have left while these sessions were being held.

Increased understanding of the climate system and the introduction of numerical models into the mix suggested that a stronger focus on climate prediction was needed and thus the Climate Diagnostics and Prediction Workshops were initiated.



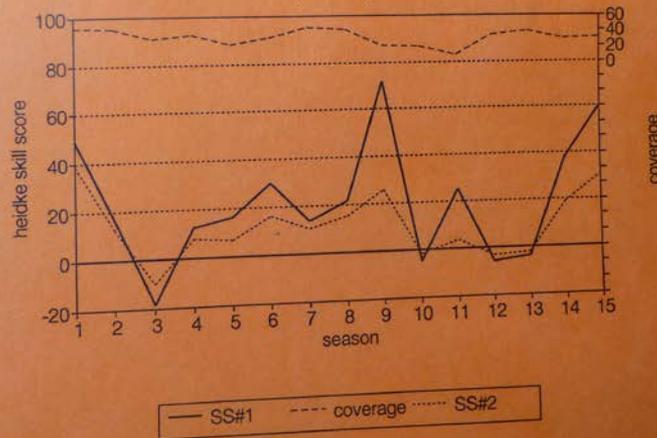
Proceedings of the Twenty-First Annual Climate Diagnostics And Prediction Workshop

Huntsville, Alabama

October 28 - November 1, 1996

Official Temperature Forecasts

verification period jfm95-mar96



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Weather Service
Climate Prediction Center / NCEP

This Workshop agenda included 3 sessions on prediction, one on the first day, and one session on model diagnostics.

The last session of the first CD&P WS was on applications.

Brief comments on Workshops 25 to 30

WS 25 2000 Palisades NY, IRI, Columbia University (2nd WS)

WS 26 2001 La Jolla, Scripps, (3rd WS)

WS 27 2002 Fairfax, VA, GMU/COLA, (Sniper)

WS 28 2003 Reno, NV, DRI

WS 29 2004 Madison WI, U of WI, CAC/CPC 25th
(Reflections on 25 years..., Reeves and Gemmil Eds.)

WS 30 2005 State College, PA, PSU

Closing Remarks and questions:

It's clear that climate science has moved beyond the "bones of bare statistics" but there are still a number of bones to pick. How can the Workshops continue to further the "basis of physical understanding"?

One original purpose of the Workshops was to encourage universities to train climate scientists. These Workshops (and a few \$B from funding agencies) have successfully accomplished this over the past 40 years. Is this still a goal of these meetings?

There's a lot of dialog about engaging the "users" of climate information. Should this series of Workshops put even more emphasis on this topic or redouble efforts to foster improved diagnostics and prediction?



There's more to tell but time is too short.
See you at the Panel Discussion. Thanks
- Chet