# El Nino/La Nina Update

## by Don Simonsen – General Forecaster and Climate Focal Point

La Nina conditions re-developed during the fall of 2008 and continued through the winter of 2008-09. This was the second winter in a row under La Nina conditions; however it was a weaker event than during the previous winter. It was different in many other ways from the previous winter too. There is a tendency to be colder and snowier than normal in northeast Montana in a La Nina winter, and this certainly proved true this past winter, much more so than what happened in the previous winter, 2007-08. This held true for much of the rest of the U.S. too, with the generally snowier and colder north, drier and warmer south this past winter, again more typical of a La Nina winter, than the 2007-08 La Nina winter had been.

Sea surface temperature departures from normal in the equatorial Pacific Ocean are closely monitored, and in large part determine whether we are in, or going into, an El Nino or a La Nina pattern. Warmer than normal temperatures (El Nino) that spread across the equatorial Pacific have been found to have a major influence on large scale weather patterns throughout the world. La Nina is the opposite of El Nino, in having cooler than normal sea-surface temperatures spreading east across the equatorial Pacific. The impacts on northeast Montana long term weather conditions for both El Nino and La Nina are significant, but in general are much more so for El Nino than for La Nina.

Neutral El Nino/La Nina conditions have returned this spring. With neither condition in place, our long-term weather in coming months will be determined by other large-scale influences that are typically less reliable and not as well understood as the El Nino/La Nina. Most of these are large–scale upper circulations that also occur in cycles. There are however, growing signs that an El Nino might develop in the coming months. Long range implications for that would be a growing confidence that next winter would tend to be warmer and drier than normal.

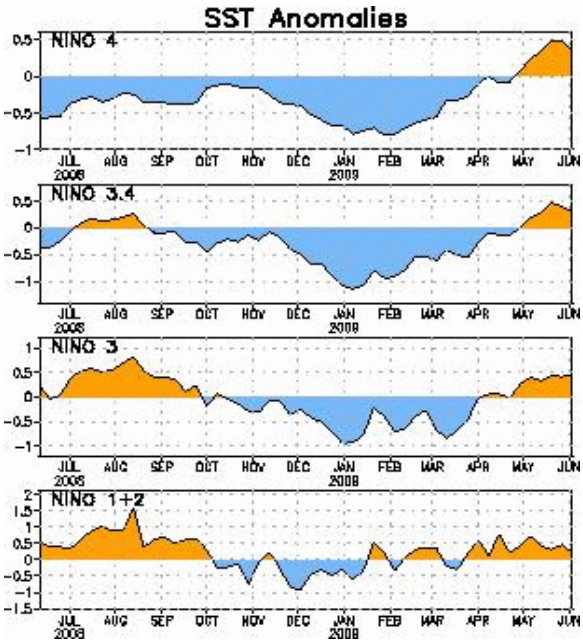
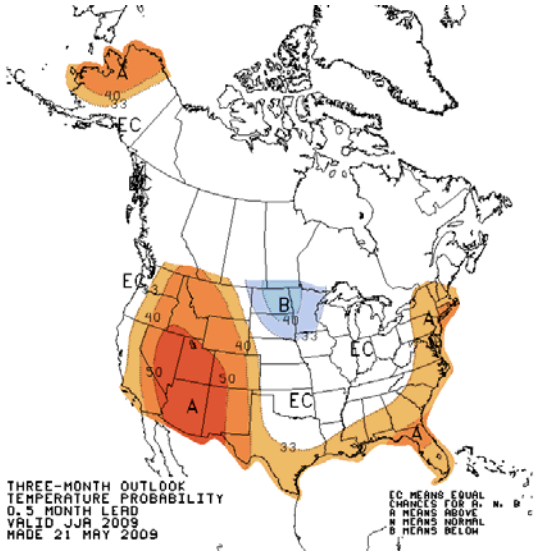
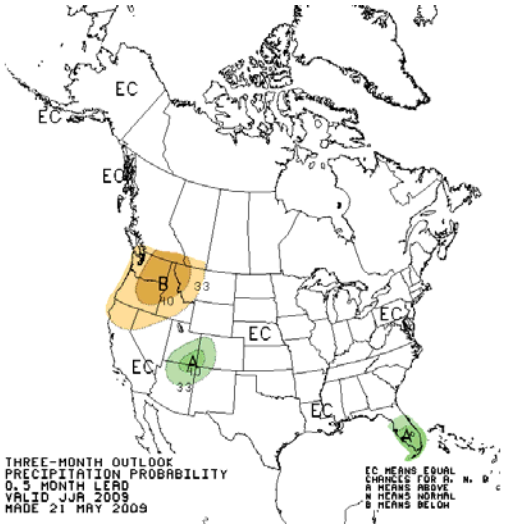



Figure 1. This diagram shows four regions along the equatorial Pacific where ocean temperatures are measured. You can see that most of the sites were above normal last summer (left side of the chart), and then the trend towards the colder temperatures over the winter. All four locations are now showing a warming trend for the past 4-6 weeks (right side of the chart).

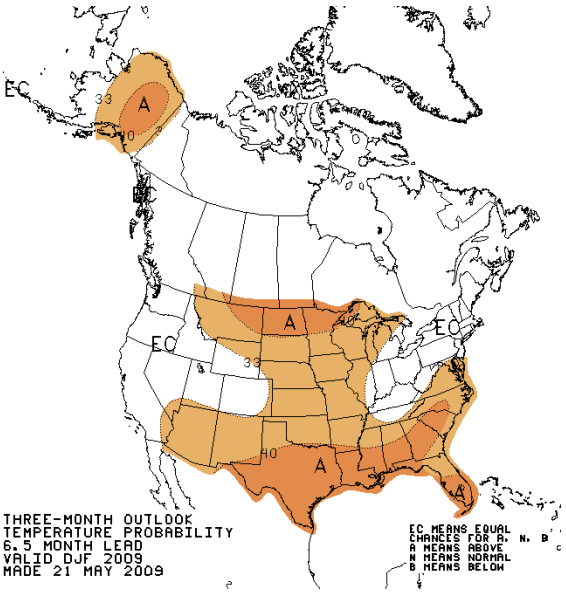
The June, July, August as well as the December, January, February three-month outlooks are shown below. These outlooks are issued by the NWS Climate Prediction Center in Maryland by the third Thursday of every month. The terminology EC that is seen in the graphics refers to their being equal chances of the being above or below normal.



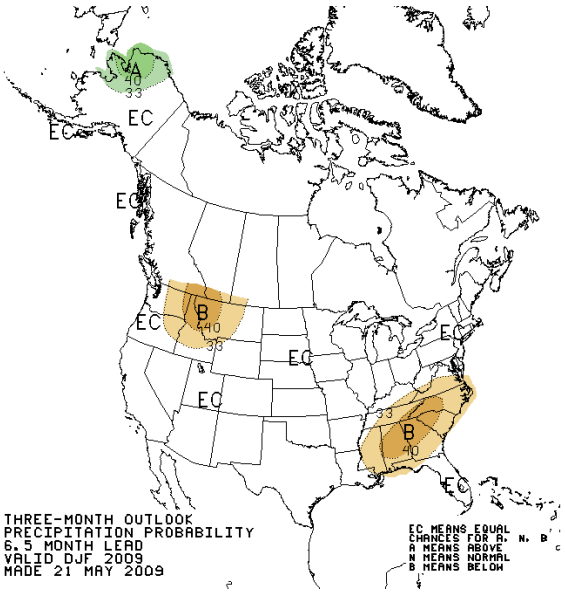
June-July-August 2009 Temperature Outlook



June-July-August 2009 Precipitation Outlook



Dec-Jan-Feb 2009-2010 Temperature Outlook



Dec-Jan-Feb 2009-2010 Precipitation Outlook

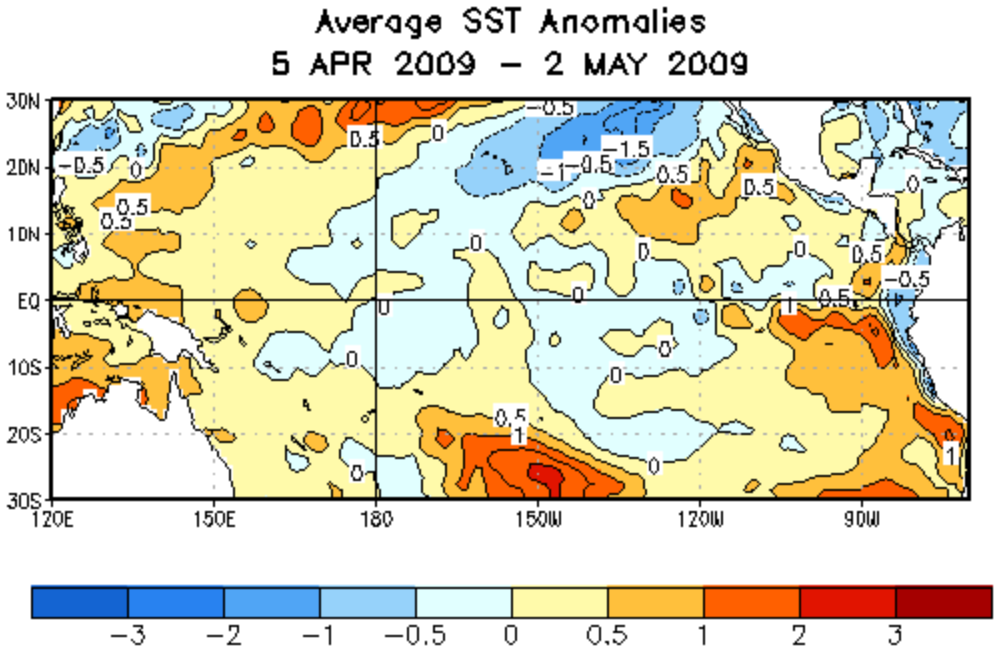



Figure 2. Average sea surface temperature (SST) anomalies (°C) for the four-week period 5 April – 2 May 2009. Anomalies are computed with respect to the 1971-2000 base period weekly means (Xue et al. 2003, *J. Climate*, **16**, 1601-1612).

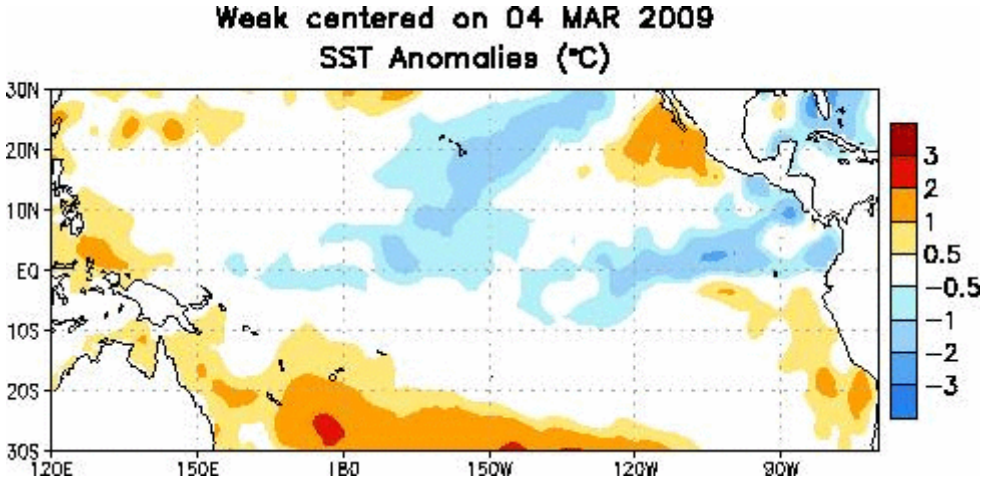



Figure 3. Weekly averaged sea surface temperatures (top, °C) and anomalies (bottom, °C) for the past twelve weeks. SST analysis is the optimum interpolation (OI) analysis, while anomalies are departures from the adjusted OI climatology (Reynolds and Smith 1995, *J. Climate*, 8, 1571-1583).

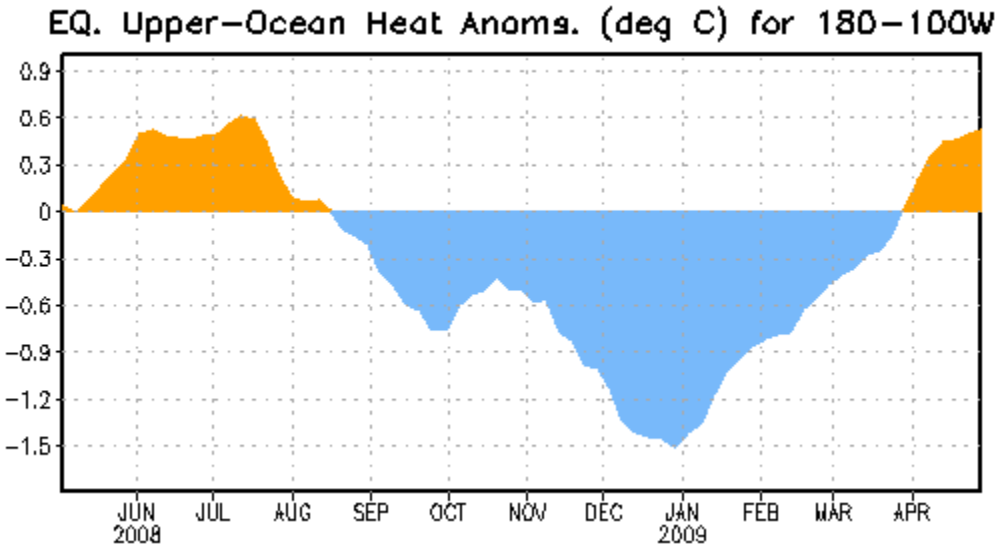



Figure 4. Area-averaged upper-ocean heat content anomalies (°C) in the equatorial Pacific (5°N-5°S, 180º-100ºW). Heat content anomalies are computed as departures from the 1982-2004 base period pentad means.

# Cold & Warm Episodes by Season

DESCRIPTION: Warm (red) and cold (blue) episodes based on a threshold of +/- 0.5°C for the Oceanic Niño Index (ONI) [3 month running mean of ERSST.v3b SST anomalies in the Niño 3.4 region (5°N-5°S, 120°-170°W)], based on the 1971-2000 base period. For historical purposes cold and warm episodes (blue and red colored numbers) are defined when the threshold is met for a minimum of 5 consecutive over-lapping seasons.

| Year | DJF | JFM | FMA | MAM | AMJ | MJJ | JJA | JAS | ASO | SON | OND | NDJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1950 | -1.7 | -1.5 | -1.3 | -1.4 | -1.3 | -1.1 | -0.8 | -0.8 | -0.8 | -0.9 | -0.9 | -1.0 |
| 1951 | -1.0 | -0.9 | -0.6 | -0.3 | -0.2 | 0.2 | 0.4 | 0.7 | 0.7 | 0.8 | 0.7 | 0.6 |
| 1952 | 0.3 | 0.1 | 0.1 | 0.2 | 0.1 | -0.1 | -0.3 | -0.3 | -0.2 | -0.2 | -0.1 | 0.0 |
| 1953 | 0.2 | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| 1954 | 0.5 | 0.3 | -0.1 | -0.5 | -0.7 | -0.7 | -0.8 | -1.0 | -1.2 | -1.1 | -1.1 | -1.1 |
| 1955 | -1.0 | -0.9 | -0.9 | -1.0 | -1.0 | -1.0 | -1.0 | -1.0 | -1.4 | -1.8 | -2.0 | -1.9 |
| 1956 | -1.3 | -0.9 | -0.7 | -0.6 | -0.6 | -0.6 | -0.7 | -0.8 | -0.8 | -0.9 | -0.9 | -0.8 |
| 1957 | -0.5 | -0.1 | 0.3 | 0.6 | 0.7 | 0.9 | 0.9 | 0.9 | 0.9 | 1.0 | 1.2 | 1.5 |
| 1958 | 1.7 | 1.5 | 1.2 | 0.8 | 0.6 | 0.5 | 0.3 | 0.1 | 0.0 | 0.0 | 0.2 | 0.4 |
| 1959 | 0.4 | 0.5 | 0.4 | 0.2 | 0.0 | -0.2 | -0.4 | -0.5 | -0.4 | -0.3 | -0.2 | -0.2 |
| 1960 | -0.3 | -0.3 | -0.3 | -0.2 | -0.2 | -0.2 | -0.1 | 0.0 | -0.1 | -0.2 | -0.2 | -0.2 |
| 1961 | -0.2 | -0.2 | -0.2 | -0.1 | 0.1 | 0.2 | 0.0 | -0.3 | -0.6 | -0.6 | -0.5 | -0.4 |
| 1962 | -0.4 | -0.4 | -0.4 | -0.5 | -0.4 | -0.4 | -0.3 | -0.3 | -0.5 | -0.6 | -0.7 | -0.7 |
| 1963 | -0.6 | -0.3 | 0.0 | 0.1 | 0.1 | 0.3 | 0.6 | 0.8 | 0.9 | 0.9 | 1.0 | 1.0 |
| 1964 | 0.8 | 0.4 | -0.1 | -0.5 | -0.8 | -0.8 | -0.9 | -1.0 | -1.1 | -1.2 | -1.2 | -1.0 |
| 1965 | -0.8 | -0.4 | -0.2 | 0.0 | 0.3 | 0.6 | 1.0 | 1.2 | 1.4 | 1.5 | 1.6 | 1.5 |
| 1966 | 1.2 | 1.0 | 0.8 | 0.5 | 0.2 | 0.2 | 0.2 | 0.0 | -0.2 | -0.2 | -0.3 | -0.3 |
| 1967 | -0.4 | -0.4 | -0.6 | -0.5 | -0.3 | 0.0 | 0.0 | -0.2 | -0.4 | -0.5 | -0.4 | -0.5 |
| 1968 | -0.7 | -0.9 | -0.8 | -0.7 | -0.3 | 0.0 | 0.3 | 0.4 | 0.3 | 0.4 | 0.7 | 0.9 |
| 1969 | 1.0 | 1.0 | 0.9 | 0.7 | 0.6 | 0.5 | 0.4 | 0.4 | 0.6 | 0.7 | 0.8 | 0.7 |
| 1970 | 0.5 | 0.3 | 0.2 | 0.1 | 0.0 | -0.3 | -0.6 | -0.8 | -0.9 | -0.8 | -0.9 | -1.1 |
| 1971 | -1.3 | -1.3 | -1.1 | -0.9 | -0.8 | -0.8 | -0.8 | -0.8 | -0.8 | -0.9 | -1.0 | -0.9 |
| 1972 | -0.7 | -0.4 | 0.0 | 0.2 | 0.5 | 0.8 | 1.0 | 1.3 | 1.5 | 1.8 | 2.0 | 2.1 |
| 1973 | 1.8 | 1.2 | 0.5 | -0.1 | -0.6 | -0.9 | -1.1 | -1.3 | -1.4 | -1.7 | -2.0 | -2.1 |
| 1974 | -1.9 | -1.7 | -1.3 | -1.1 | -0.9 | -0.8 | -0.6 | -0.5 | -0.5 | -0.7 | -0.9 | -0.7 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1975** | **-0.6** | **-0.6** | **-0.7** | **-0.8** | **-0.9** | **-1.1** | **-1.2** | **-1.3** | **-1.5** | **-1.6** | **-1.7** | **-1.7** |
| **1976** | **-1.6** | **-1.2** | **-0.8** | **-0.6** | **-0.5** | -0.2 | 0.1 | 0.3 | **0.5** | **0.7** | **0.8** | **0.7** |
| **1977** | **0.6** | **0.5** | 0.2 | 0.2 | 0.2 | 0.4 | 0.4 | 0.4 | **0.5** | **0.6** | **0.7** | **0.7** |
| **1978** | **0.7** | 0.4 | 0.0 | -0.3 | -0.4 | -0.4 | -0.4 | -0.4 | -0.4 | -0.3 | -0.2 | -0.1 |
| **1979** | -0.1 | 0.0 | 0.1 | 0.1 | 0.1 | -0.1 | 0.0 | 0.1 | 0.3 | 0.4 | 0.5 | 0.5 |
| **1980** | 0.5 | 0.3 | 0.2 | 0.2 | 0.3 | 0.3 | 0.2 | 0.0 | -0.1 | -0.1 | 0.0 | -0.1 |
| **1981** | -0.3 | -0.5 | -0.5 | -0.4 | -0.3 | -0.3 | -0.4 | -0.4 | -0.3 | -0.2 | -0.1 | -0.1 |
| **1982** | 0.0 | 0.1 | 0.1 | 0.3 | **0.6** | **0.7** | **0.7** | **1.0** | **1.5** | **1.9** | **2.2** | **2.3** |
| **1983** | **2.3** | **2.0** | **1.5** | **1.2** | **1.0** | **0.6** | 0.2 | -0.2 | -0.6 | -0.8 | -0.9 | -0.7 |
| **1984** | -0.4 | -0.2 | -0.2 | -0.3 | -0.5 | -0.4 | -0.3 | -0.2 | -0.3 | **-0.6** | **-0.9** | **-1.1** |
| **1985** | **-0.9** | **-0.8** | **-0.7** | **-0.7** | **-0.7** | **-0.6** | **-0.5** | **-0.5** | **-0.5** | -0.4 | -0.3 | -0.4 |
| **1986** | -0.5 | -0.4 | -0.2 | -0.2 | -0.1 | 0.0 | 0.3 | **0.5** | **0.7** | **0.9** | **1.1** | **1.2** |
| **1987** | **1.2** | **1.3** | **1.2** | **1.1** | **1.0** | **1.2** | **1.4** | **1.6** | **1.6** | **1.5** | **1.3** | **1.1** |
| **1988** | **0.7** | **0.5** | 0.1 | -0.2 | **-0.7** | **-1.2** | **-1.3** | **-1.2** | **-1.3** | **-1.6** | **-1.9** | **-1.9** |
| **1989** | **-1.7** | **-1.5** | **-1.1** | **-0.8** | **-0.6** | -0.4 | -0.3 | -0.3 | -0.3 | -0.3 | -0.2 | -0.1 |
| **1990** | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.4 |
| **1991** | 0.4 | 0.3 | 0.3 | 0.4 | **0.6** | **0.8** | **1.0** | **0.9** | **0.9** | **1.0** | **1.4** | **1.6** |
| **1992** | **1.8** | **1.6** | **1.5** | **1.4** | **1.2** | **0.8** | **0.5** | 0.2 | 0.0 | -0.1 | 0.0 | 0.2 |
| **1993** | 0.3 | 0.4 | 0.6 | 0.7 | 0.8 | 0.7 | 0.4 | 0.4 | 0.4 | 0.4 | 0.3 | 0.2 |
| **1994** | 0.2 | 0.2 | 0.3 | 0.4 | **0.5** | **0.5** | **0.6** | **0.6** | **0.7** | **0.9** | **1.2** | **1.3** |
| **1995** | **1.2** | **0.9** | **0.7** | 0.4 | 0.3 | 0.2 | 0.0 | -0.2 | **-0.5** | **-0.6** | **-0.7** | **-0.7** |
| **1996** | **-0.7** | **-0.7** | **-0.5** | -0.3 | -0.1 | -0.1 | 0.0 | -0.1 | -0.1 | -0.2 | -0.3 | -0.4 |
| **1997** | -0.4 | -0.3 | 0.0 | 0.4 | **0.8** | **1.3** | **1.7** | **2.0** | **2.2** | **2.4** | **2.5** | **2.5** |
| **1998** | **2.3** | **1.9** | **1.5** | **1.0** | **0.5** | 0.0 | **-0.5** | **-0.8** | **-1.0** | **-1.1** | **-1.3** | **-1.4** |
| **1999** | **-1.4** | **-1.2** | **-0.9** | **-0.8** | **-0.8** | **-0.8** | **-0.9** | **-0.9** | **-1.0** | **-1.1** | **-1.3** | **-1.6** |
| **2000** | **-1.6** | **-1.4** | **-1.0** | **-0.8** | **-0.6** | **-0.5** | -0.4 | -0.4 | -0.4 | **-0.5** | **-0.6** | **-0.7** |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2001** | **-0.6** | **-0.5** | -0.4 | -0.2 | -0.1 | 0.1 | 0.2 | 0.2 | 0.1 | 0.0 | -0.1 | -0.1 |
| **2002** | -0.1 | 0.1 | 0.2 | 0.4 | **0.7** | **0.8** | **0.9** | **1.0** | **1.1** | **1.3** | **1.5** | **1.4** |
| **2003** | **1.2** | **0.9** | **0.5** | 0.1 | -0.1 | 0.1 | 0.4 | 0.5 | 0.6 | 0.5 | 0.6 | 0.4 |
| **2004** | 0.4 | 0.3 | 0.2 | 0.2 | 0.3 | **0.5** | **0.7** | **0.8** | **0.9** | **0.8** | **0.8** | **0.8** |
| **2005** | **0.7** | **0.5** | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.3 | 0.2 | -0.1 | -0.4 | -0.7 |
| **2006** | -0.7 | -0.6 | -0.4 | -0.1 | 0.1 | 0.2 | 0.3 | **0.5** | **0.6** | **0.9** | **1.1** | **1.1** |
| **2007** | **0.8** | 0.4 | 0.1 | -0.1 | -0.1 | -0.1 | -0.1 | -0.4 | **-0.7** | **-1.0** | **-1.1** | **-1.3** |
| **2008** | **-1.4** | **-1.4** | **-1.1** | **-0.8** | **-0.6** | -0.4 | -0.1 | 0.0 | 0.0 | 0.0 | -0.3 | -0.6 |
| **2009** | -0.8 | -0.7 | -0.5 | | | | | | | | | |