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An exploratory approach: Using financial market technical indicators to assess temporal trends in MDN data

Arnout F. H. ter Schure, Ph.D.

David A. Gay

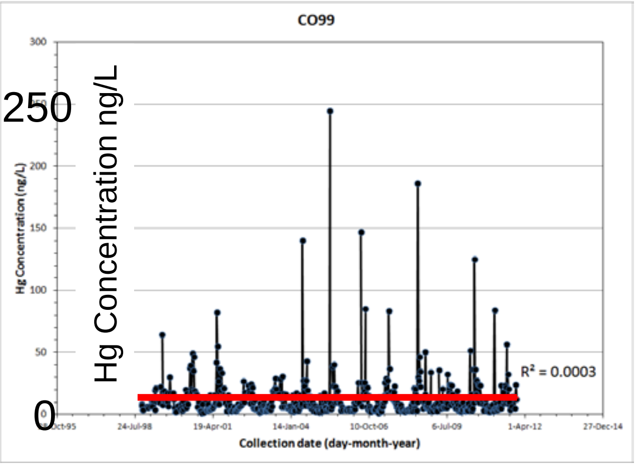
NADP 2012 Fall Meeting and Scientific Symposium

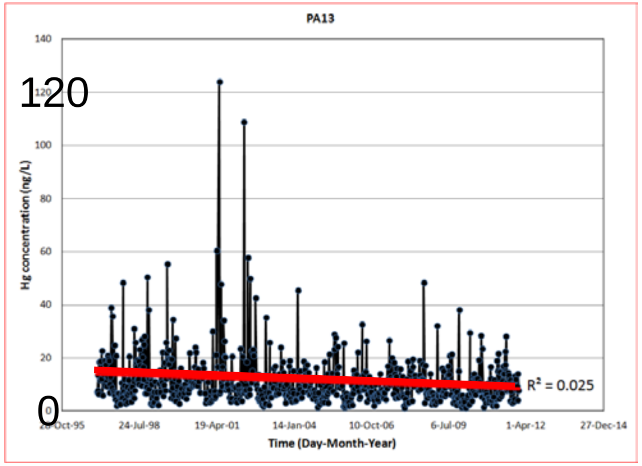
South Portland, ME

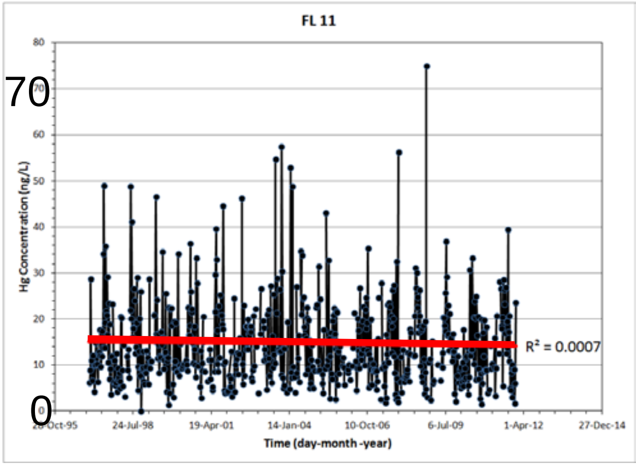
October 2-5, 2012

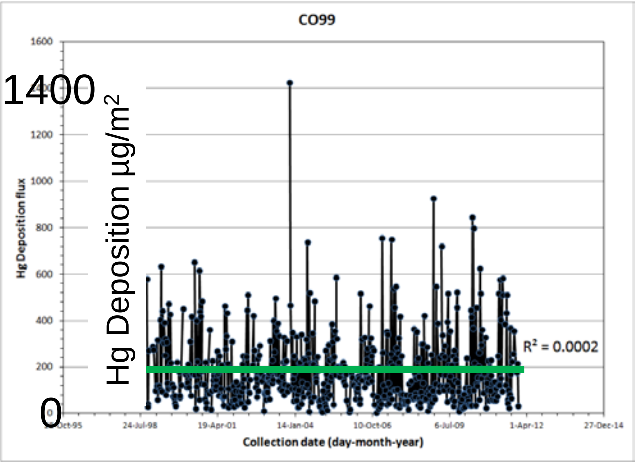
MDN data: highly variable

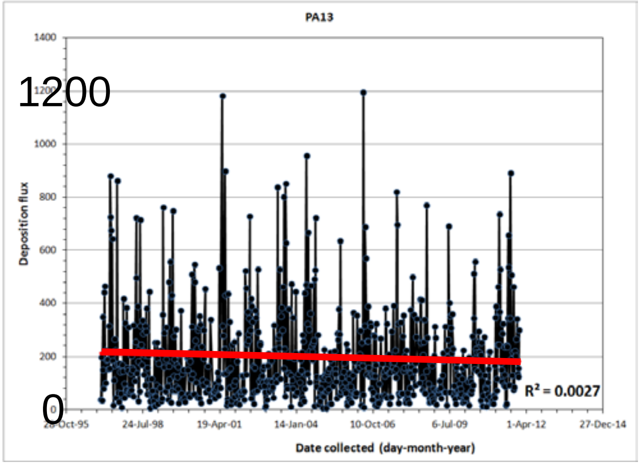
SITE: CO 99 PA 13 FL 11

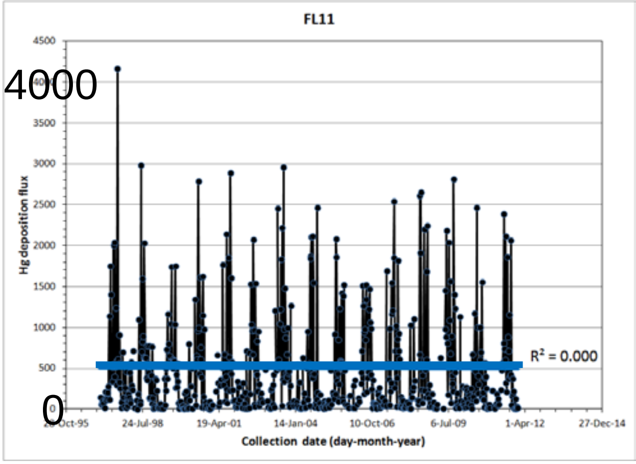












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Complex statistical analyses…

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ScienceDirect
Atmospheric Environment 42 (2008) 1582–1592
ELSEVIER
ATMOSPHERIC ENVIRONMENT
www.elsevier.com/locate/atmosenv

Regional precipitation mercury trends in the eastern USA, 1998–2005: Declines in the Northeast and Midwest, no trend in the Southeast

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Abstract

Mercury emissions in the USA declined between the 1990s and the beginning of this decade, largely due to the closure of

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Six-Year Trend (1990–1995) of Wet Mercury Deposition in the Upper Midwest, U.S.A.

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National Health and Environmental Effects, Research Laboratory, U.S. EPA, 6201 Congdon Boulevard, Duluth, Minnesota 55804, and University of Minnesota, Duluth, Archaeometry Laboratory, 10 University Drive, Duluth, Minnesota 55812-2496

Total wet mercury deposition was monitored weekly at six Upper Midwest, U.S.A. sites for a period of six years, 1990–1995, to assess temporal and spatial patterns and

Near vs Distant Atmospheric Sources. One method of inferring the importance of near vs distant mercury source contributions is to study spatial gradients in deposition rates. One early observation of a gradient in mercury deposition rates was in Sweden where somewhat pristine northern sites were found to receive significantly less deposition than those in the south (*14*), nearer to industrial sources of northern Europe. A similar circumstance was observed for Michigan by Hoyer et al. (*6*). Another method of comparing source inventories was conducted by Engstrom and Swain (*15*) where mercury levels in sediments were compared between northern Minnesota and Alaska. In that study it was estimated that global sources had a slightly greater contribution to mercury deposition rates in northern Minnesota than regional sources.

In this work we report wet mercury deposition data, spanning six years, from six monitoring sites in and near Minnesota, and use it to investigate spatial and temporal patterns and make qualitative comparisons with predicted

Ecotoxicology, 14, 37–52, 2005
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Patterns of Mercury Deposition and Concentration in Northeastern North America (1996–2002)

ALAN VANARSDALE,[1,*] JERI WEISS,[2] GERALD KEELER,[3] ERIC MILLER,[4] GILLE BOULET,[5] RAYNALD BRULOTTE[5] AND LAURIER POISSANT[6]
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[3] Air Quality Laboratory, University of Michigan, Ann Arbor, Michigan, 48109, USA
[4] Ecosystems Research Group Ltd., Norwich, Vermont, 05055, USA
[5] Ministère de l'environment du Québec, Québec, (Québec), Canada
[6] Environment Canada, Meteorological Service of Canada, Montreal, Québec, Canada

Accepted 4 December 2004

Abstract. Data from 13 National Atmospheric Deposition Program Mercury Monitor Network (NADP/MDN) monitoring stations (1996–2002) and the Underhill (VT) event-based monitoring site (1993–2002)

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ScienceDirect
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Atmospheric Environment 41 (2007) 5423–5441
ATMOSPHERIC ENVIRONMENT
www.elsevier.com/locate/atmosenv

Trend, seasonal and multivariate analysis study of total gaseous mercury data from the Canadian atmospheric mercury measurement network (CAMNet)

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[b] GKSS Research Centre Geesthacht, Institute for Coastal Research, Max-Planck-Str.1, D-21502 Geesthacht, Germany
[c] Environment Canada, Meteorological Service of Canada, 45 Alderney Drive, Dartmouth, NS, Canada B2Y 2N6
[d] Environment Canada, Science and Technology Branch, 105 rue McGill, Montréal, Qué., Canada H2Y 2E7
[e] Environment Canada, Prairie and Northern Region, 4999-98 Ave., Edmonton, AB, Canada T6B 2X3

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Abstract

Long-term monitoring data of total gaseous mercury (TGM) concentrations from the Canadian Atmospheric Mercury

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Contents lists available at ScienceDirect
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journal homepage: www.elsevier.com/locate/atmosenv
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Long-term relationships between mercury wet deposition and meteorology

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[a] University of Michigan Air Quality Laboratory, 109 S. Observatory Ann Arbor, MI 48109, USA
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ARTICLE INFO

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ABSTRACT

Daily-event precipitation samples collected in Underhill, VT from 1995 to 2006 were analyzed for total mercury and results suggest that there were no statistically significant changes in annual mercury wet

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Complex statistical analyses…

Environ Monit Assess
DOI 10.1007/s10661-010-1504-6

Mercury trends in fish from rivers and lakes in the United States, 1969–2005

Ann T. Chalmers · Denise M. Argue · David A. Gay · Mark E. Brigham · Christopher J. Schmitt · David L. Lorenz

Received: 4 December 2009 / Accepted: 6 May 2010

Abstract A national dataset on concentrations of … of similar lengths. Site-based trends were evalu-

Environ. Sci. Technol. **XXXX**, *xxx*, 000–000

Trend Reversal of Mercury Concentrations in Piscivorous Fish from Minnesota Lakes: 1982–2006

BRUCE A. MONSON*
Minnesota Pollution Control Agency, 520 Lafayette Road No., St. Paul, Minnesota

Received September 26, 2008. Revised manuscript received December 26, 2008. Accepted January 8, 2009.

The trend of mercury concentrations in standardized length northern pike (NP_{55}) and walleye (WE_{40}) was evaluated for a 25-year period, 1982–2006, based on a data set of 1707 cases from 845 lakes throughout Minnesota. Two lines of evidence—changes within individual lakes and regression analyses for all lakes together—indicate a downward trend before the mid-1990s and an upward trend thereafter. Within lakes, the evidence is based on the difference between two years of data at least 5 years apart. Before 1995, 64% decreased and 31% increased; after 1995, 35% decreased and 60% increased. Three regression models—linear, quadratic, and two-segment linear piecewise—were evaluated for best fit using the Akaike Information Criteria (AIC). The two-segment linear piecewise regression model, with a breakpoint of 1992, was the best fit, while the quadratic model, with an inflection point of 1995, also had substantial support. The linear model was not

analyses has been limitec
lack the statistical bene
collection. Most often, t
regression analysis (*9–11*
those studies that have ar
mainly found downward
(*10, 12–14*).
Minnesota's Fish Cont
collected fish for mercu
database contains mercur
fish species. The ubiquito
pike (*Esox lucius*) and wa
indicators of mercury con
trations in northern pike
nesota lakes were statistic
standardized lengths of
indicators of mercury co
temporal trends in merc
and 2006.

Materials and Methods

Fish Collection, Processi
Department of Natural Res
lakes over the last 50 year
number of lakes surveyed
lakes per year. The fish su
and angling use; large, hea
frequently than small, ligh
in 1–3 year cycles, but m
and remote lakes have
representative subset of t
mercury analysis of fish
resampled sites. Site selec

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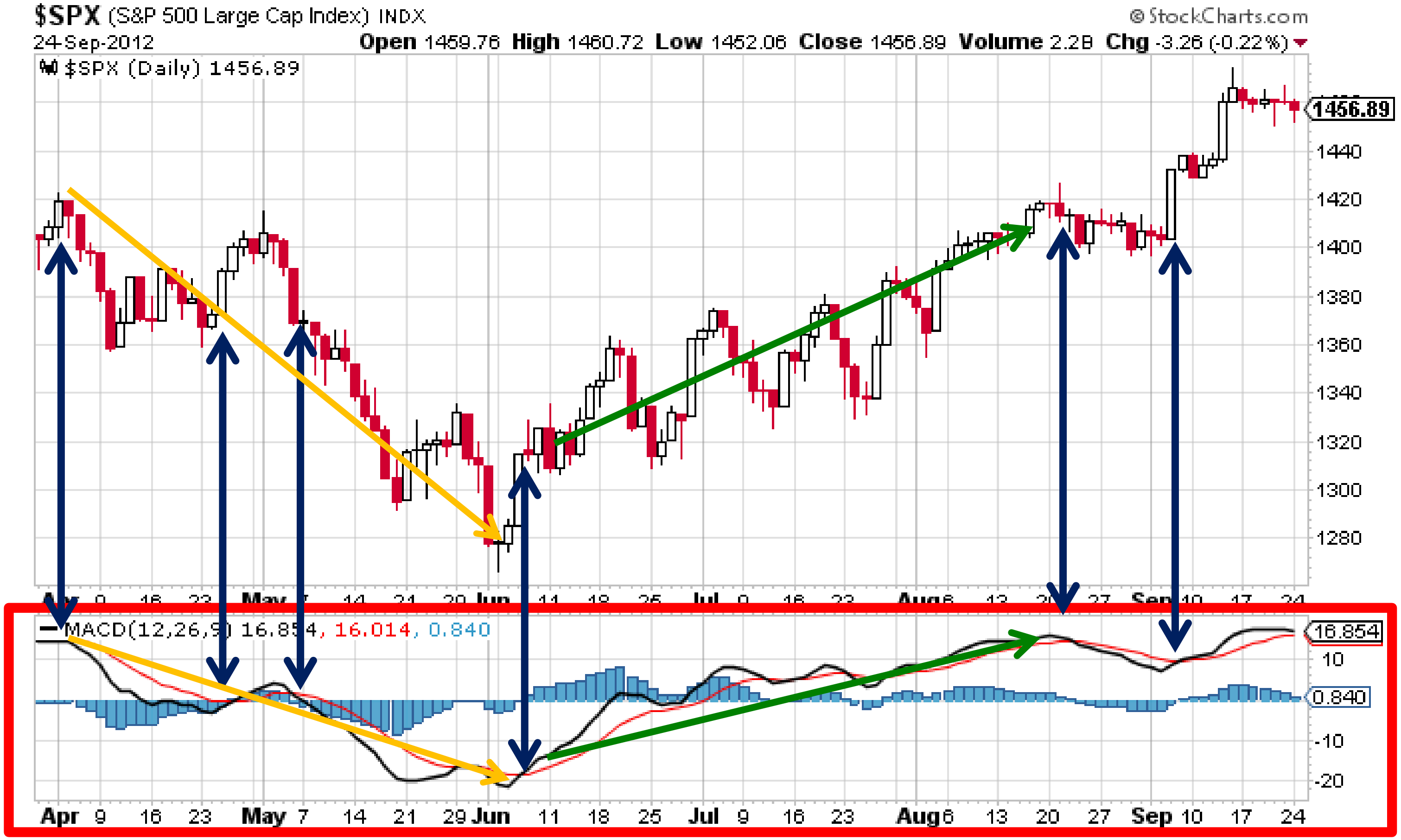
Financial markets: how to pick tops and bottoms?

Moving Average Convergence-Divergence (MACD)

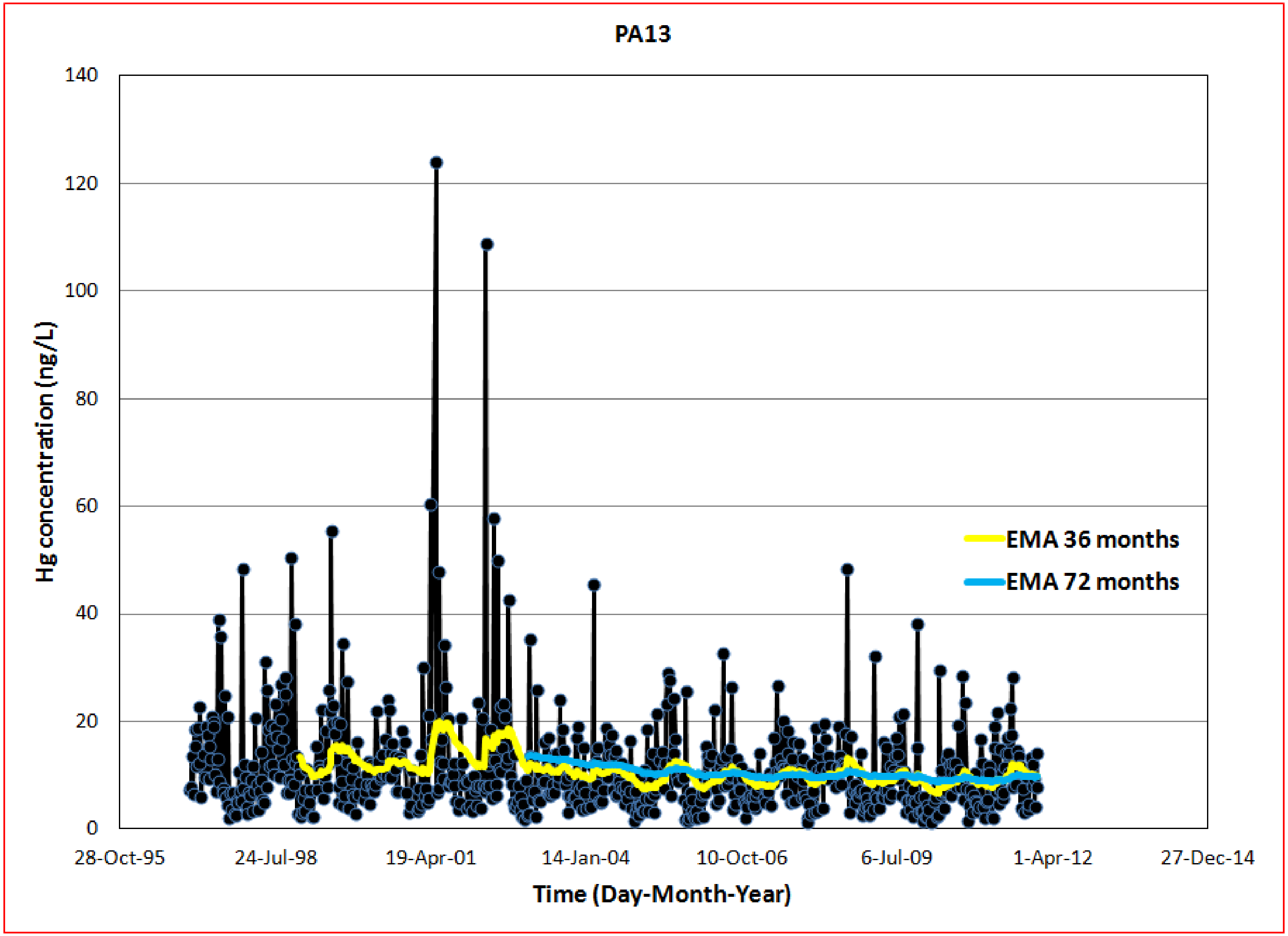


Moving Average Convergence-Divergence (MACD)

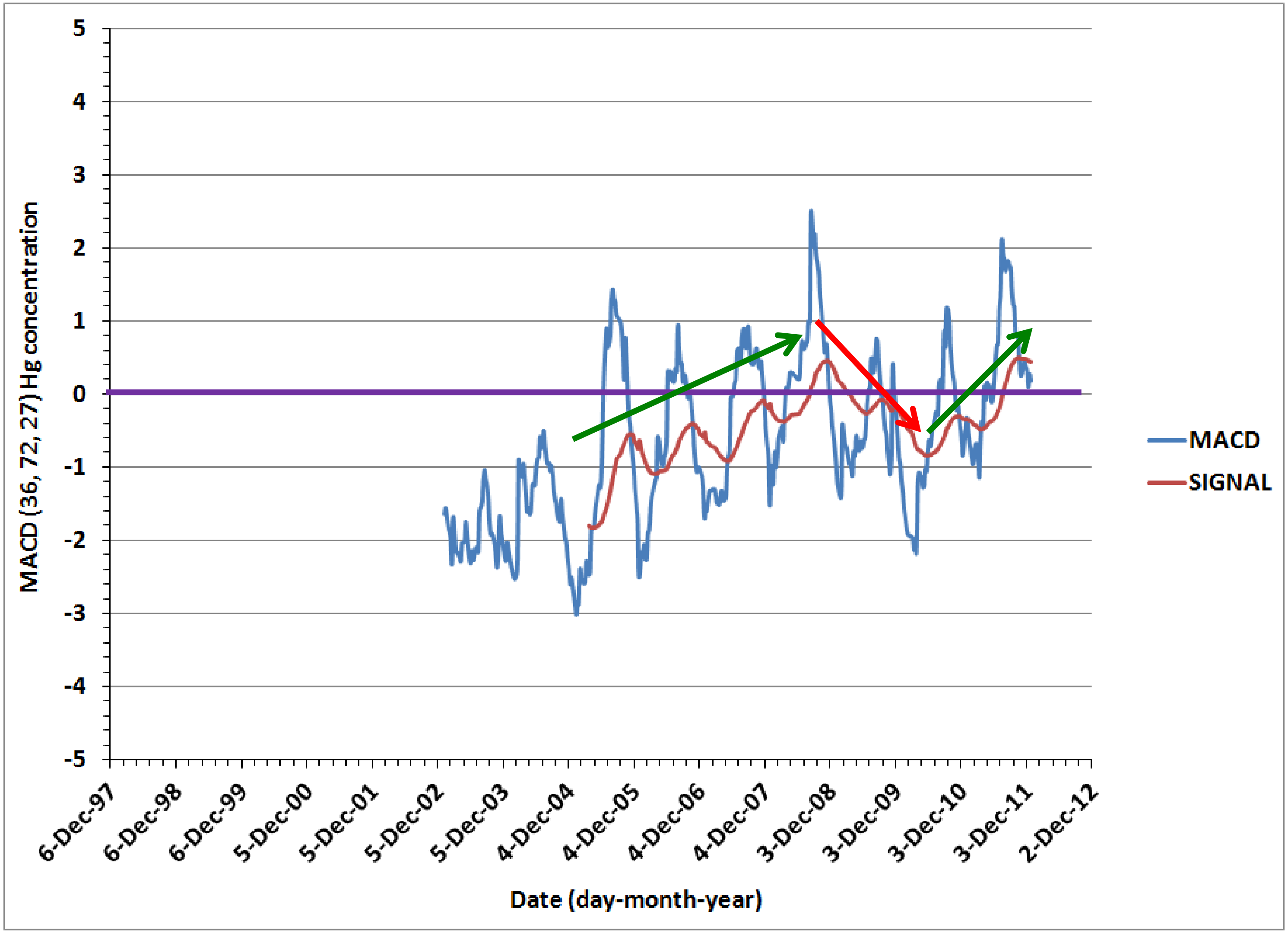
- Developed by Gerald Appel in the late seventies.
- Turns moving averages into a trend-following and momentum-oscillator by subtracting a longer moving average from a shorter moving average.
- The MACD fluctuates above and below a zero line as the moving averages converge, cross and diverge.
- Look for signal line crossovers, zero line crossovers and divergences to generate signals.
- **Calculation**
  - **MACD Line** : *12-day* ***E****xponential* ***M****oving* ***A****verage (****EMA****)* **—** *26-day EMA*
  - **Signal Line** : *9-day EMA of the MACD Line*
  - **EMA** : *#-day* ***M****oving* ***A****verage* **X** *Weighting multiplier* [# = 9, or 12, or 26)
  - **Weighting multiplier** = *2 / (time period + 1)* [Time period is 9, or 12, or 26]

Can the MACD be applied to MDN data?

Hg conc. at PA13: EMA 36 and 72 months



MACD of PA13 Hg concentrations longer term



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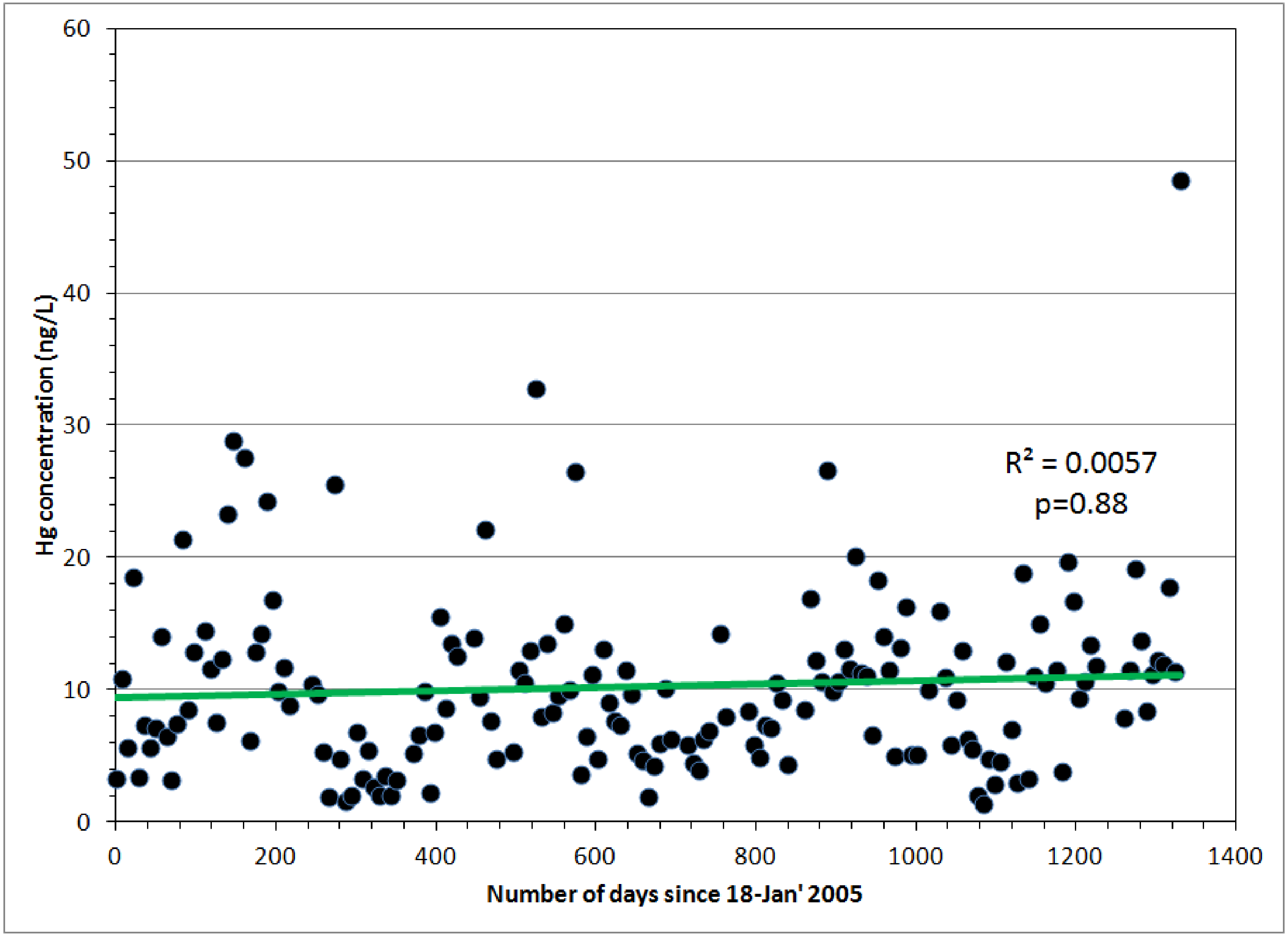
PA13: Hg conc. trend between January 18, 2005 and August 19, 2008



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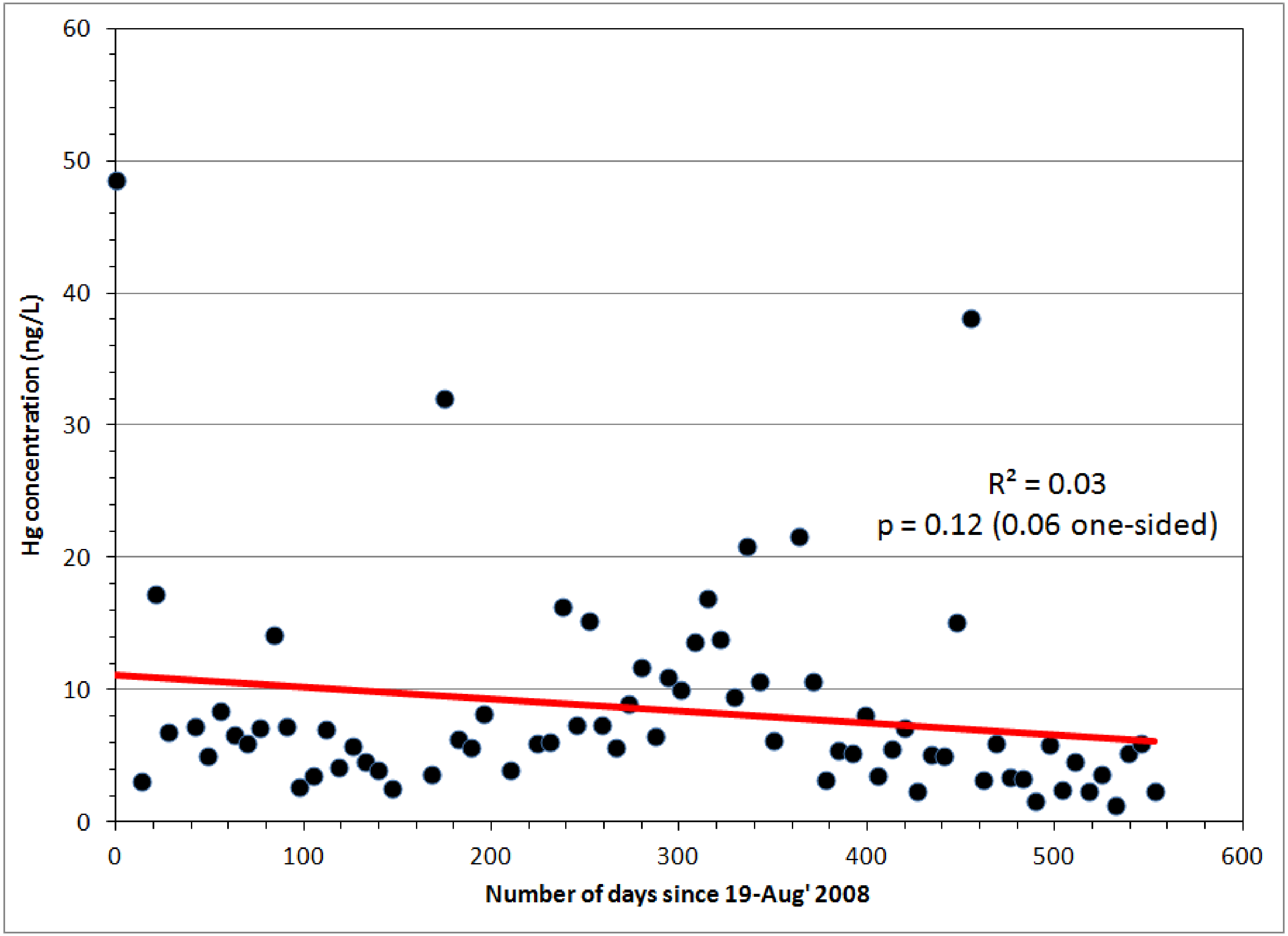
PA13: Hg conc. trend between August 19, 2008 and March 16, 2010



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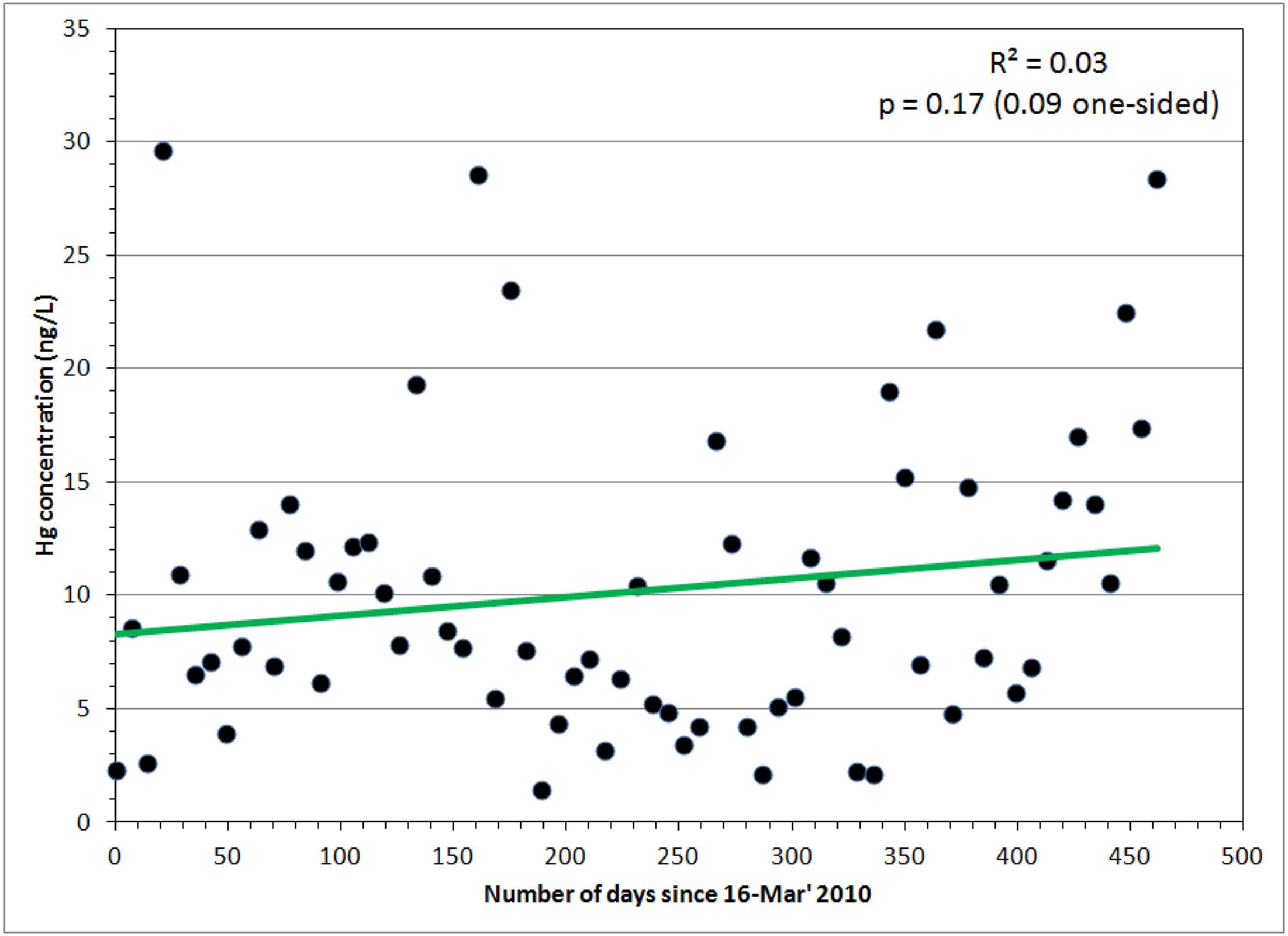
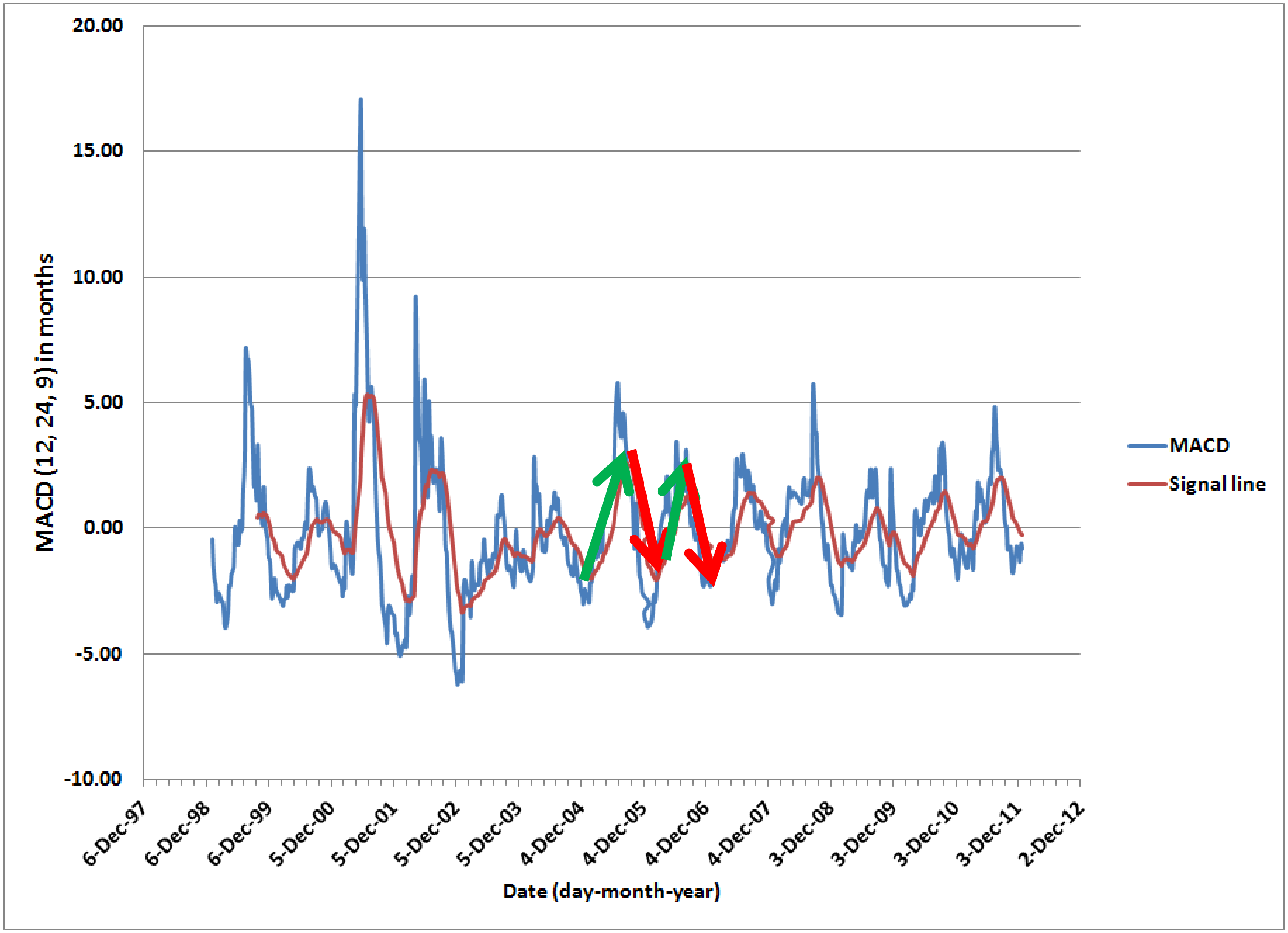
PA13: Hg conc. trend between March 16, 2010 and July 19, 2011



PA13: MACD shows seasonal Hg conc. trends



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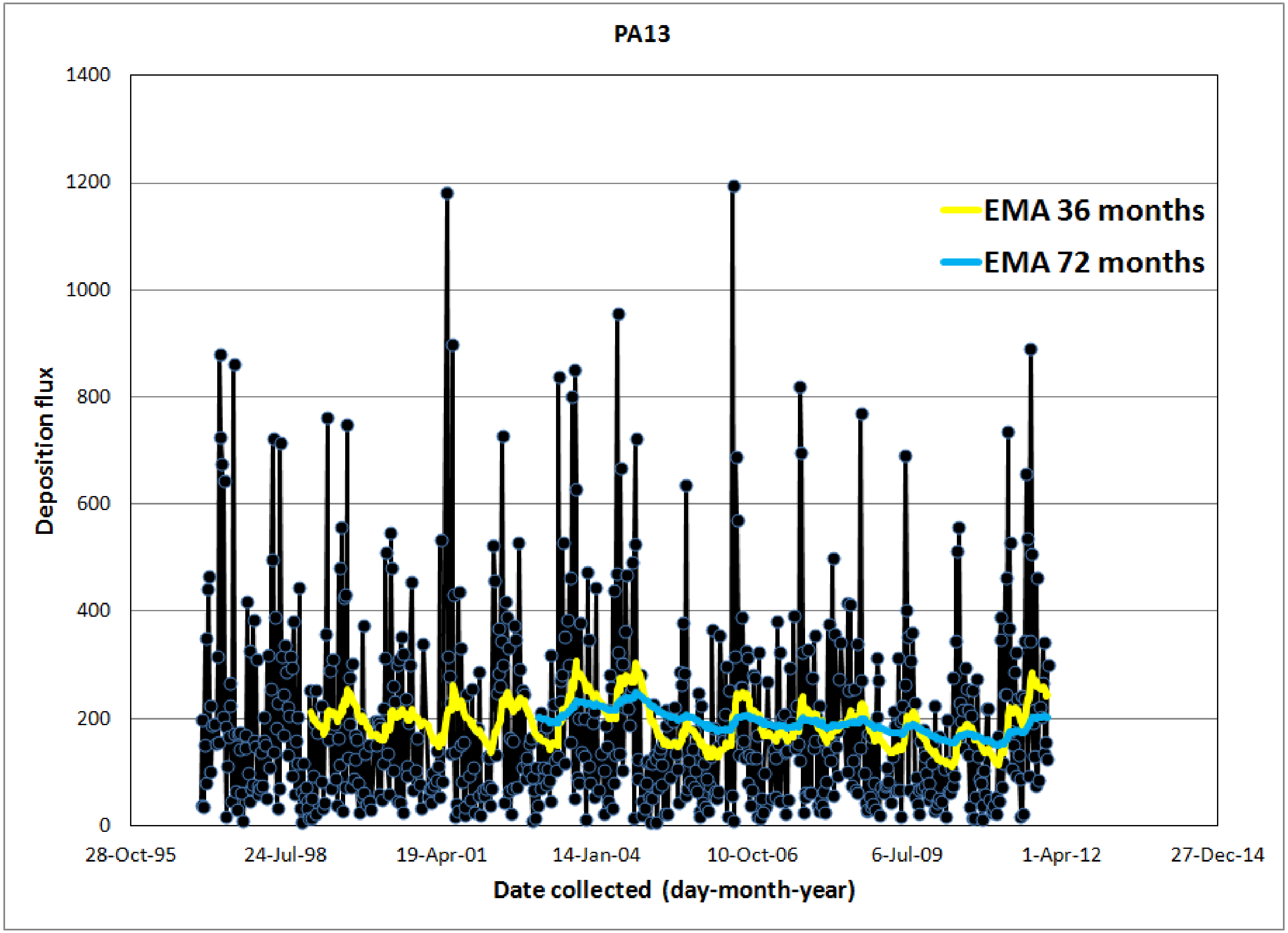
Hg deposition at PA13: EMA 36 and 72 weeks



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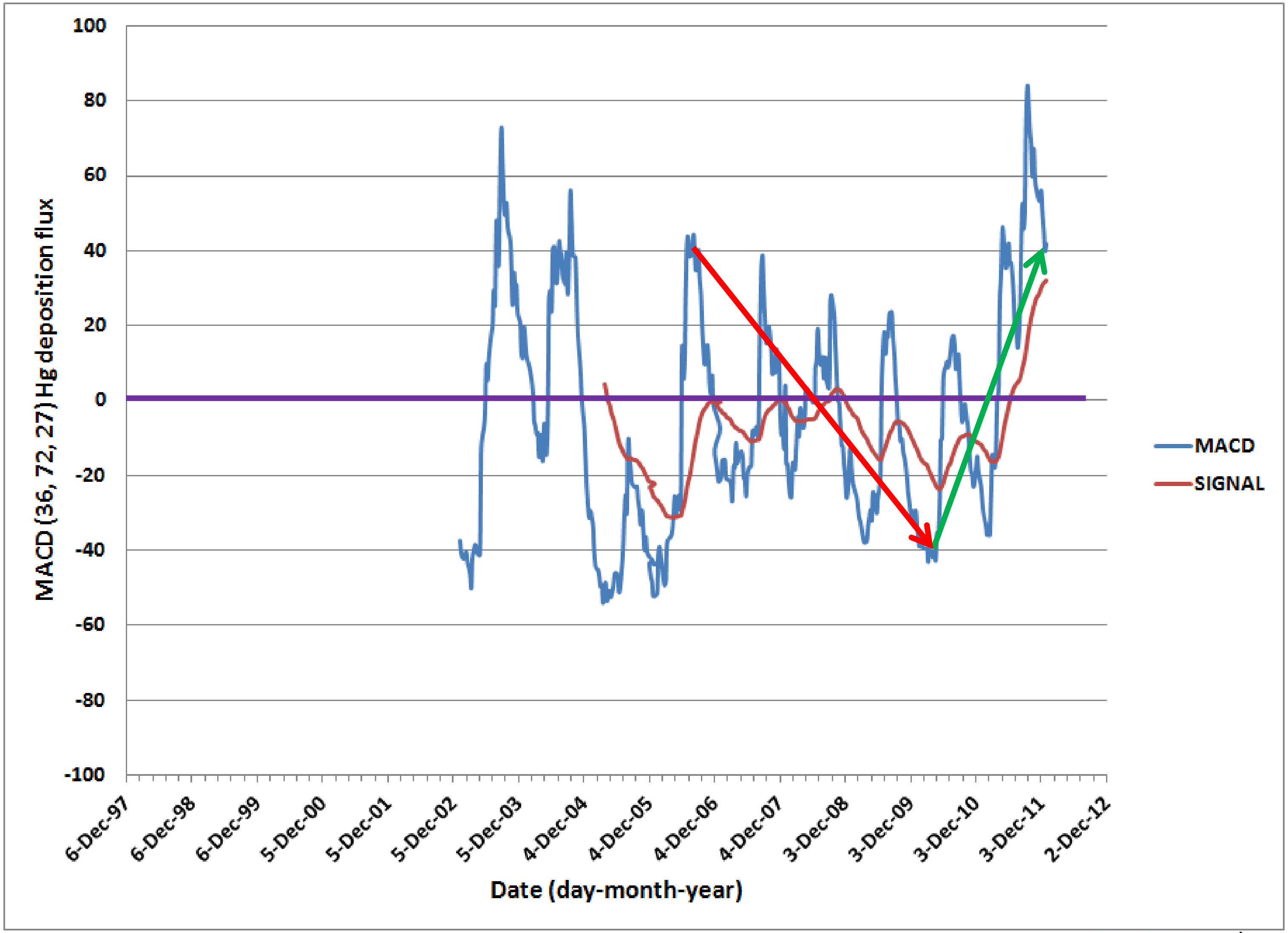
MACD of PA13 Hg deposition flux



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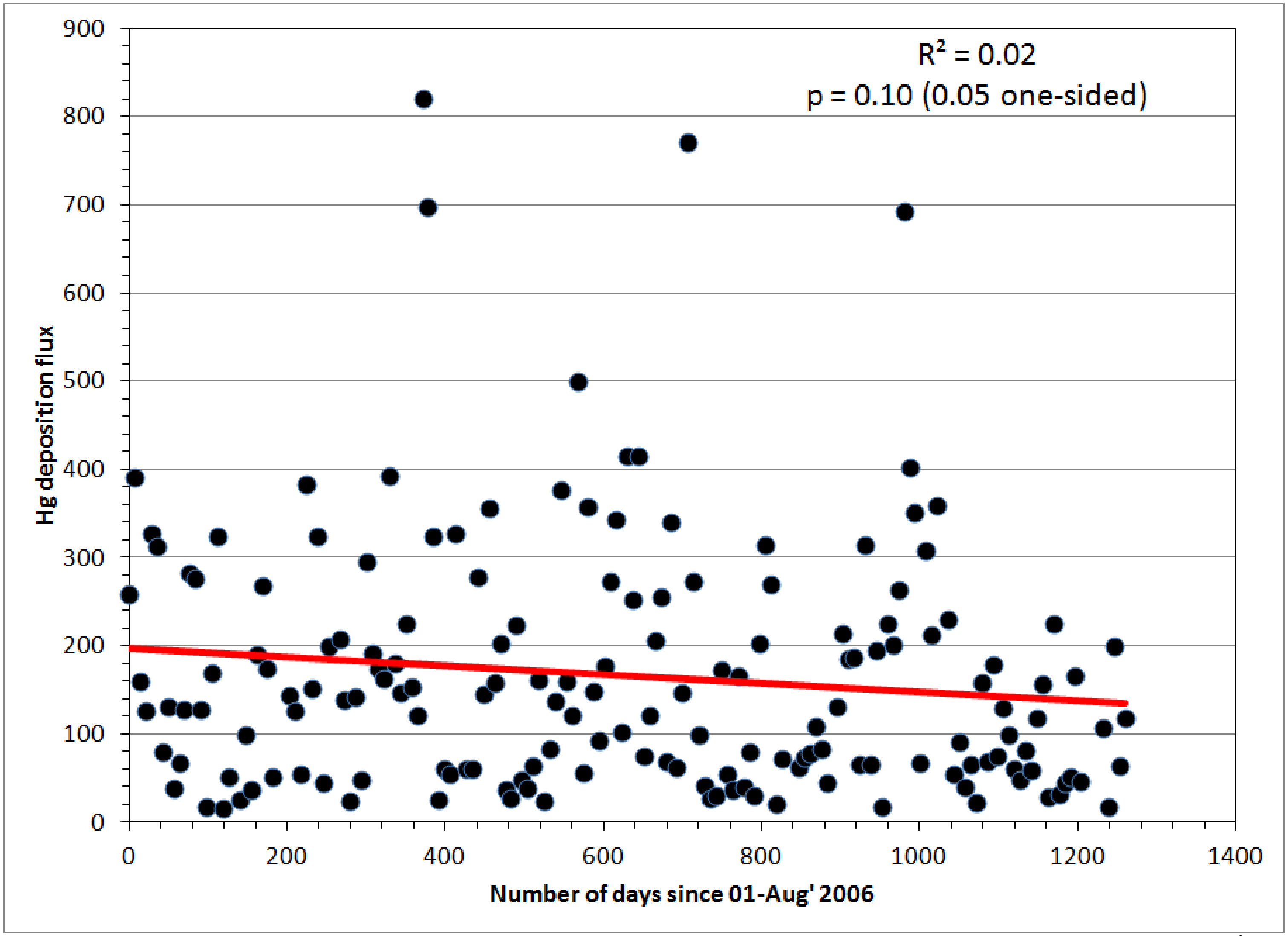
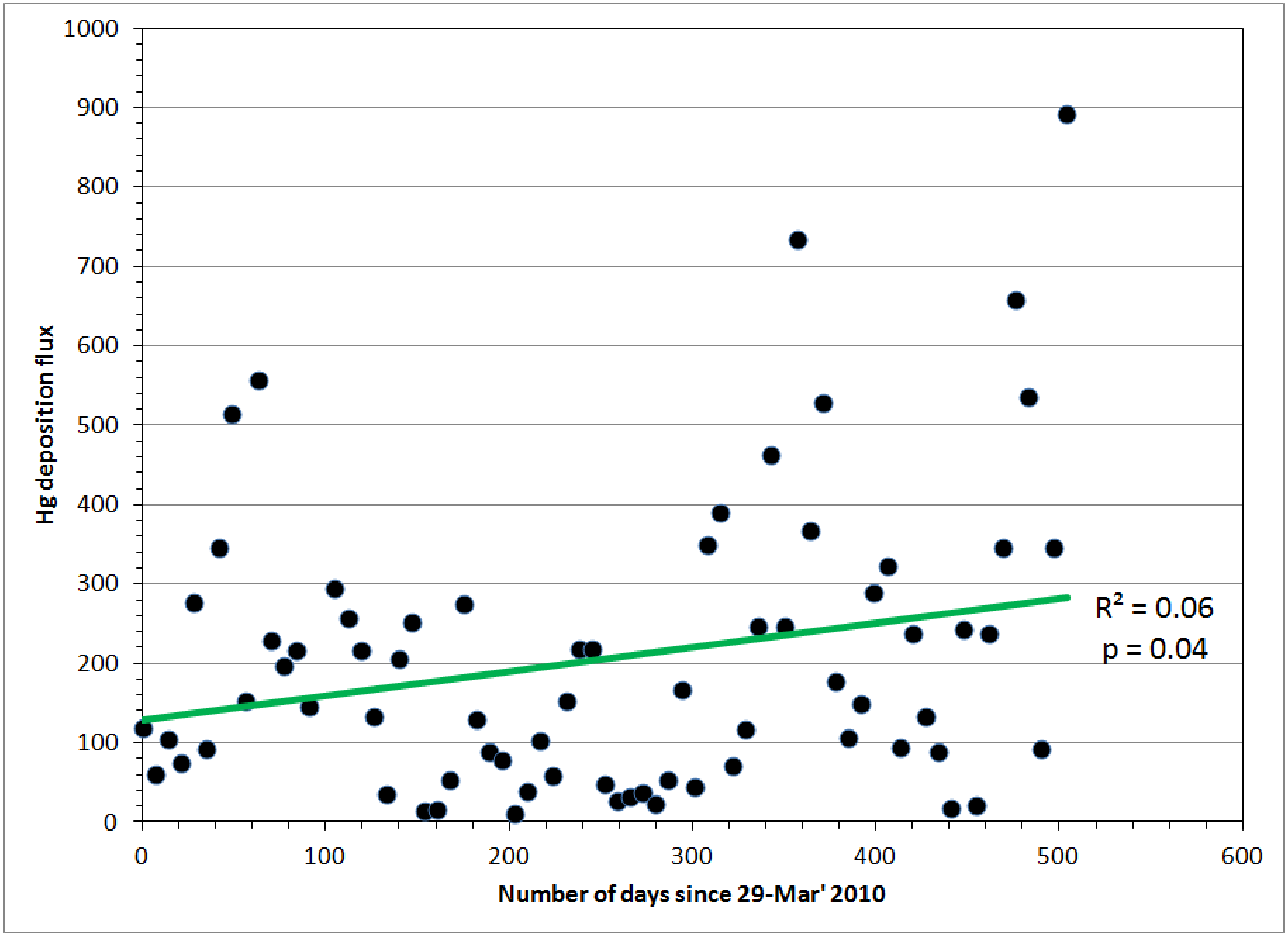
PA13: Hg dep. trend between August 1, 2006 and March 29, 2010



PA13: Hg dep. trend between March 29, 2010 and October 6, 2011



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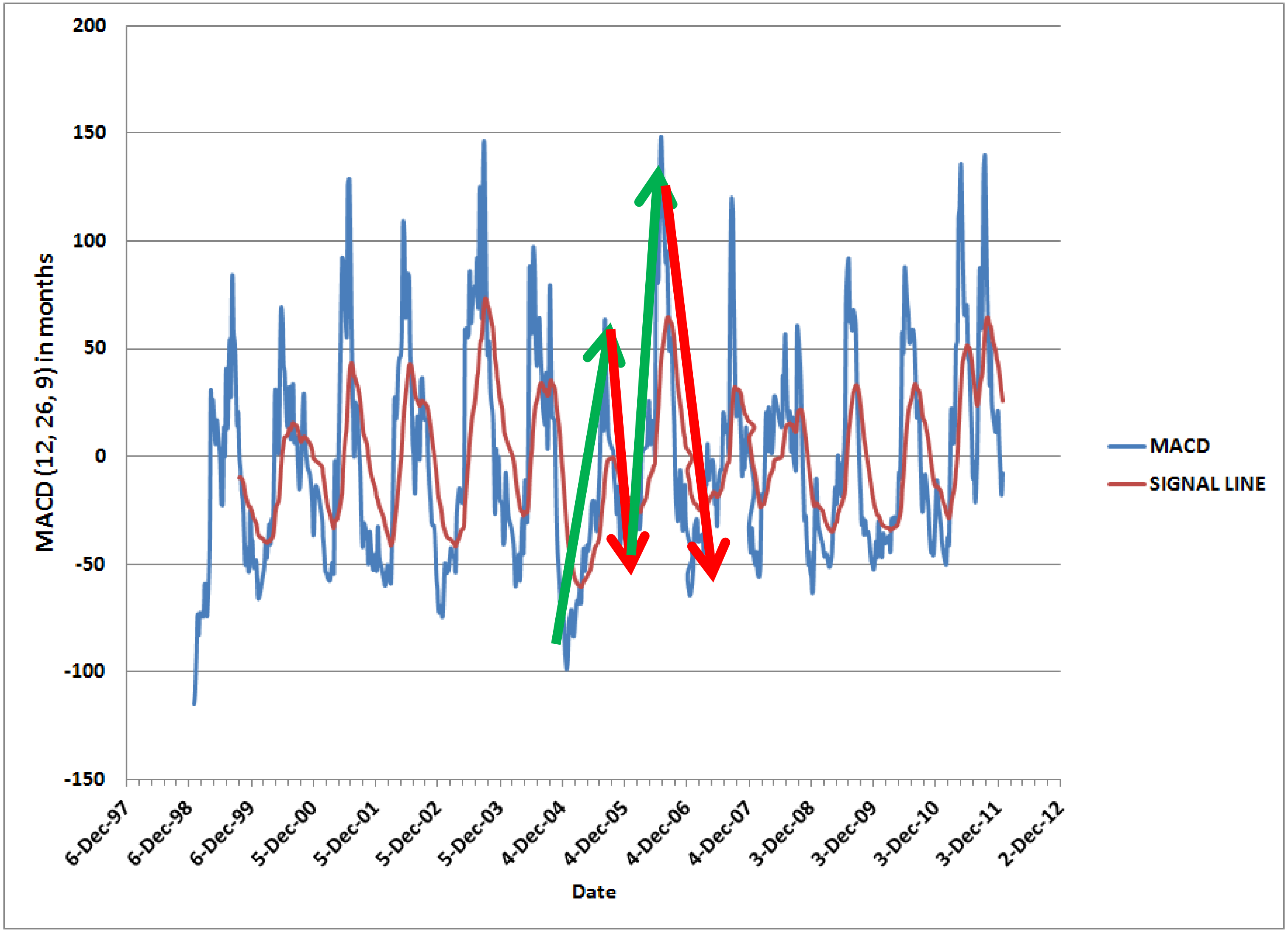
PA13: MACD shows seasonal Hg dep. trends



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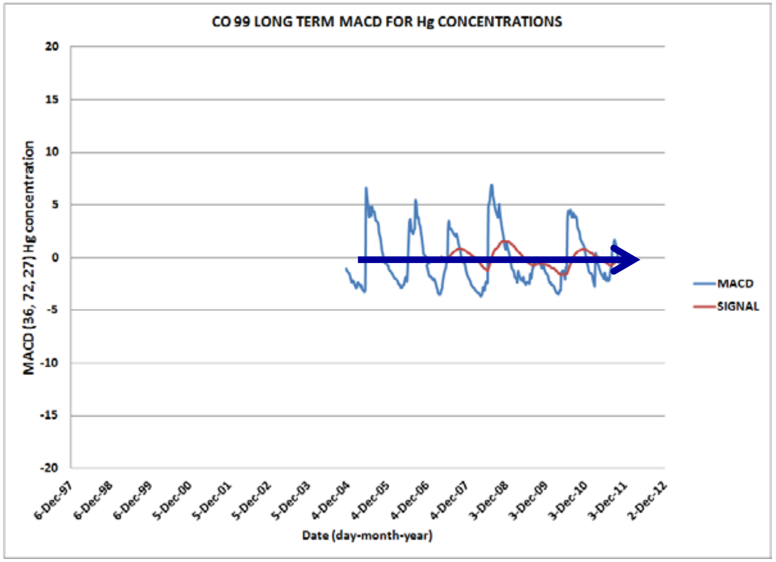
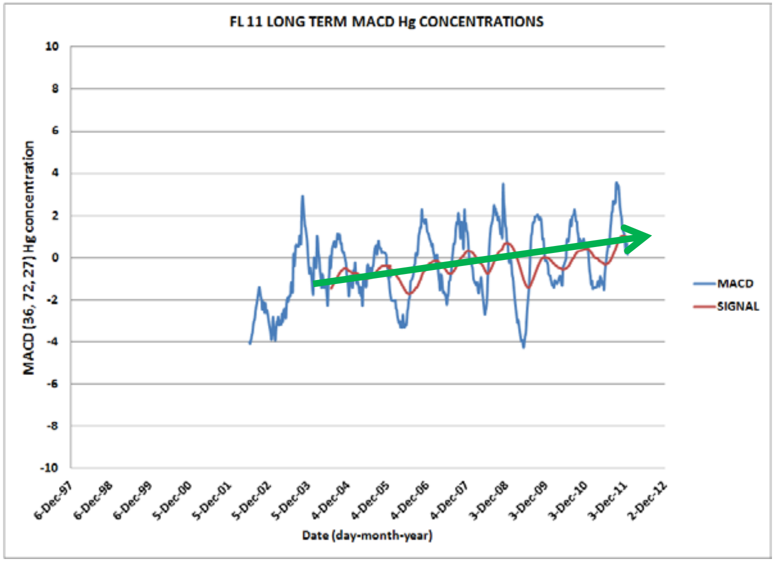
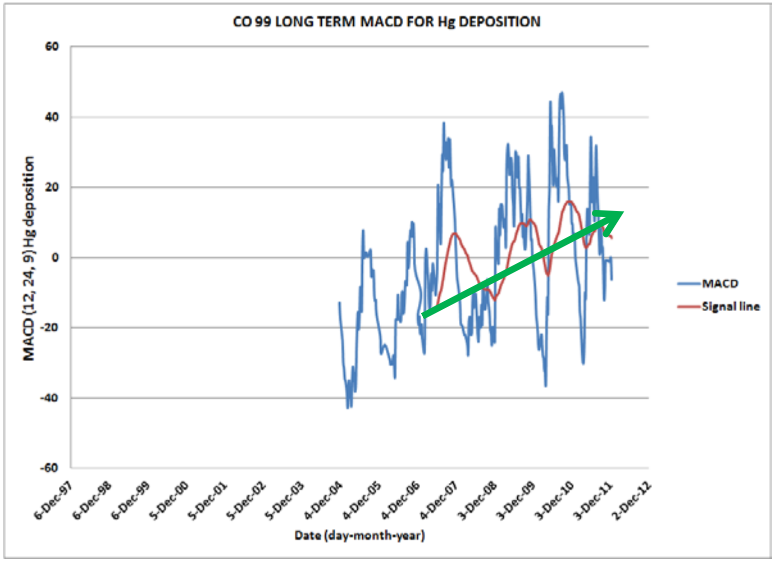
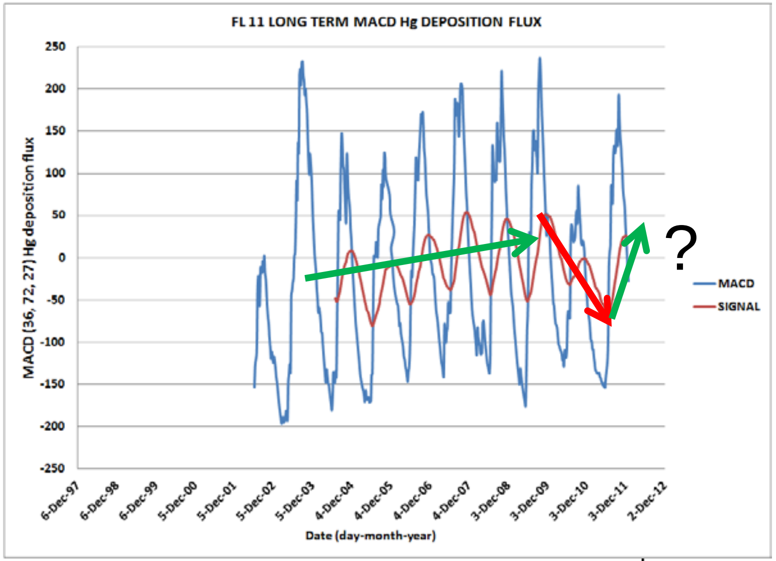
How about CO99, and FL11? Longer term MACD



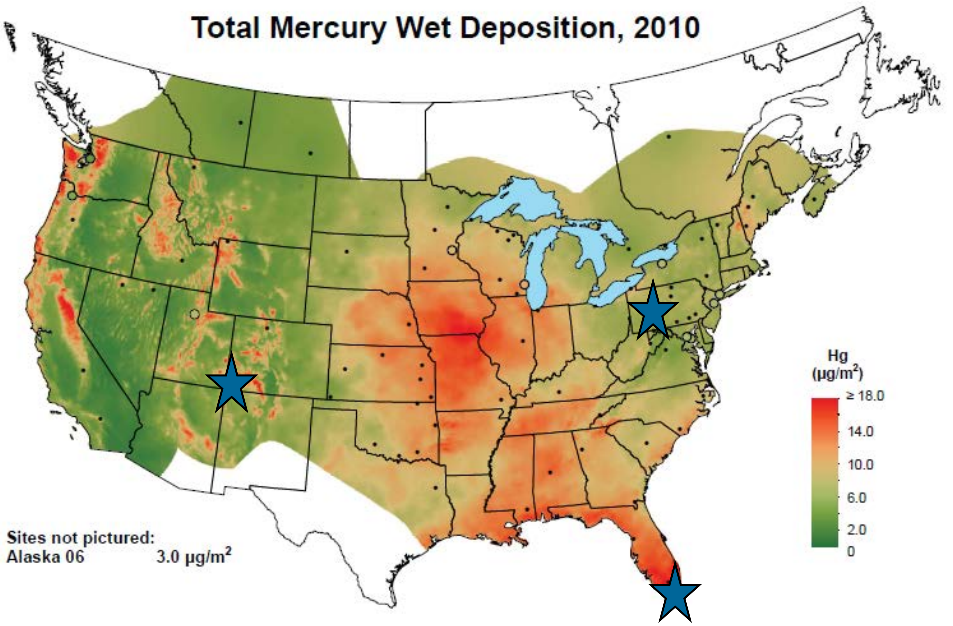






Conclusions

- MACD can be applied to MDN data.
- MACD capable of identifying:
  - Seasonal trends (months)
  - Intermediate term trends (years)
  - Long term trends (decades) ?



- Mercury concentrations and deposition trends differ within and between sites PA37, CO99 and FL11.
- MACD suggests temporal trends are not static straight lines, but complex, with changing slopes and over different time periods.

MACD can be applied to MDN data (for sites with sufficiently long data records)

Together…Shaping the Future of Electricity