Multivariate ENSO Index (MEI)

- Comparison of 1997/98 El Niño event with historic events
- Comparison of 1998-2000 La Niña event with historic events
- Most recent loading maps
- Most recent anomaly maps
- Discussion and comparison of present conditions with near-neutral/weak La Niña events

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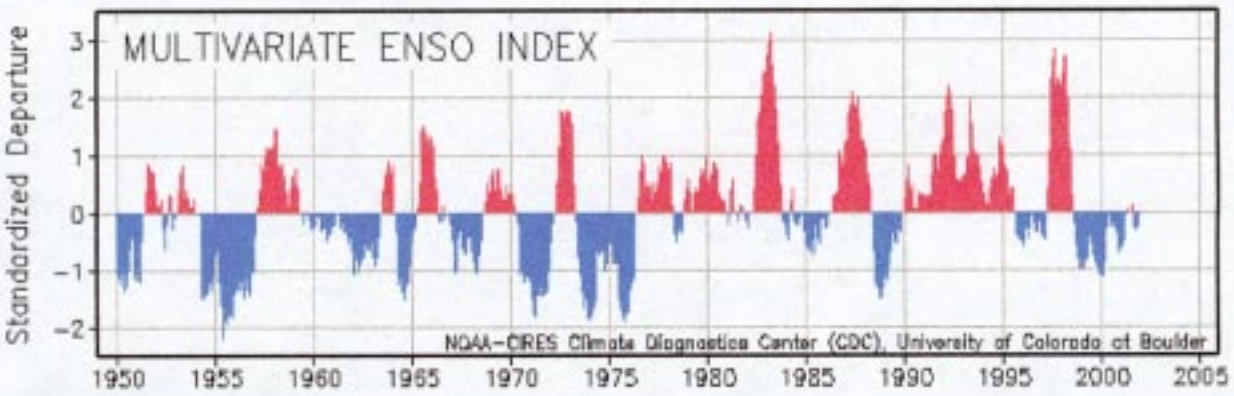

El Niño/Southern Oscillation (ENSO) is the most important coupled ocean-atmosphere phenomenon to cause global climate variability on interannual time scales. Here we attempt to monitor ENSO by basing the Multivariate ENSO Index (MEI) on the six main observed variables over the tropical Pacific. These six variables are: sea-level pressure (P), zonal (U) and meridional (V) components of the surface wind, sea surface temperature (S), surface air temperature (A), and total cloudiness fraction of the sky (C). These observations have been collected and published in COADS for many years. The MEI is computed separately for each of twelve sliding bi-monthly seasons (Dec/Jan, Jan/Feb,..., Now/Dec). After spatially filtering the individual fields into clusters (Wolter, 1987), the MEI is calculated as the first unrotated Principal Component (PC) of all six observed fields combined. This is accomplished by normalizing the total variance of each field first, and then performing the extraction of the first PC on the co-variance matrix of the combined fields (Wolter and Timlin, 1993). In order to keep the MEI comparable, all seasonal values are standardized with respect to each season and to the 1950-93 reference period. The MEI is extended during the first week of the following month based on near-real time marine ship and buoy observations (courtesy of R.W. Reynolds at NCEP) summarized into COADS-compatible 2-degree monthly statistics at CDC. Caution should be exercised when interpreting the MEI on a month-to-month basis, since the input data for updates are not as reliable as COADS, and the MEI has been developed mainly for research purposes. Negative values of the MEI represent the cold ENSO phase, a.k.a.La Niña, while positive MEI values represent the warm ENSO phase (El Niño).

Starting on October 4th, 2001, you can find the numerical values of the MEI timeseries under this link, and historic ranks under this related link. You are welcome to use any of the figures or data from the MEI websites, but proper acknowledgment would be appreciated. Please refer to the (Wolter and Timlin, 1993, 1998) papers, and/or this webpage. If you have trouble getting at the data, and/or would like a hard copy of the Wolter&Timlin papers, please contact me under Klaus Wolter (kew@cdc.noaa.gov)

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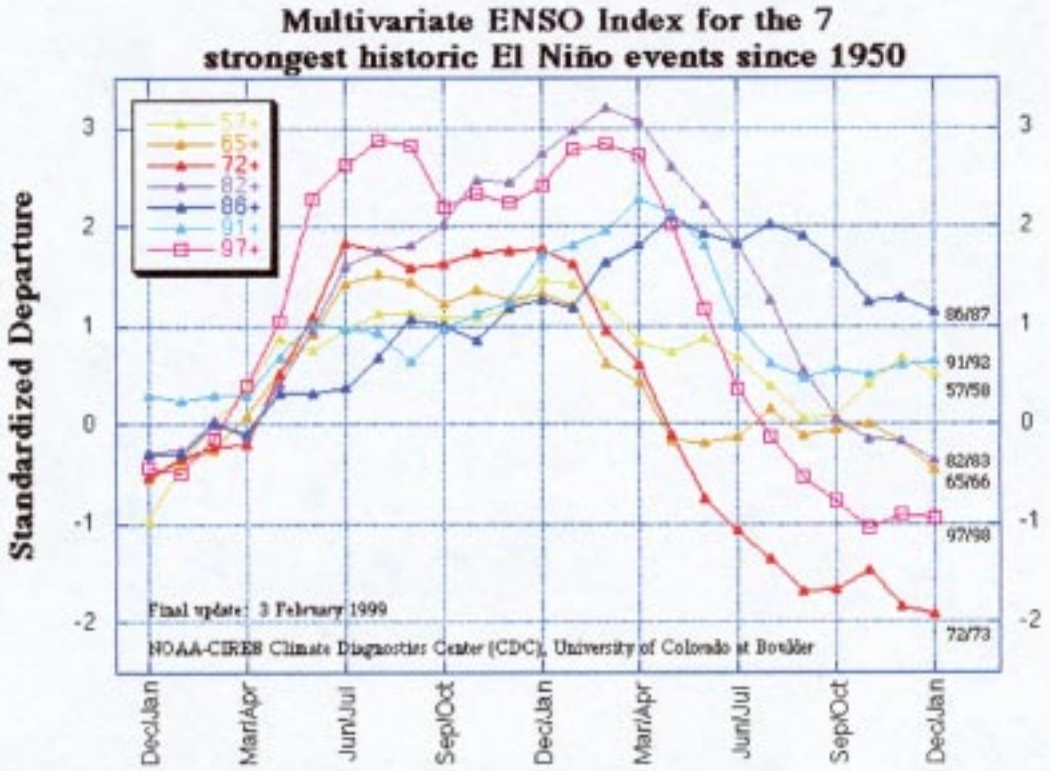

How does the 1997/98 event compare against the six previous biggest El Niño events since 1950? The first three events (1957/58, 65/66, and 72/73) all featured early warming in the far eastern Pacific and reached their standardized peak by the end of the first year. The more recent events (1982/83, 86/87, and 91/92) took longer to mature, lacking the early warming in the eastern Pacific, and typically reached their peak in the spring of the second year or even later. The 1997/98 El Niño event had more in common with the first three events during 1997, but more or less split the difference between the second year of the 1972/73 and 82/83 events during 1998. Its peak values of nearly +2.9 in July/August 1997 and February/March 1998 have only been surpassed in early 1983 (for a more detailed comparison of this event with others, see Wolter and Timlin, 1998). This figure should be considered final until further notice. Click on the "Comparison" button below to find a comparison of the 1998-2000 La Niña against historic La Niña events. Click on the "Discussion" button below that to find a comparison of recent MEI conditions against historic near-neutral/weak La Niña events.

- Comparison of 1998-2000 La Niña event with historic events
- Discussion and comparison of present conditions with near-neutral/weak La Niña events
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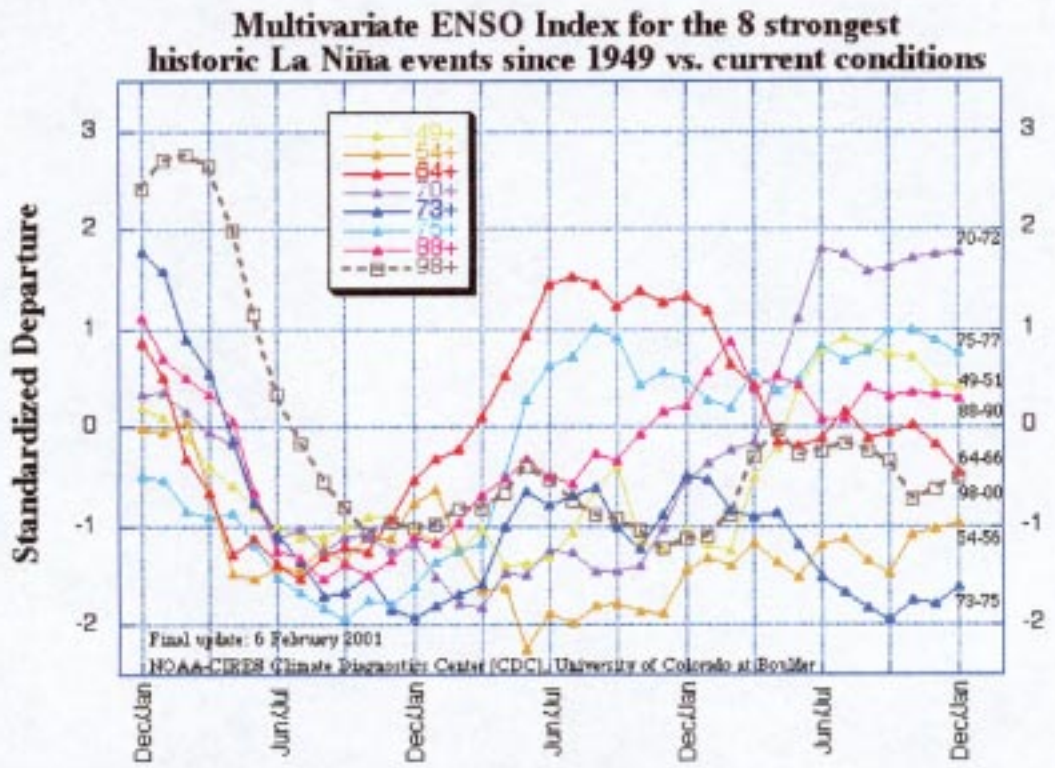

How does the 1998-2000 event compare against the seven previous biggest La Niña events since 1949? As in the El Niño category, only strong events (peak value below -1.2 sigma) are included in this figure. Note that some events last through the full three years shown here (for instance, 54-56), while others revert to "normal" or El Niño conditions by the second or third year (especially in 64-66 and 75-77). The 1998-2000 La Niña does not resemble any previous event in this comparison figure. It started late (about three months later than the previous latest case), and it featured a superimposed annual cycle (peaking around May and troughing around November) that does not match the other events displayed in this figure. However, the weak La Niña period after the 1982-83 El Niño had similar characteristics. Click on the "Discussion" button below to find a comparison of recent MEI conditions against historic near-neutral/weak La Niña events.

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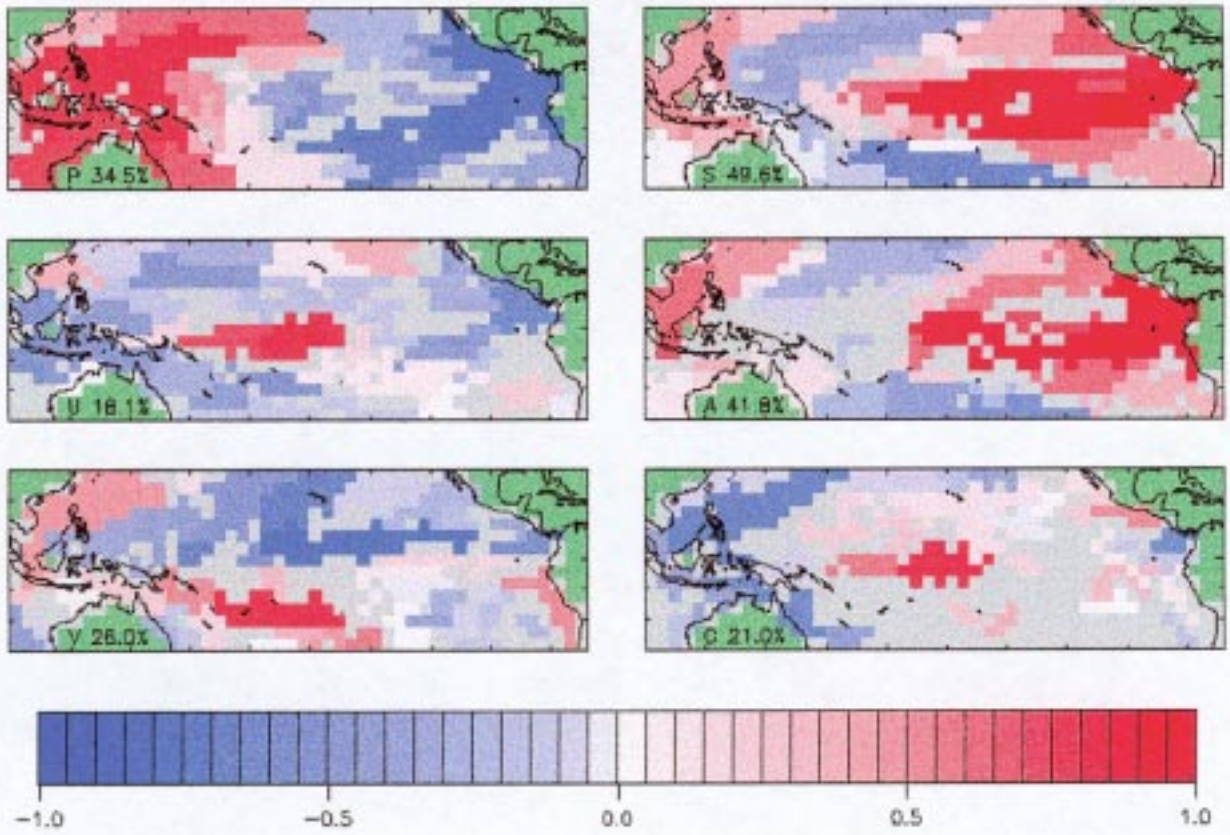
Dec/Jan Index Loadings 1950–2002
Variance Explained = 31.9%



The six loading fields show the correlations between the local anomalies and the MEI. Land areas are flagged in green, and typically noisy regions with no coherent structures and/or lack of data are shown in grey. Each field is denoted by a single capitalized letter and the explained variance for the same field in the Australian corner.

The sea level pressure (P) loadings show the familiar signature of the Southern Oscillation: low pressure anomalies in the west and high pressure anomalies in the east correspond to negative MEI values, or La Niña events. Consistent with P, U shows positive loadings along the Equator, corresponding to easterly anomalies near the dateline. The meridional wind field (V) features negative loadings north of the Equator across the Pacific basin, denoting the northward shift of the ITCZ so common during La Niña conditions, juxtaposed with high positive loadings northeast of Australia.

Both sea (S) and air (A) surface temperature fields show the typical ENSO signature of a wedge of positive loadings stretching from the Central and South American coast to the dateline, or cold anomalies during a La Niña event, flanked by negative loadings (warm anomalies) mainly to its southwest. During La Niña conditions, total cloudiness (C) tends to be suppressed over the central equatorial Pacific, as opposed to increased cloudiness over the Philippines and north of Australia.

Now just past its annual peak in importance, the MEI explains just under one third of the total variance of all six fields in the tropical Pacific from 30N to 30S. Although its temperature components dominate the MEI with close to one half each of their possible variance, even P, V, and C join in with 34.5%, 26%, and 21% variance, respectively, at or close to their highest values during the calendar year. The loading patterns shown here resemble the seasonal composite anomaly fields of Year 1 in Rasmusson and Carpenter (1982).

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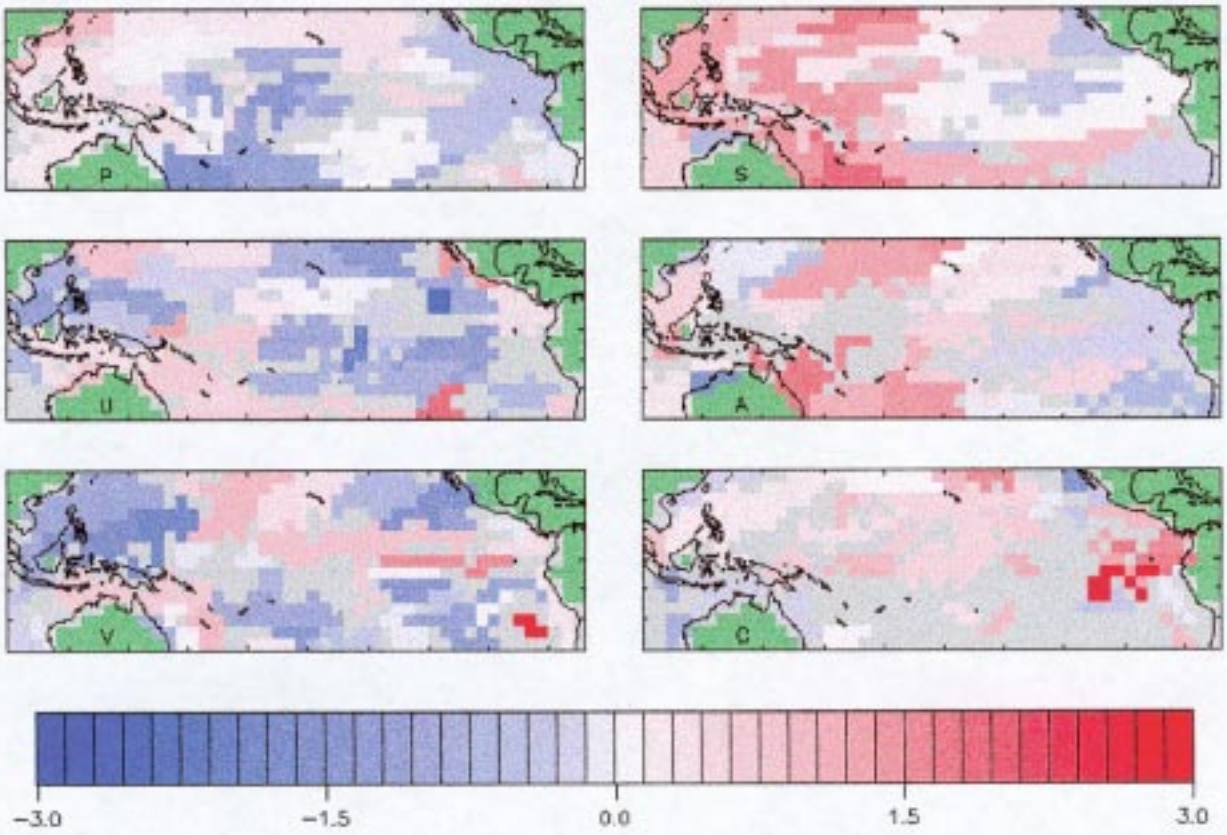
Dec/Jan 2002 Standardized Cluster Anomalies



Consistent with near-neutral MEI values, only a handful of the observed key anomalies exceed one standard deviation, or one sigma (compare to loadings figure), of one sign or the other. They coincide with high loadings in the following large-scale regions and fields: for S, positive anomalies east of Australia are consistent with La Niña; for A, positive anomalies west of Java hint at El Niño; and for C, enhanced cloudiness near Panama indicates conditions more typical of La Niña. What is remarkable about these three significant anomalies is that they are all occurring in regions of secondary importance compared to the main centers of action.

If you prefer to look at anomaly maps without the clustering filter, check out the climate products map room.

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Discussion and comparison of present conditions with near-neutral/weak La Niña events

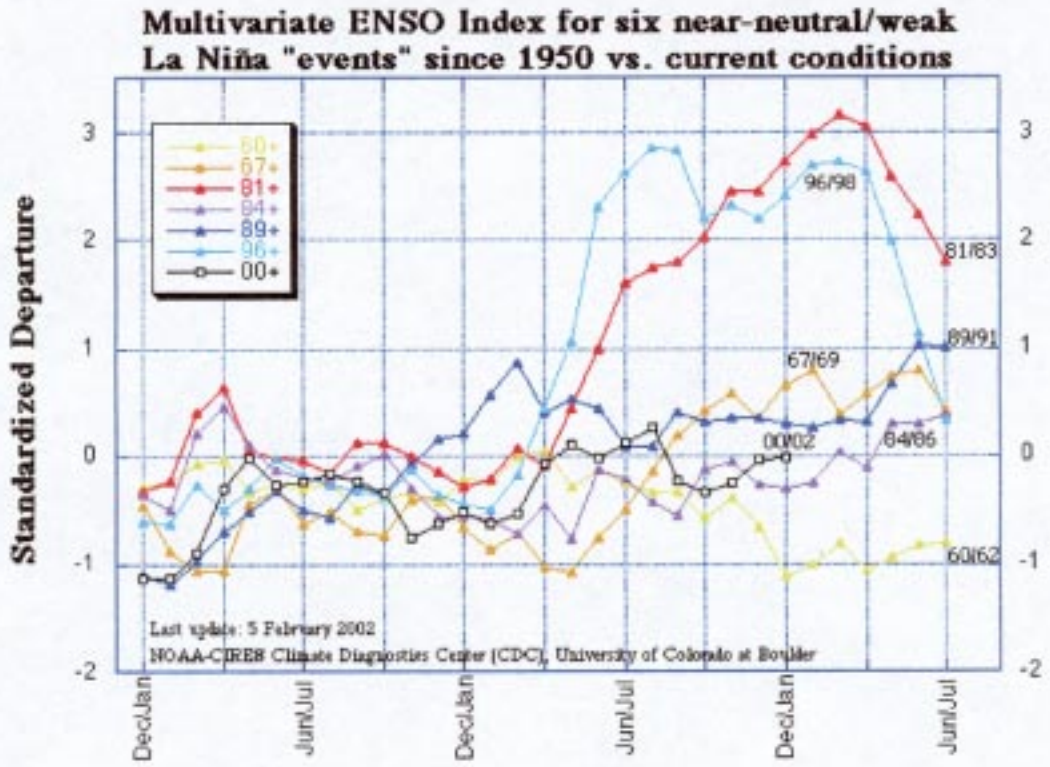
In the context of recent near-neutral MEI values, this section shows a comparison figure of historic transition situations since 1950. The first year of every case shown here features a negative beginning, followed by at least five months of value between -0.5 and +0.5 sigma within the same calendar year. Such situations have been more frequent in the last two decades (five cases out of seven) than before. It is noteworthy that two such transition years preceded the two biggest El Niño events of the 20th century (1982/83 and 1997/98). Three of the four other cases took longer to evolve into sustained El Niño conditions, while only 1960-62 transitioned into La Niña conditions. Therefore, it appears more likely that 2002 will see the emergence of an El Niño event than yet another round of La Niña conditions.

The latest MEI value of -.03 (see MEI-table for all values since 1950) represents a second neutral value in two months after three bigger negative values in a row. This is the tenth month in a row with MEI values between -0.5 and +0.5. Negative SST anomalies in the eastern Pacific vs. positive anomalies near the dateline continue in the latest weekly SST map, with a bit of an eastward shift of the central Pacific anomalies compared to previous months.

For an alternate interpretation of the current situation, I recommend reading the latest NOAA ENSO Advisory which represents the official and most recent Climate Prediction Center opinion on this subject. As of February 5th, their latest discussion centers around an eastward moving oceanic Kelvin wave that is due to impinge on the South American coast by early February, and may be strong enough to replace current negative anomalies in the eastern tropical Pacific with positive anomalies within the next few months. Beyond this first warming, they anticipate that "warm episode (El Niño) conditions will develop in the tropical Pacific during the next 3 months". This is more optimistic than my current assessment, but their threshold for "El Niño" may be a bit lower than mine. The next few months will be interesting to watch.

In this context, there are a few other ENSO indices that are kept up-to-date on the web. Several of these are tracked at the NCEP website that is usually updated around the same time, or earlier than the MEI. For extended Tahiti-Darwin SOI data, check the Australian Bureau of Meteorology website, while extended SST-based ENSO data can be found at the University of Washington-JISAO website, even though that data has not been updated in two years.

Stay tuned for the next update (by March 6th) to see whether the recent coasting of near-normal ENSO conditions will continue, or whether the surface effects of the current Kelvin wave will be large and coherent enough to push the MEI upwards. For the next month or so, it will be hard to beat persistence, but beyond February we could see a large increase, not unlike early 1990. Note that I have discontinued my monthly e-mail announcements in favor of keeping the discussion right here on this webpage.



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- CDC ENSO homepage
- CDC Map Room Climate Products

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http://www.cdc.noaa.gov/~kew/MEI/mei.html