Global warming and natural variability

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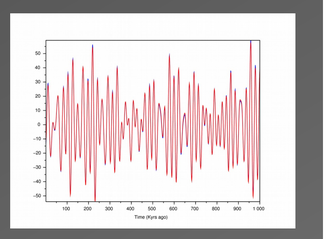
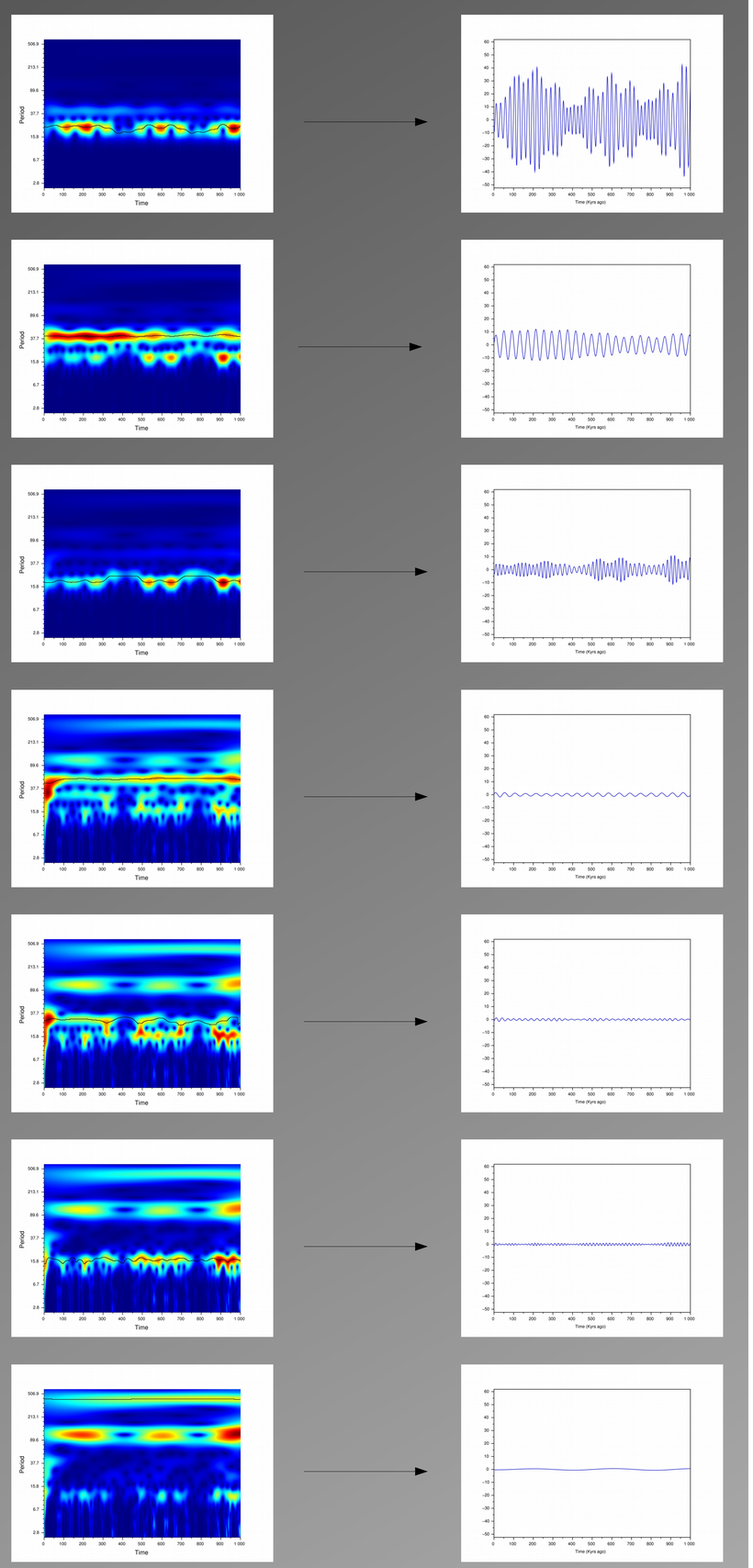
The WIME method

1. Given a signal $s(t)$, one performs the continuous wavelet transform $W_s(t,a)$ of $s(t)$, where t stands for the time and a for the inverse of the frequency.
2. The wavelet spectrum is defined as follows: $a \mapsto \Lambda(a) = E_t|W_s(t,a)|$, where E_t denotes the mean over the time.
3. A starting point (t,a_*) is selected in the time-frequency plane for the highest maximum a_*.
4. A ridge of high energy containing (t,a_*) on the whole time domain is defined.
5. A signal $c_{a*}(t)$ corresponding to this ridge is extracted from the time-frequency domain.
6. The signal $c_{a*}(t)$ is subtracted from $s(t)$ to obtain $s_2(t)$.
7. The whole process is repeated with $s_2(t)$ instead of $s(t)$.

Example: Milankovitch (Orbit91)

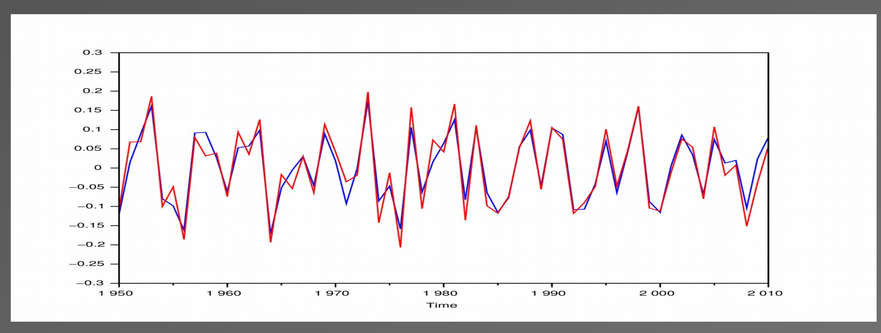
Right: The original signal (red) and the reconstruction (blue), i.e. the sum of the AM-FM components. The signals are barely distinguishable



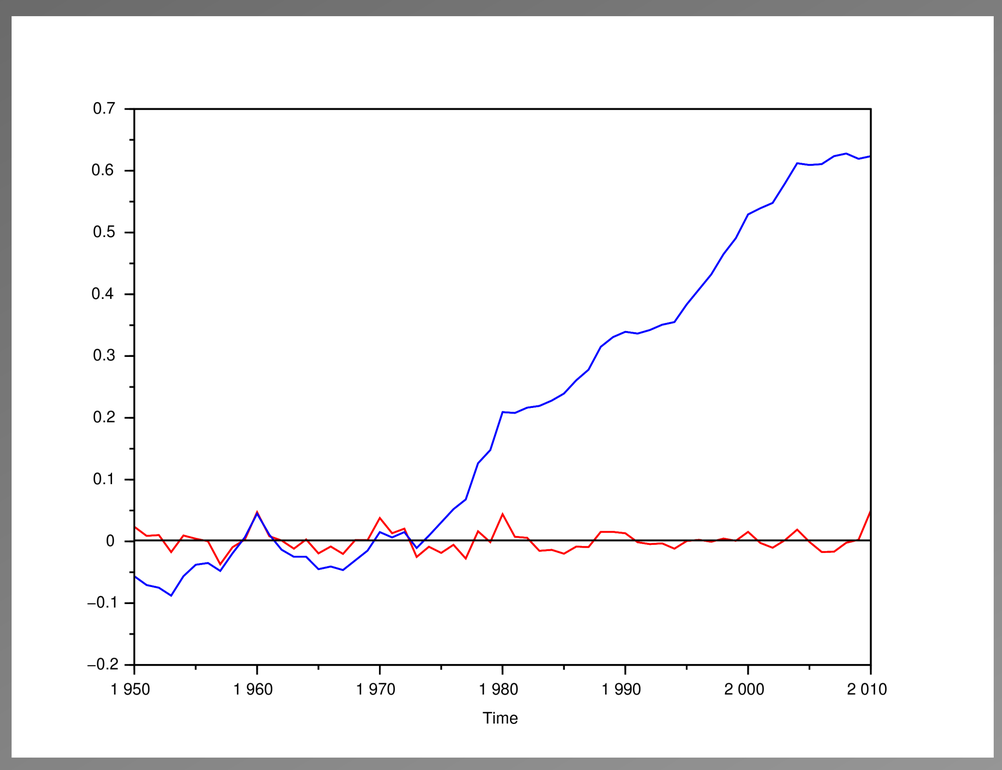


Conclusion: The WIME method provides a remarkable decomposition of Orbit91 into AM-FM components

Application: Study of the global warming in GISS



The method applied to GISS provides a very good reconstruction (correlation: 0.89) of the residual GISS signal obtained by subtracting GISS smoothed with a moving average of 7 years to the original signal.



When comparing the reconstruction with the original GISS signal (both are smoothed for the sake of clarity), one clearly sees that the episodes where the temperature ceases to increase during the global warming are explained with the AM-FM components, which sum up to give rise to a negative tendency during these events.

Conclusion: The episodes during which the temperature ceases to increase during the global warming can be explained from the AM-FM components. This suggests that such events can be explained by the natural climatic variability of the signal.