WHY EARTH ROTATION IS IMPORTANT FOR CLIMATE PREDICTION

AOGS-2019 16th Annual Meeting Asia Oceania Geosciences Society

PS06-A006

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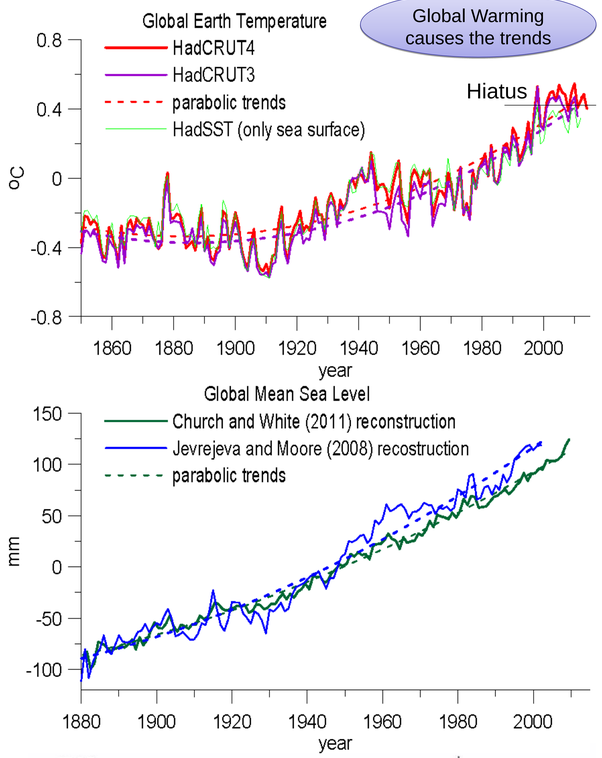
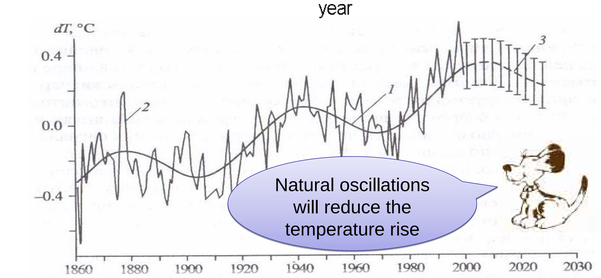
Abstract: Analysis of the Global Mean Sea Level (GMSL) and Global Average Earth Temperature (HadCRUT4) reveals presence of quasi-periodic components with periods of ~ 60, 20 and 10 years. 60-year component of temperature changes is correlated with the secular changes in the Earth rotation velocity represented by length of the day (LOD) while GMSL is correlated with the amplitude of the Chandler wobble (ChW) of the Earth's pole. We speculate that Hiatus and deceleration of the Global Warming, observed in 2010th, are related to the deceleration of the Earth rotation and Chandler wobble amplitude decrease. The mechanism is not yet explained, but it may involve Atlantic Multidecadal Oscillation (AMO), responsible for 60-year changes in temperature, North Atlantic Oscillation (NAO), which forces AMO, brings wet and cold summer to Northern Europe and drafts to Mediterranean (2017 yr), El Nino (ENSO), etc. Mutual information, which present in these processes, can be used for climate predictions.

Global Earth temperature and Global Mean Sea Level

Global Warming causes the trends

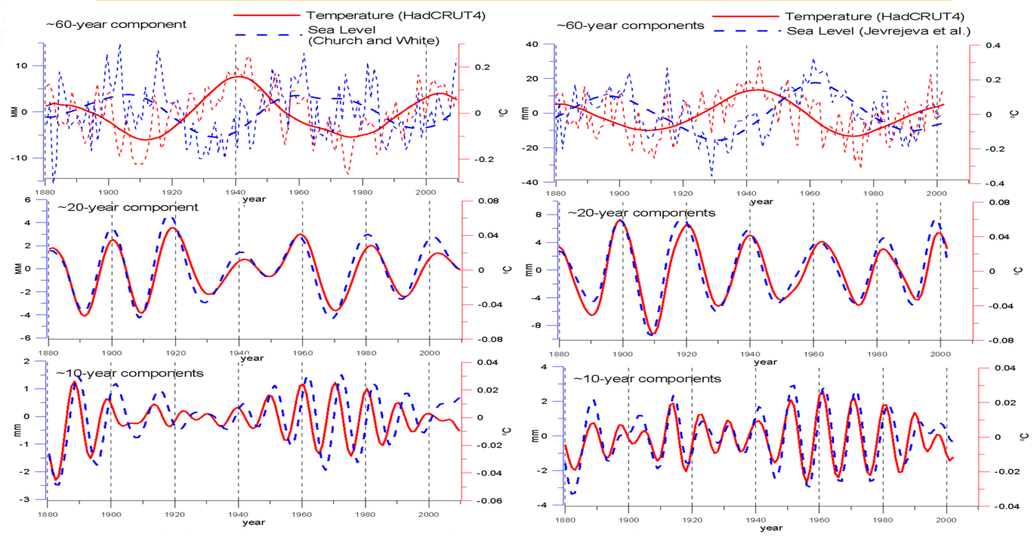




Trend (1) of temperature anomaly (2) and its prediction (3) by Lyubushin and Klyashtorin.

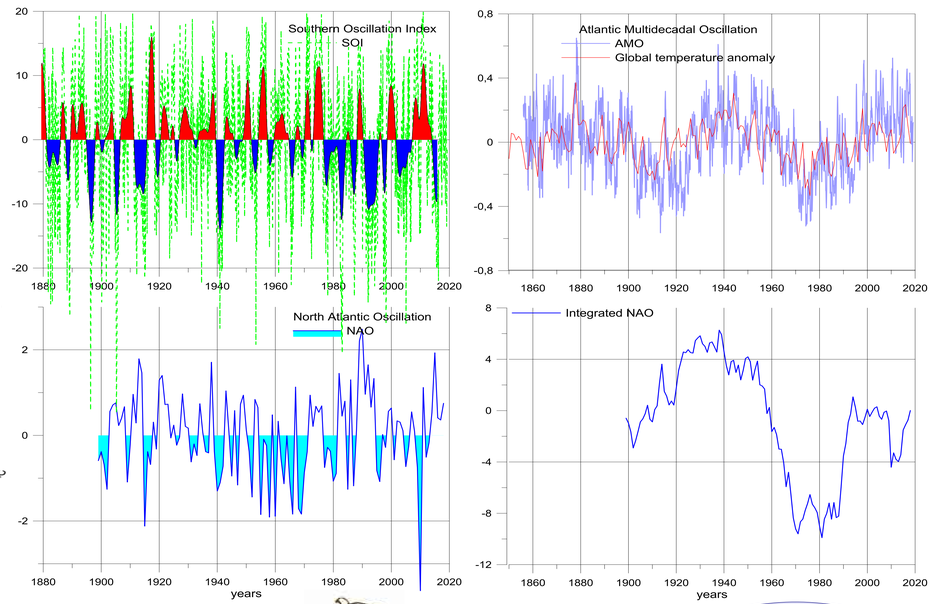
Common oscillations in temperature and sea level

HadCRUT4+Church&White | HadCRUT4+Jevrejeva

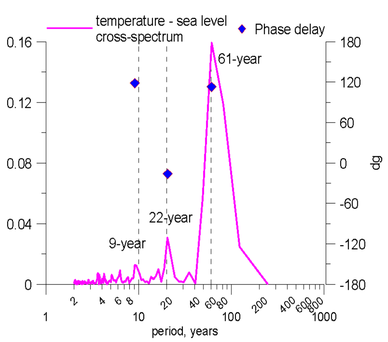


Multichannel Singular Spectrum Analysis (MSSA) with lag parameter L=22 years

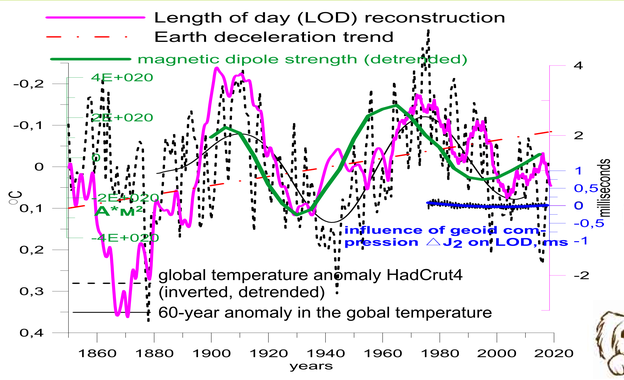
Important Global Climate Modes



T-SL cross-spectrum



Temperature anomaly, LOD, J_2, and magnetic dipole

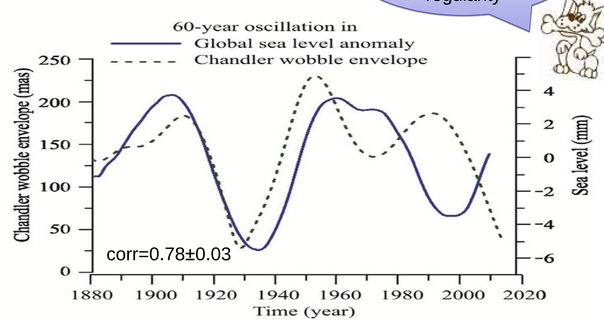


Processes in the core can be responsible for temperature and LOD 60-year oscillations

There are many arguments in favor that climate changes and Earth rotation are interrelated

Chandler wobble amplitude and SL

Chandler wobble amplitude changes present some regularity



Let's add Earth Rotation Parameters (ERP) to GCOS Essential Climate Variables (ECV) list!

Earth rotates slower when temperature decreases

Conclusion: Climate change and Earth rotation seems to be interrelated. Besides Global Warming trends there are quasi-periodic components of 60, 20, 10-year periods in temperature and sea level. 20- and 60-year component of Earth rotation rate (inverted LOD) matches temperature changes. 60-year temperature anomaly is related to Atlantic Multidecadal Oscillation (AMO). Correlation between Earth rotation velocity and global temperature anomaly can be used for these signals prediction. Earth deceleration in recent decade, extrema in AMO, which seems to begin to decrease, brings us to conclusion, that natural oscillations will cause deceleration of the global temperature rise in the nearest future. We propose to add ERP to Essential Climate Variables.

Reference:
[1] Zotov L., Bizouard C., Shum C.K. A possible interrelation between Earth rotation and climatic variability at decadal time-scale, Geodesy and Geodynamics, Vol. 7, Iss. 3, 2016, p. 216-222, KeAi, China.
[2] Zotov L. Study of the links between the Earth rotation and geophysical processes. Doctoral thesis, Lomonosov Moscow State University, 2019 (in Russian) https://istina.msu.ru/dissertations/211744667/

Acknowledgements: NRU HSE grant supports this presentation. We also thank "111" plan B17033