Comments on "Continuous-time Data-Based Mechanistic (DBM) Models and Their Importance in a Changing Environment" by Prof. P. C. Young

Marcos Bujosa

IIF Workshop: Forecasting in a changing environment

December 10, 2021

OCGtools: processing OCG's ...

Structure of the paper

Three parts

1. Philosophical Background: in which Prof. Young explains the *Hypothetico-Inductive DBM Modeling* (HI-DBM)
2. Modelling of Global Climate Change
3. Monitoring and Forecasting the Progression of the COVID-19

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Philosophical Background (I)

The first part is illuminating and reveals Professor Young's deep convictions about how to model data.

Vindication of data-based inductive procedure (HI-DBM)

"Hypotheses are not ignored but they are not allowed to prejudice the data-based modeling"

My comment: This is a useful guide in many cases but not always ("Einstein's thought experiments" provide a deep understanding of the physical world without using data)

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Philosophical Background (II)

Vindication of models with mechanistic interpretation

(as opposed to pure black-box modelling)

> *"a model should. . . also provide a* **mechanistic description of the system under investigation***"*

Prof. Young underlines the advantages *differential equation models* in terms of uniqueness and mechanistic interpretation

My comment: to exploit this advantage we should have a theory stated in the language of differential equations (but this is not always the case in all fields of study).

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HI-DBM modeling is not a pre-defined methodology

it is an "ART AND CRAFT"

The rest of the article shows the extent to which Professor Young has mastered this "ART AND CRAFT".

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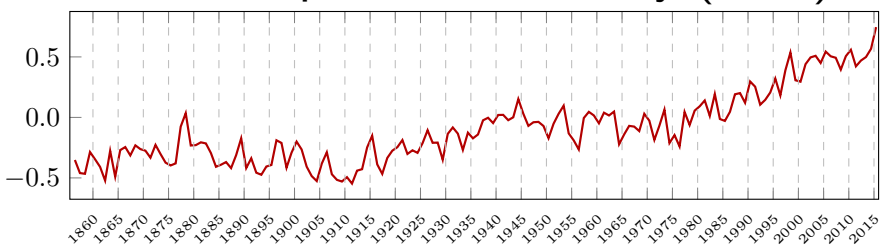
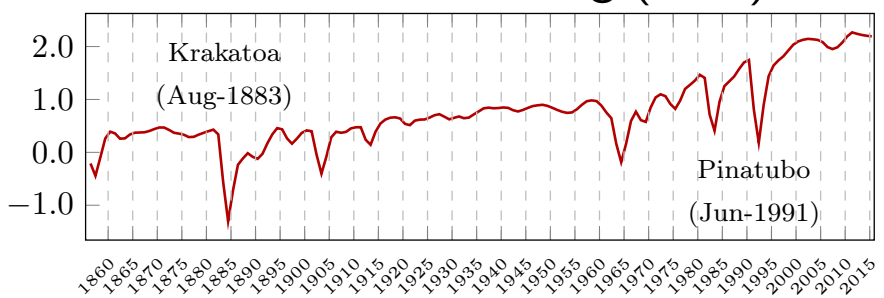
Modelling of Global Climate Change

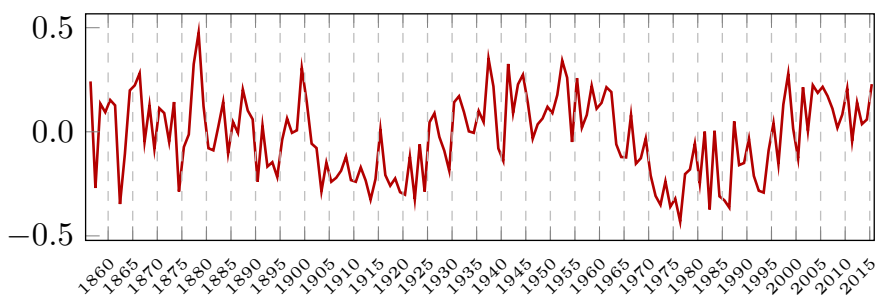
Global Temperature Anomaly (GTA)



Total Radiative Forcing (TRF)



Atlantic Multidecadal Oscillation (AMO)



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$$GTA(t) = a_1(t) + a_2(t) + noise(t)$$

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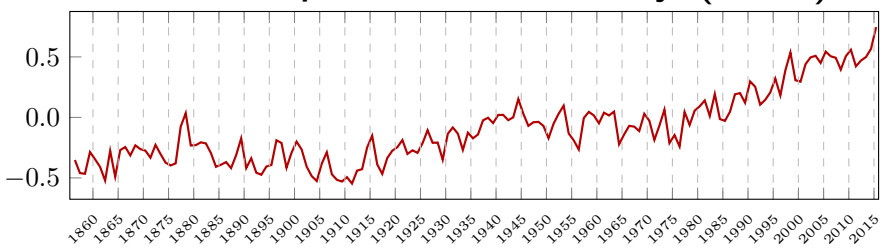

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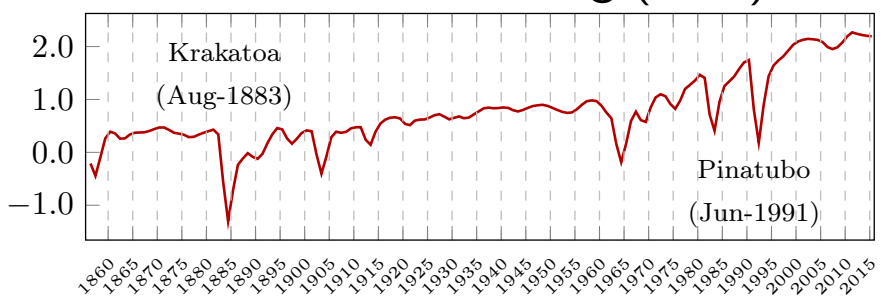

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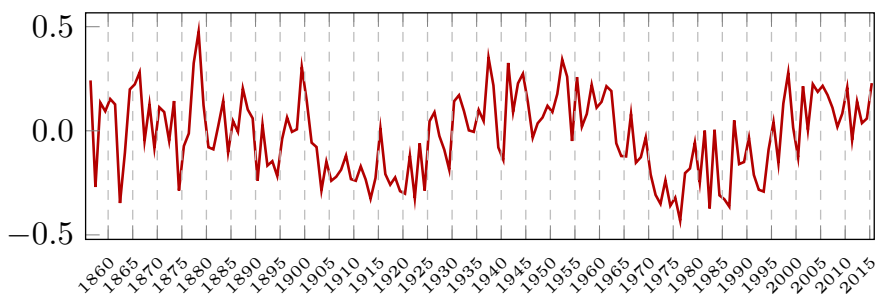

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differential operator $s^i = d^i/dt^i$

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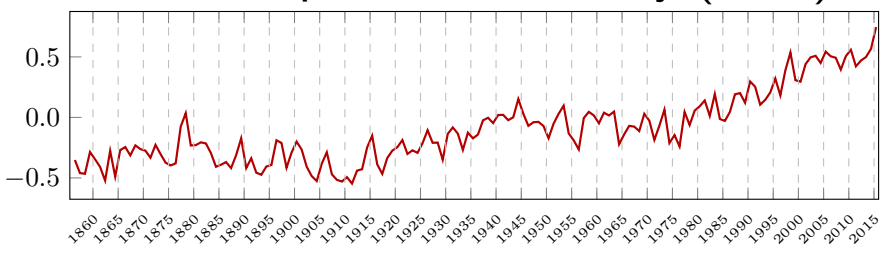

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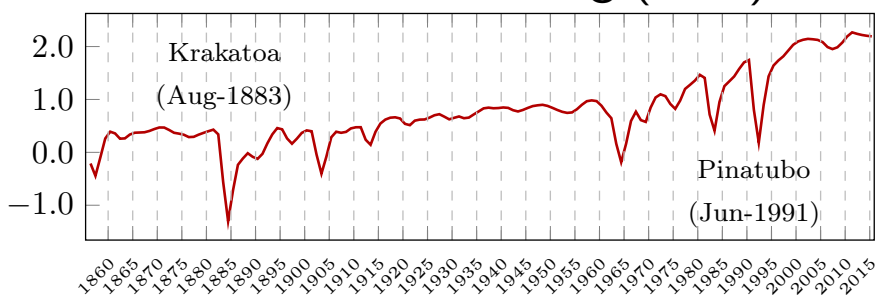

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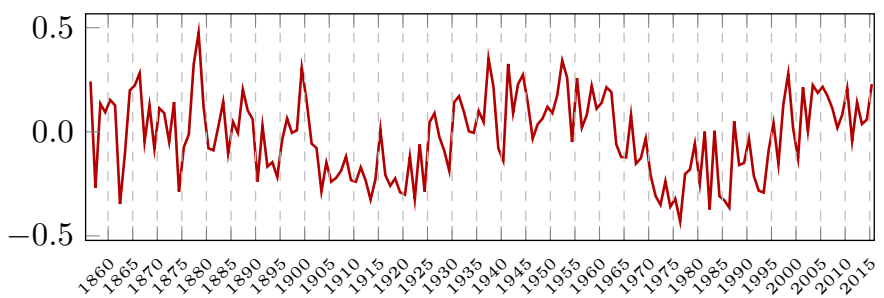

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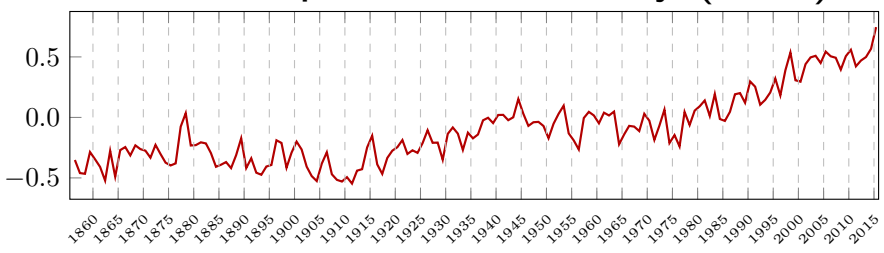

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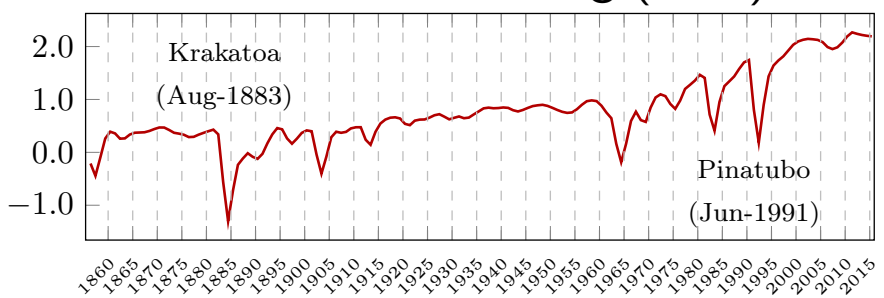

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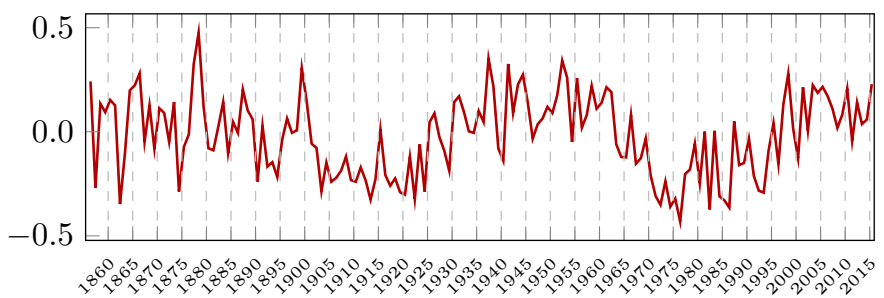

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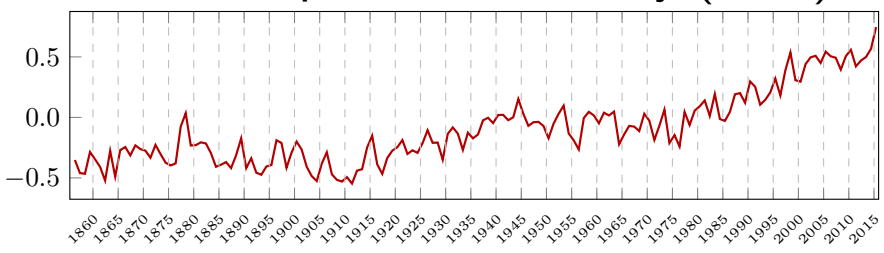

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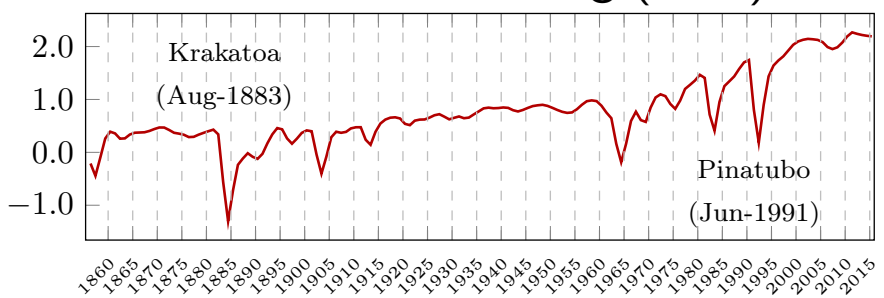

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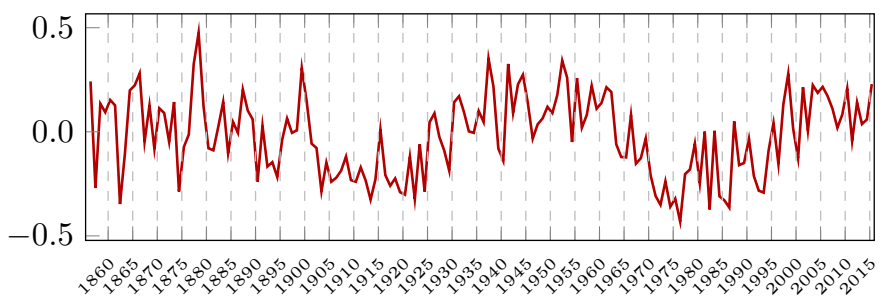

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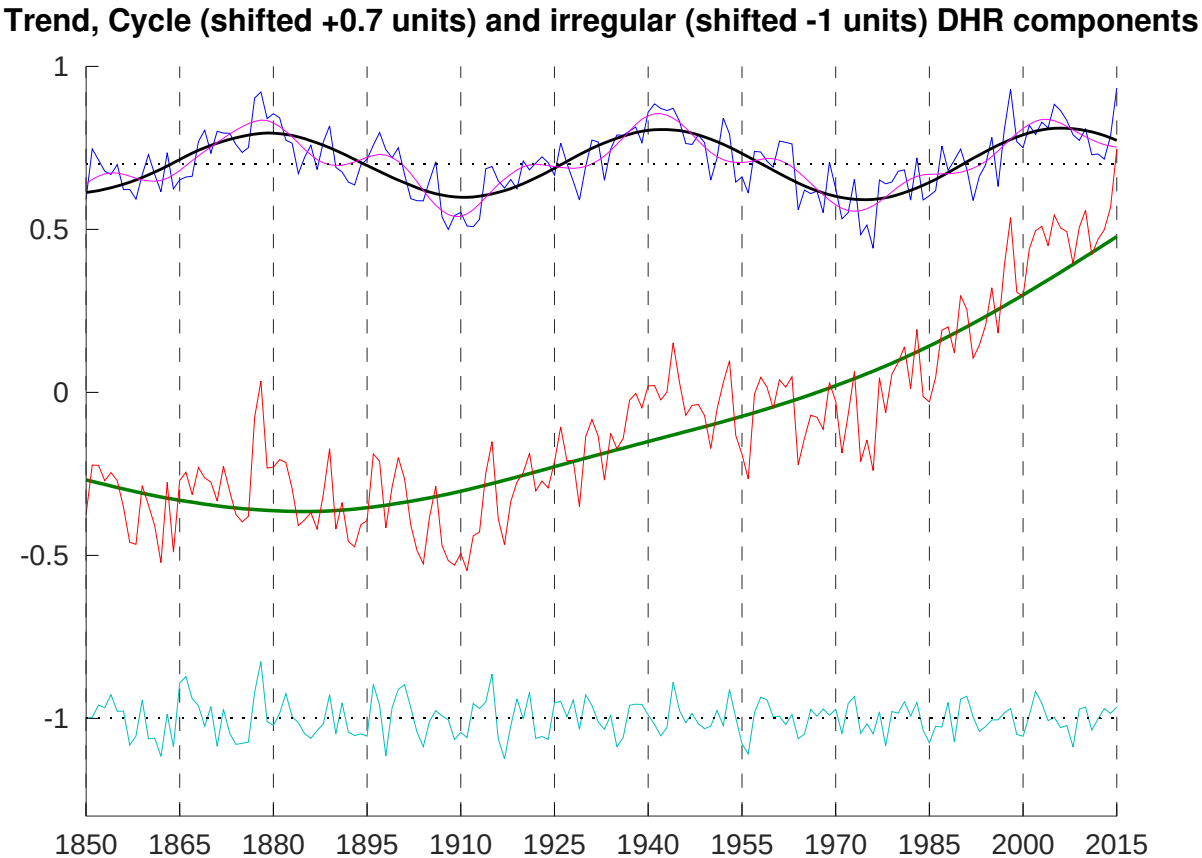
Have AMO and GTA a common 63-years cycle?

DHR components for GTA



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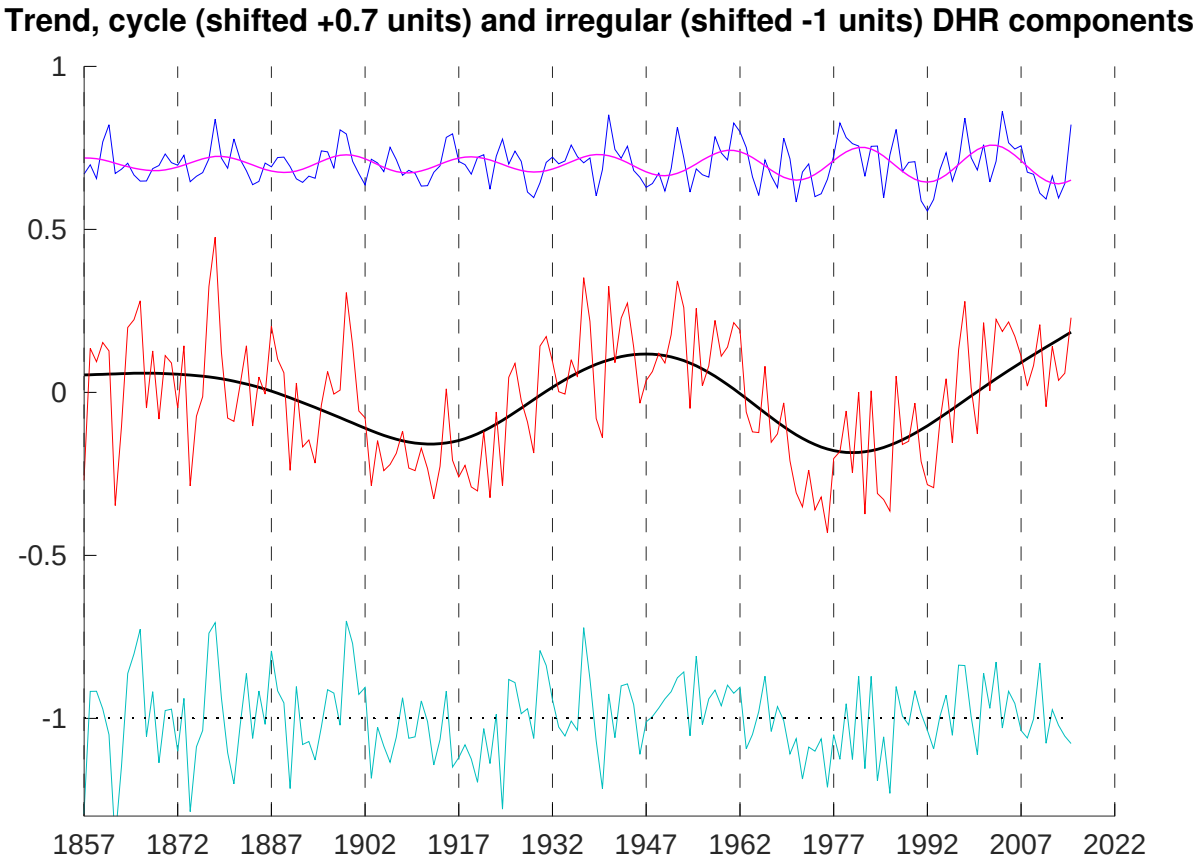

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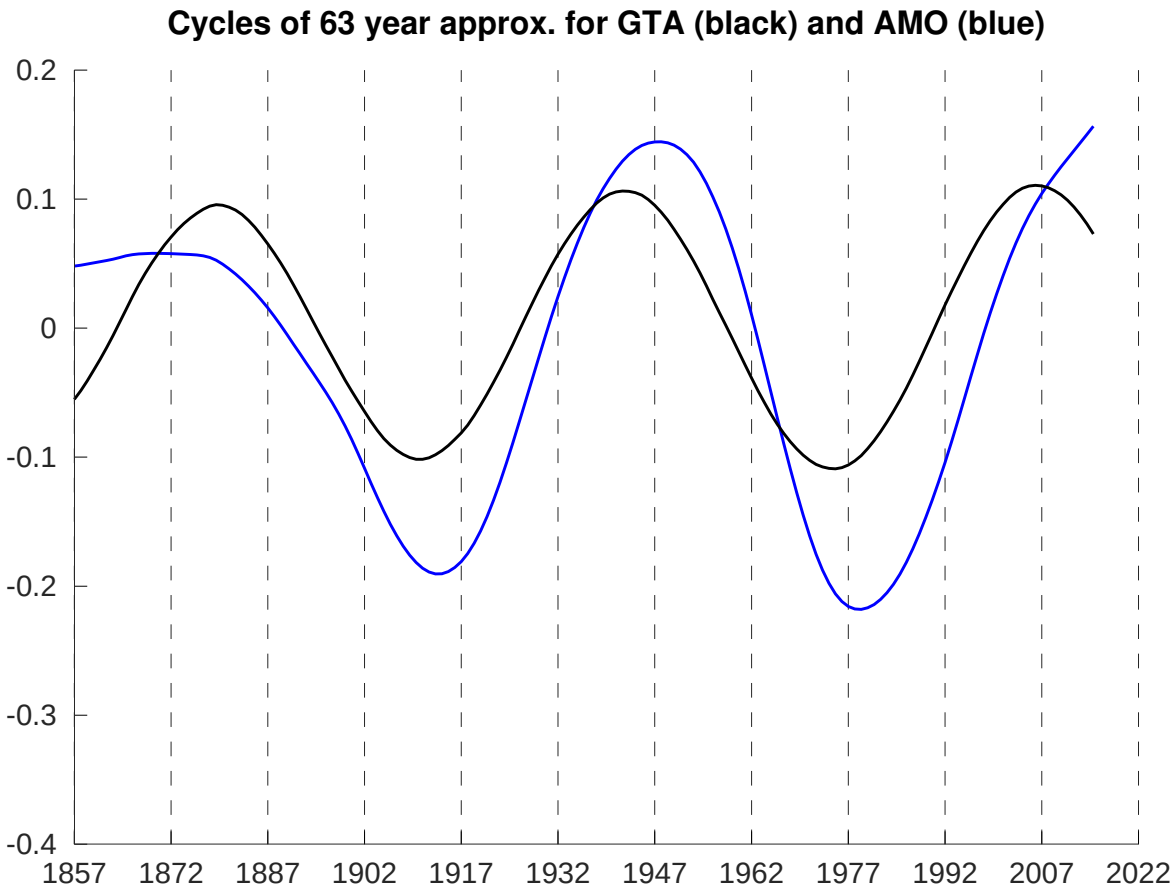
Have AMO and GTA a common 63-years cycle?

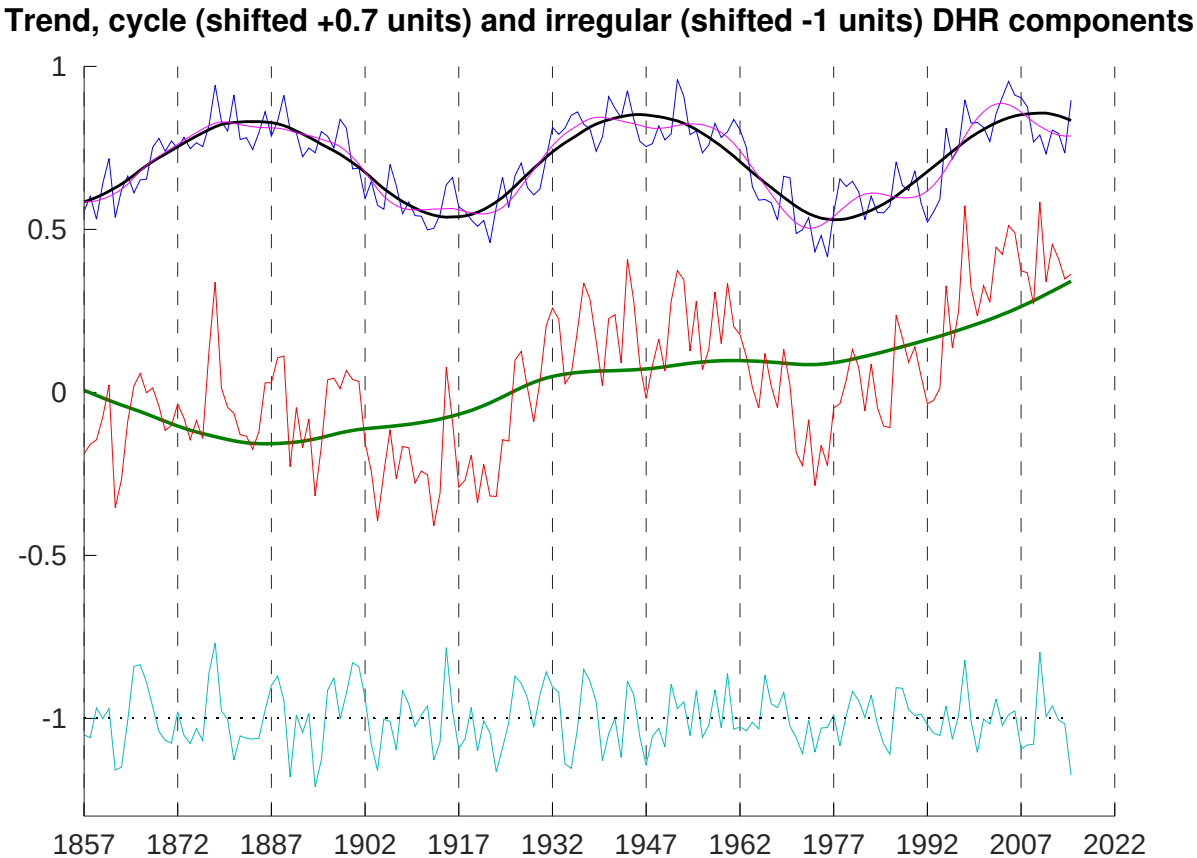
Not clear

GTA has a periodic cycle, but not AMO



Have original AMO and GTA a common 63-years cycle?

DHR components for *"original"* AMO data

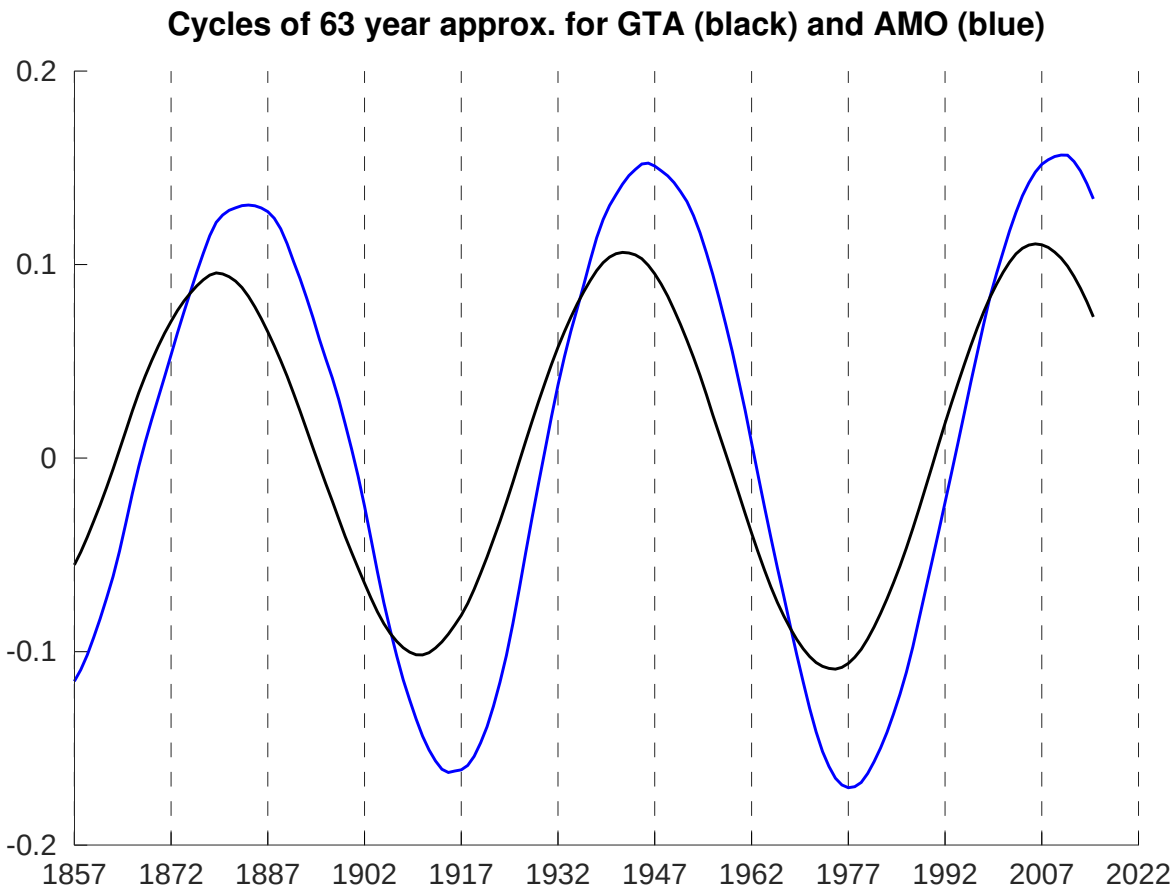


$$AMO_{\text{with trend}} = T + S^{63} + S^{21} + \sum(\text{other harmonics}) + Irreg$$

Have the *"original"* AMO and GTA a common cycle?

They seem to have a common cycle

(as suggested in Professor Young's article)



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