Using an ensemble of runs of a coupled model (labelled by n)

Look at annual mean surface air T and TOA longwave and shortwave fluxes.

$T(n, t)$, $L(n, t)$, $S(n, t)$

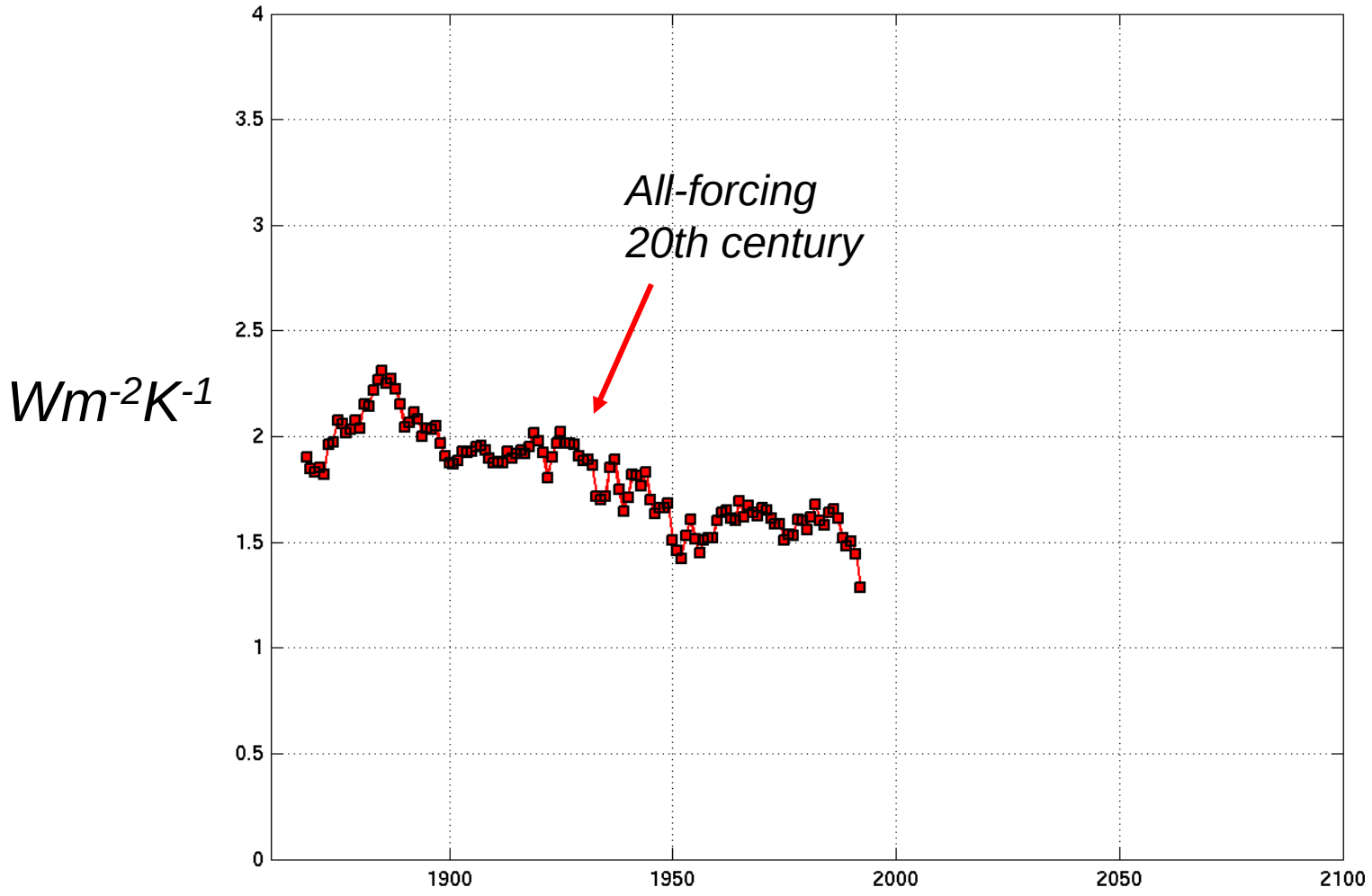
Regress L and S vs T across ensemble n for each year t.

Do these regressions evolve in time?

Started to look at this with Kyle Swanson in 2008 – seemed like a curiosity – not so sure any more.

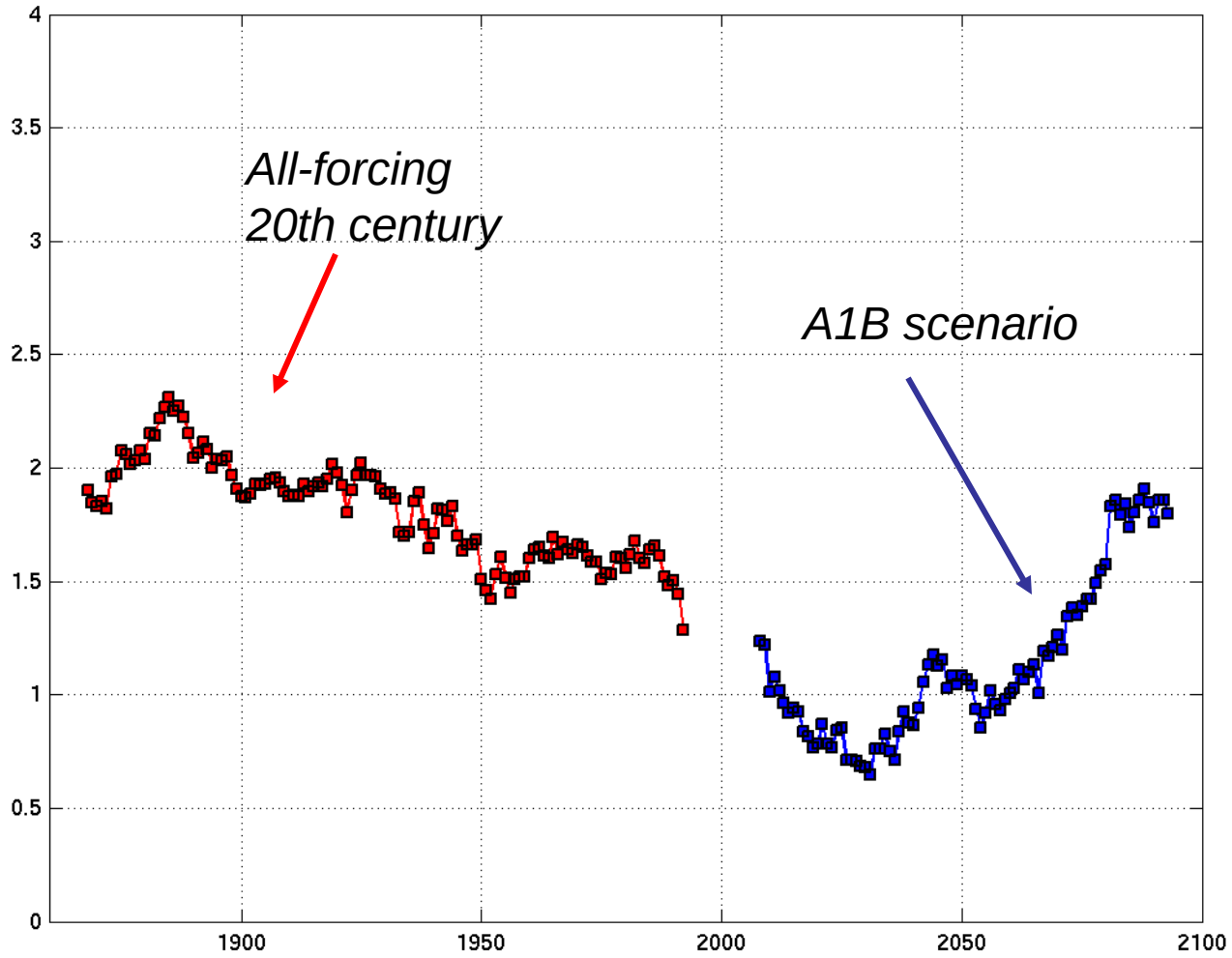
Isaac Held, Ringberg, March 2014

Longwave regression across ensemble

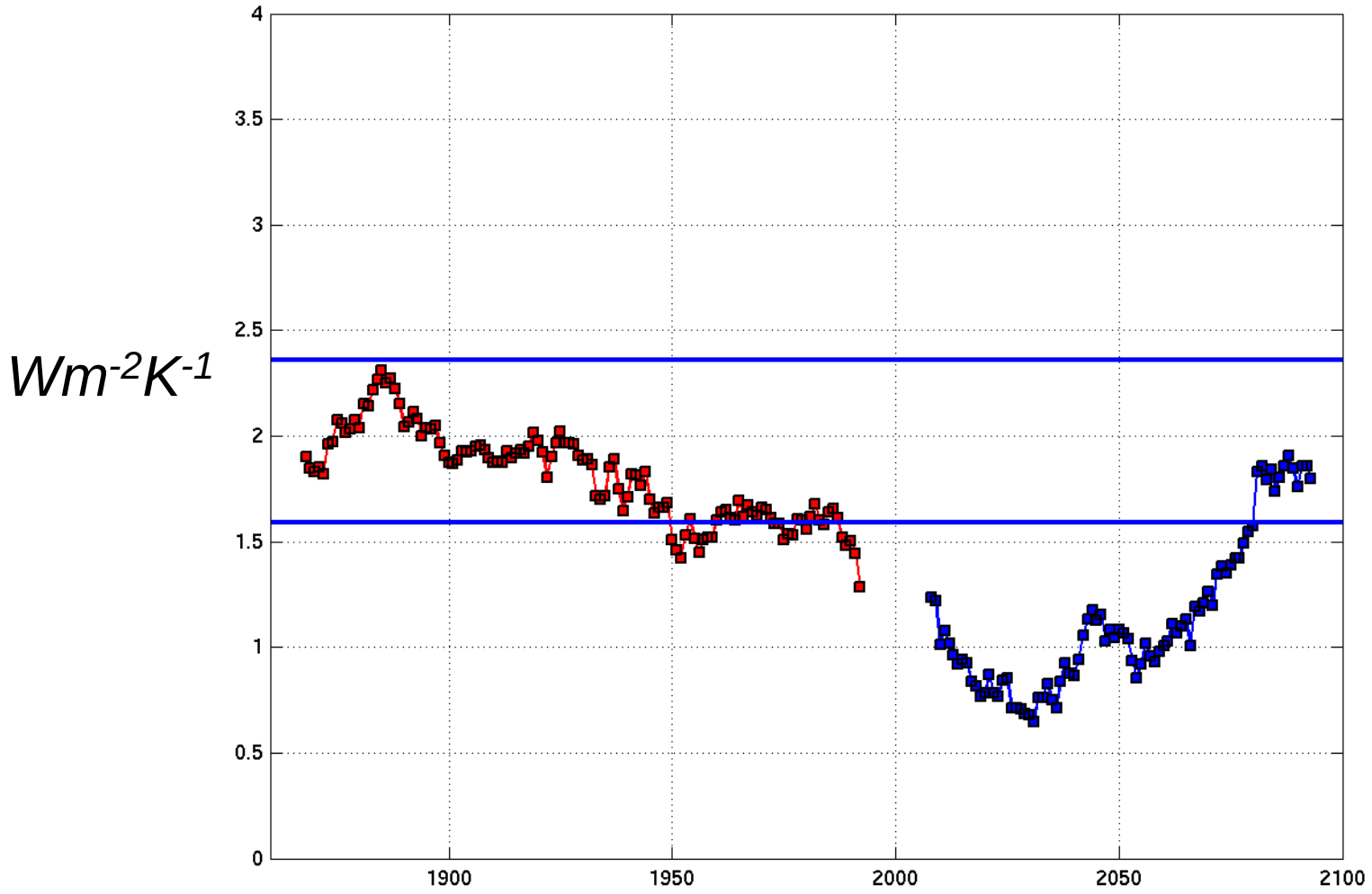


Longwave regression across ensemble

$Wm^{-2}K^{-1}$

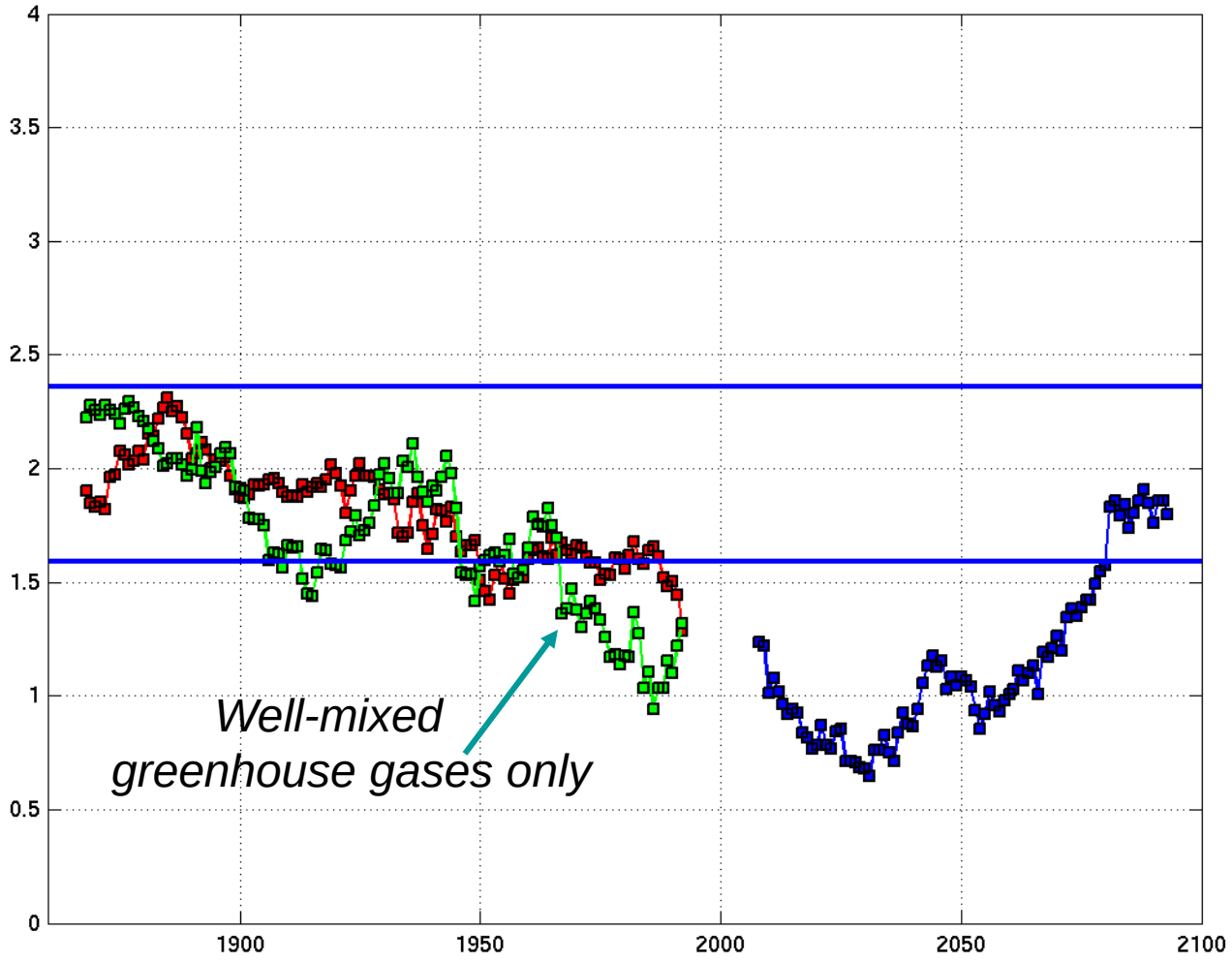


Longwave regression across ensemble



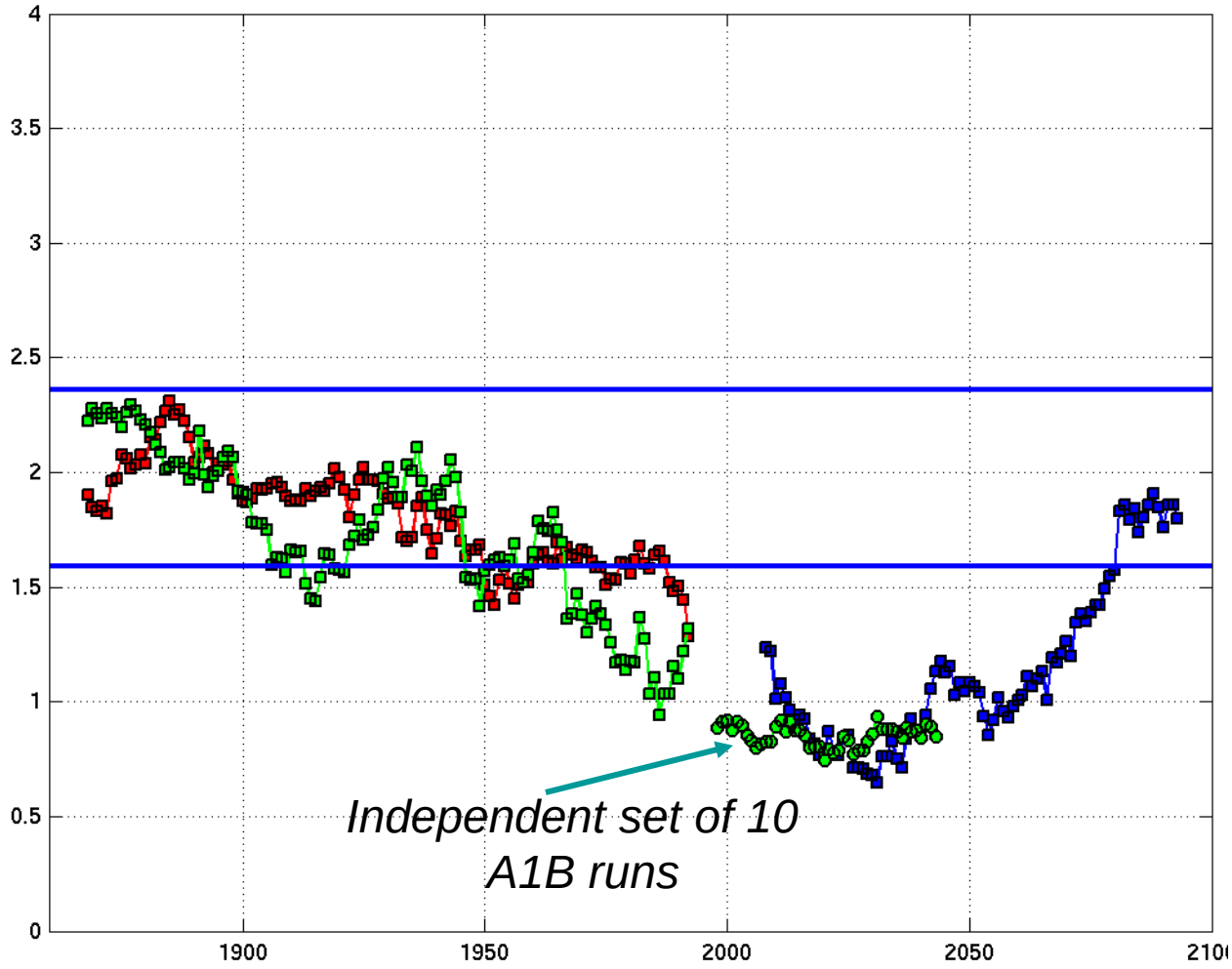
Longwave regression across ensemble

$Wm^{-2}K^{-1}$

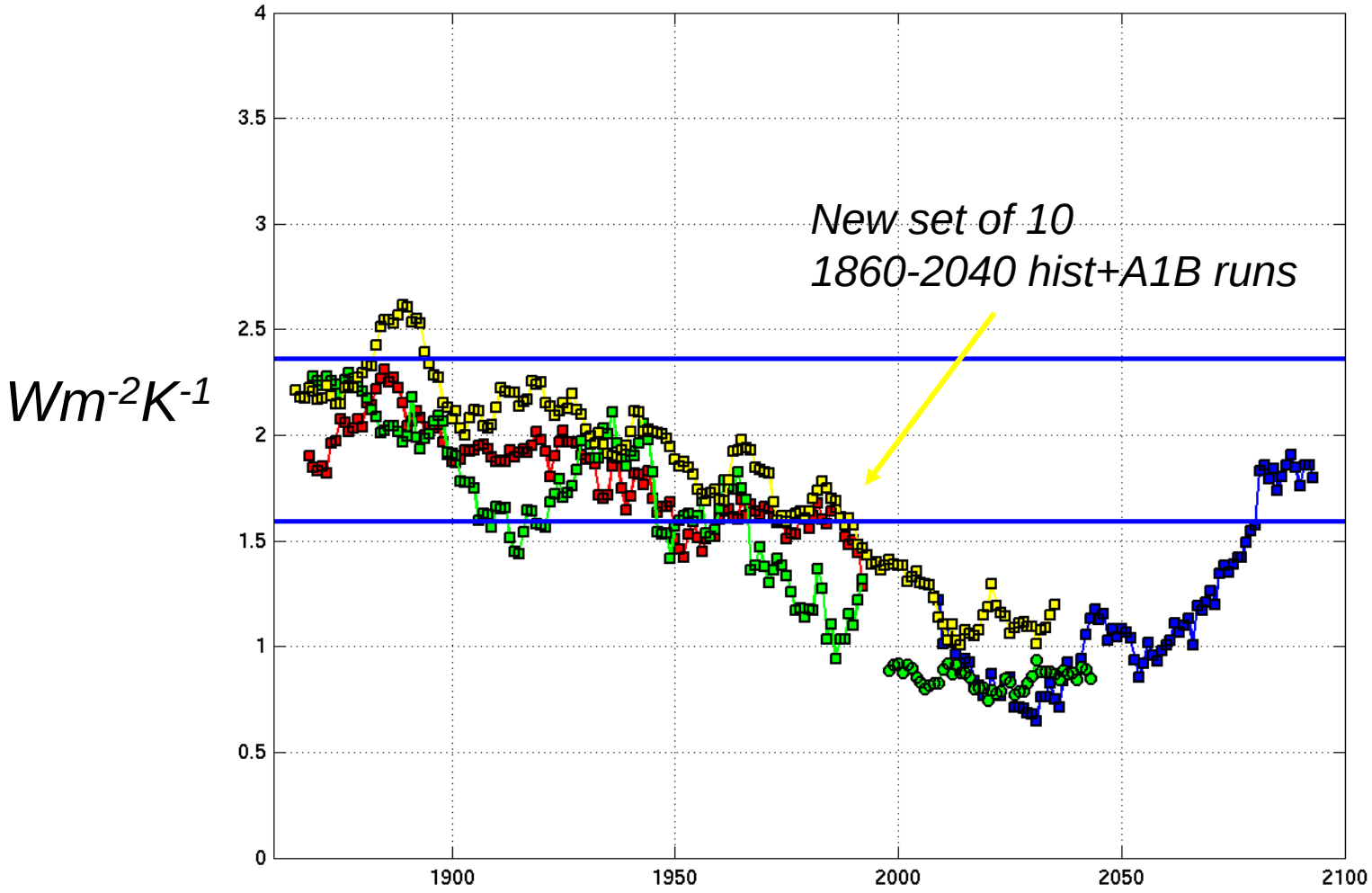


Longwave regression across ensemble

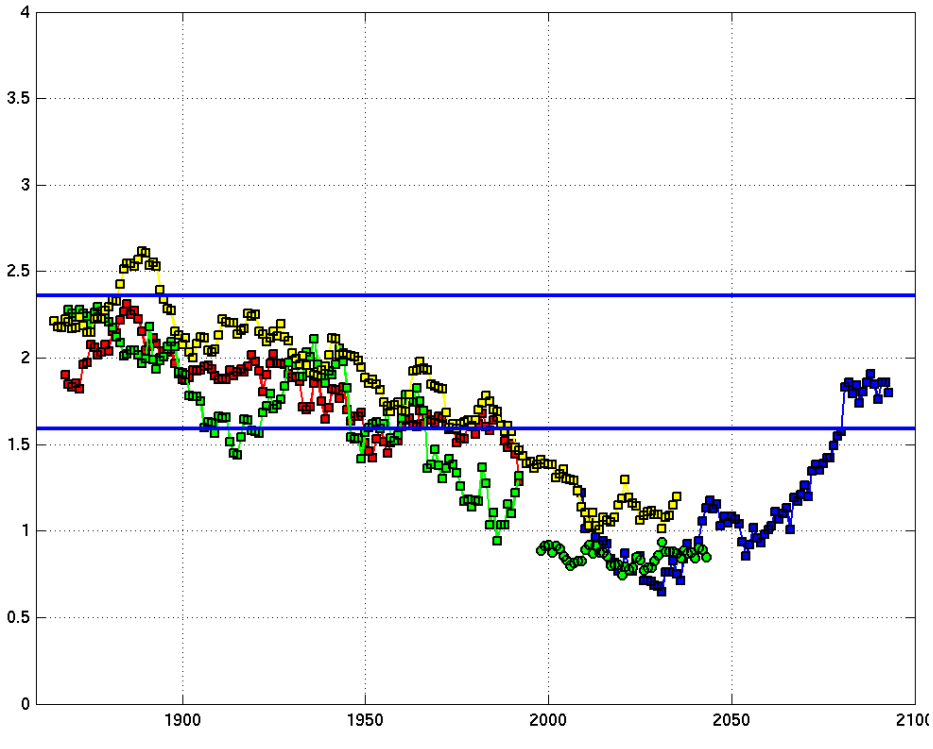
$Wm^{-2}K^{-1}$



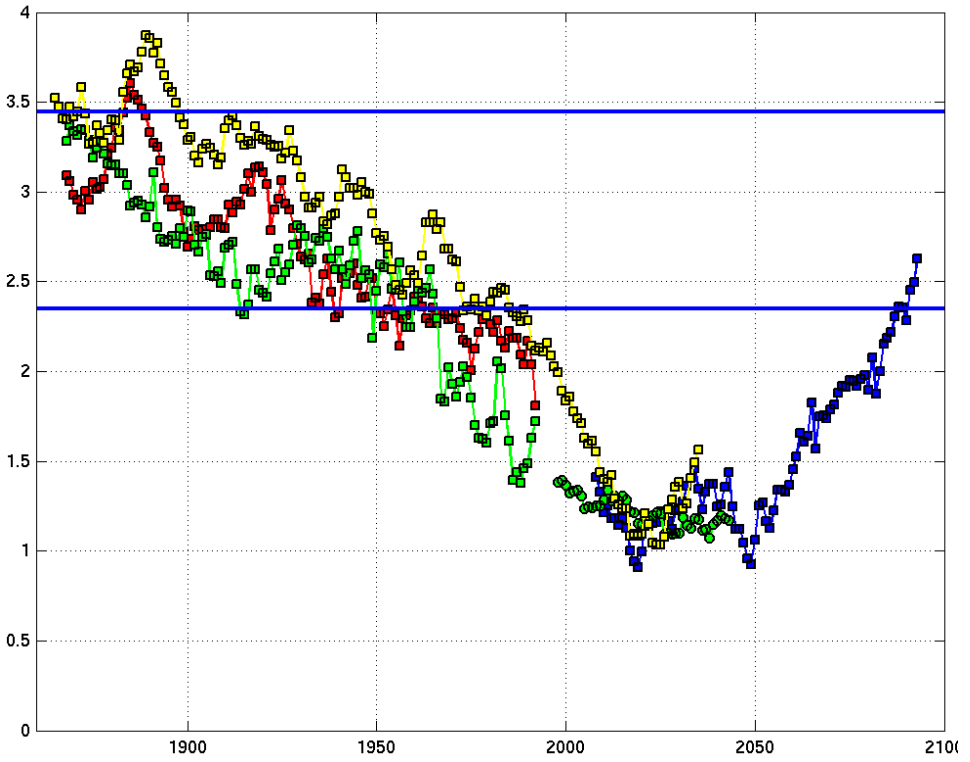
Longwave regression across ensemble, following K. Swanson 2008



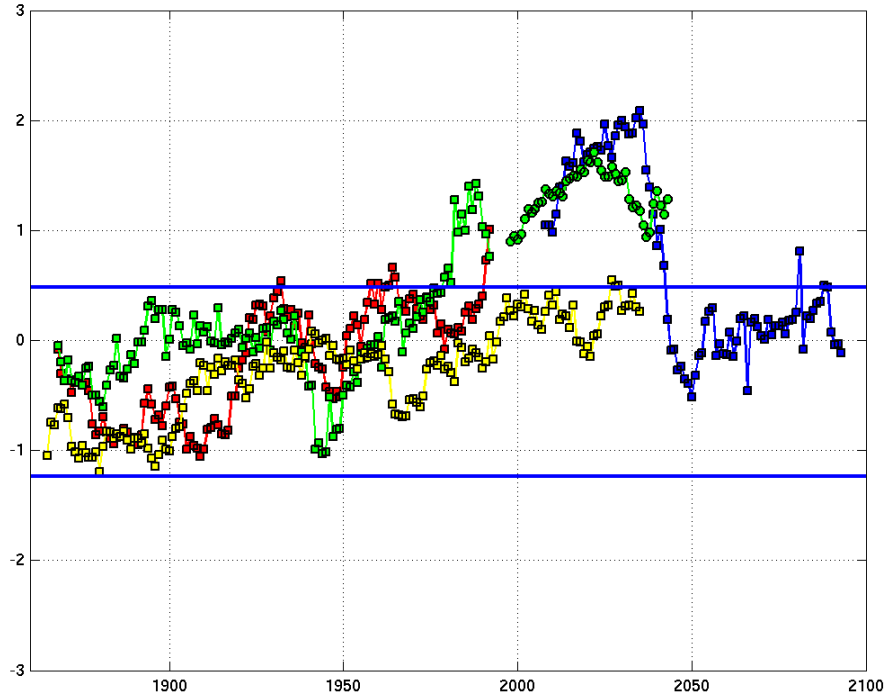
Global mean longwave regression



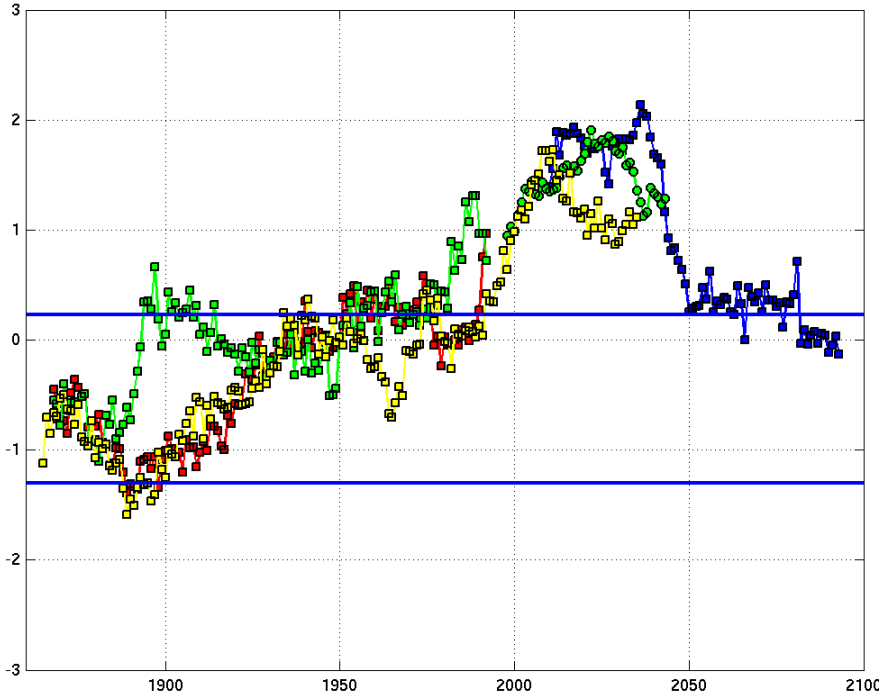
Tropical mean longwave regression

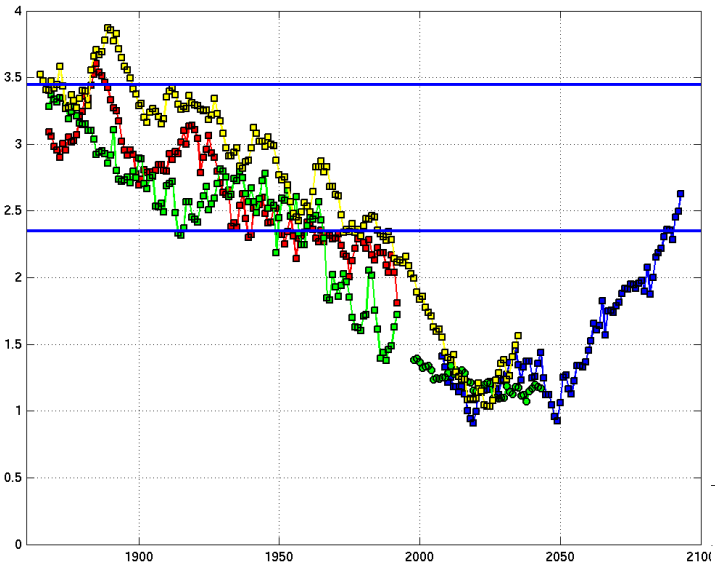


Global mean short wave regression



Tropical mean short wave regression




4
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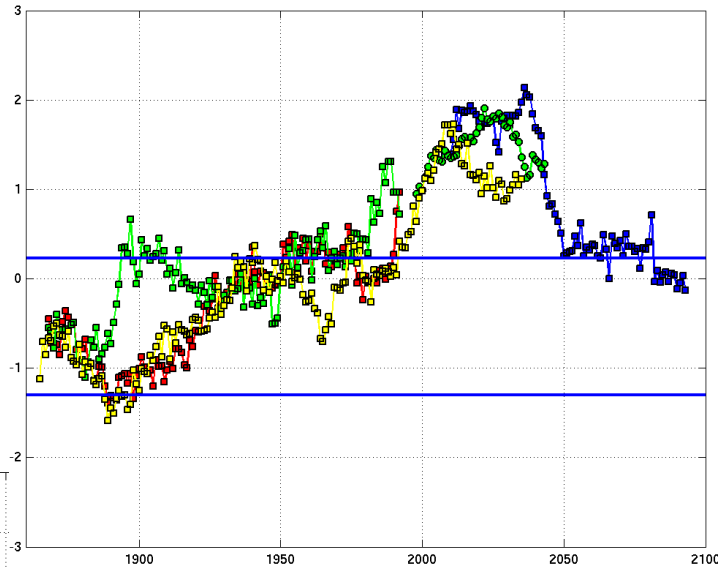
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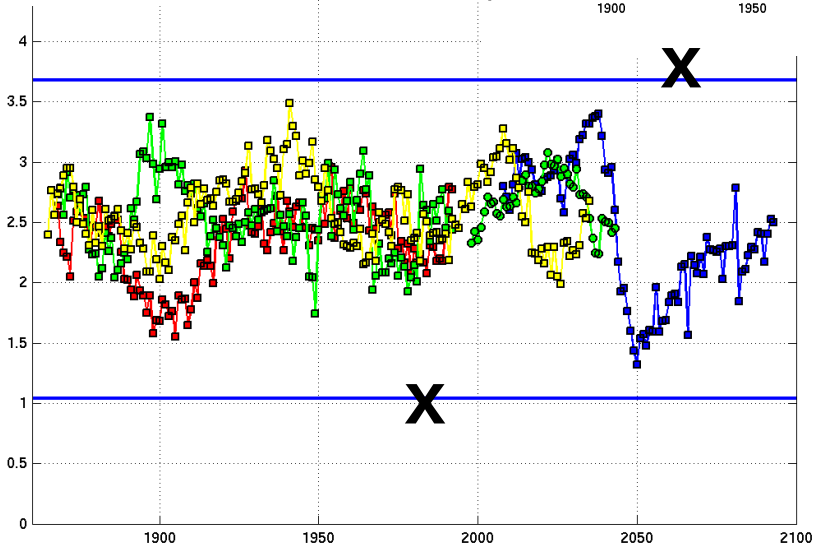
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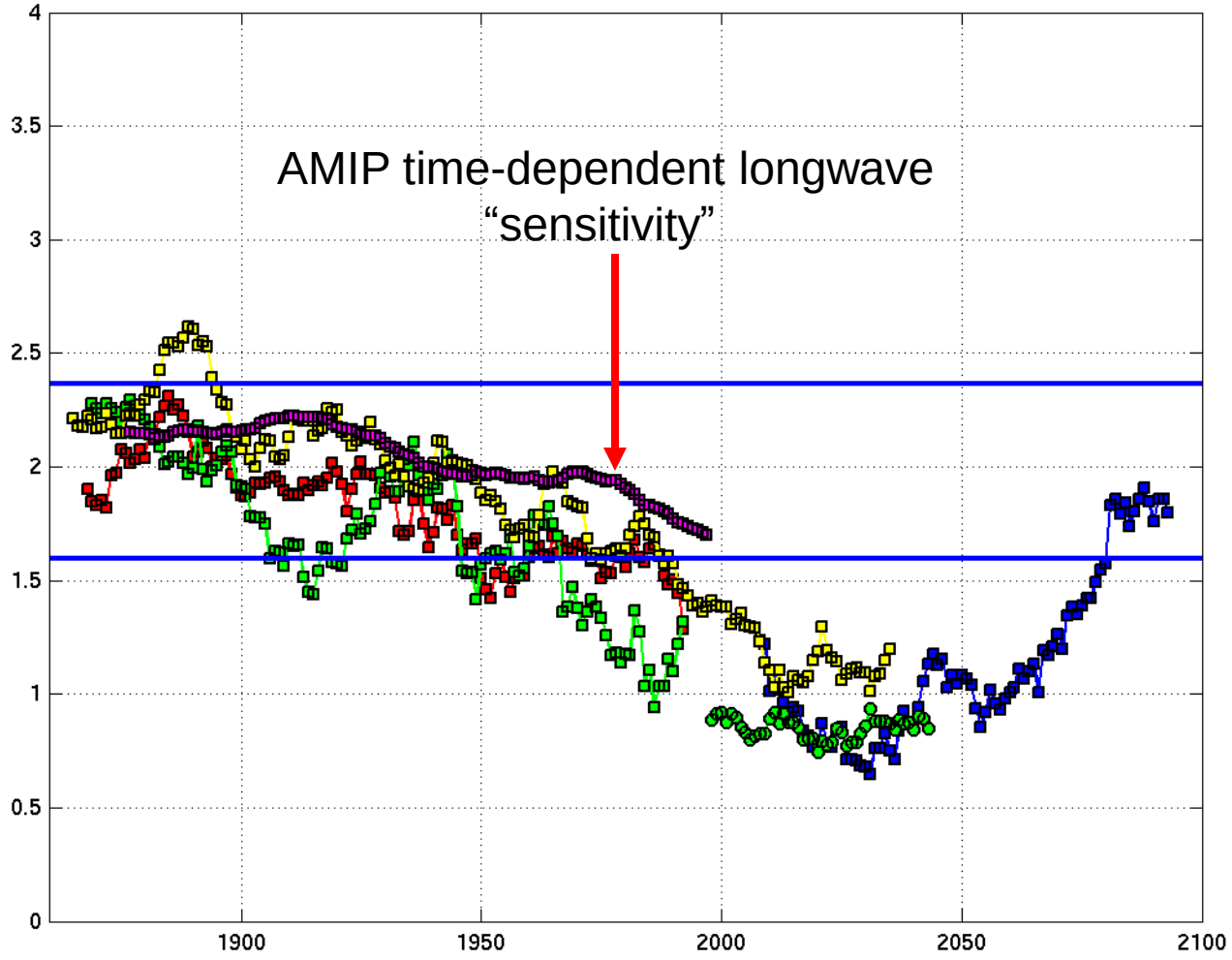
Now take an AMIP simulation with fixed forcing

(ideally an ensemble to obtain a smoother result -- here I use 10 runs)

Plot T(t) against L(t), S(t) (globally or tropically averaged)

Fit these relations with a smooth curve

Differentiate to get dL/dT, dS/dT as a function of time


AMIP time-dependent longwave
“sensitivity”
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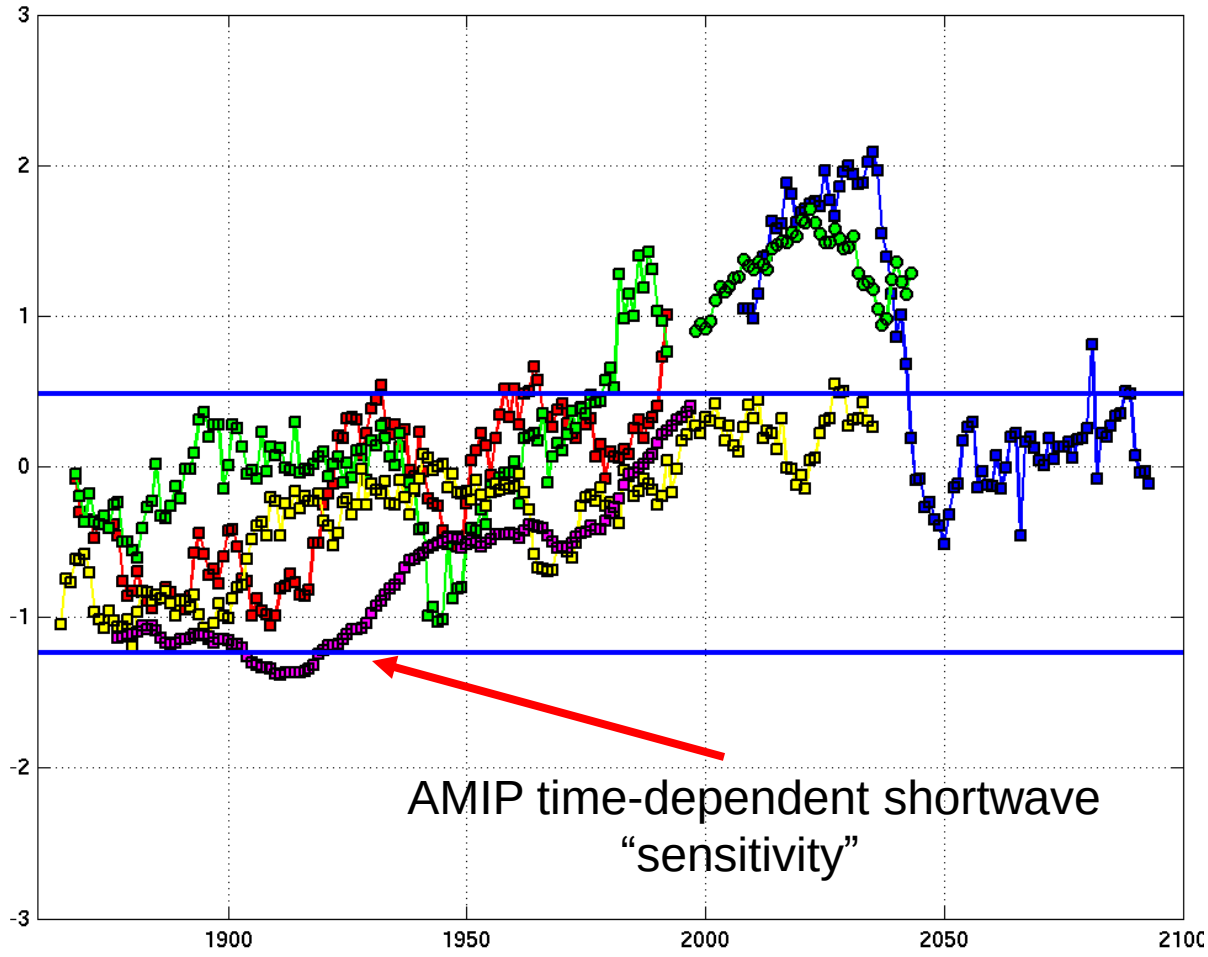
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AMIP time-dependent shortwave
“sensitivity”