Estimating evolution of periodic components of seismic process

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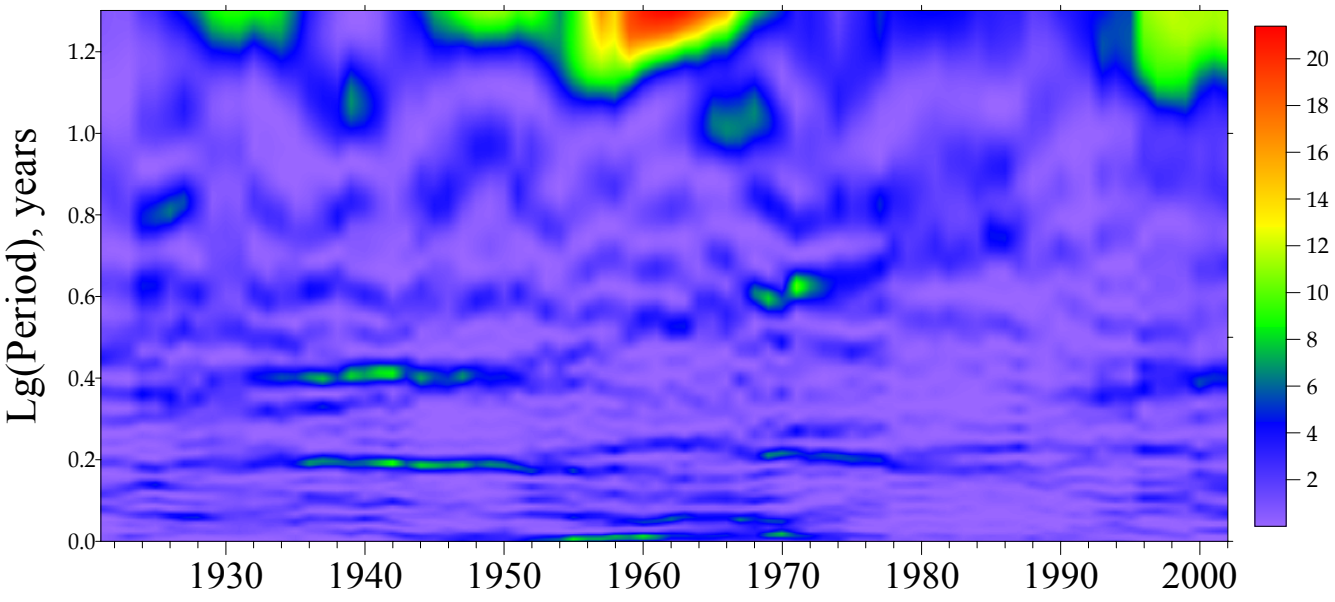
Seismic process intensity $\lambda(t)$ is presented in the form with periodic multiplier with a given period **T**:

$$\lambda(t)=\mu\cdot(1+a\cdot\cos(2\pi t/T+\varphi)),\ |a|<1,\ \mu\geq 0$$

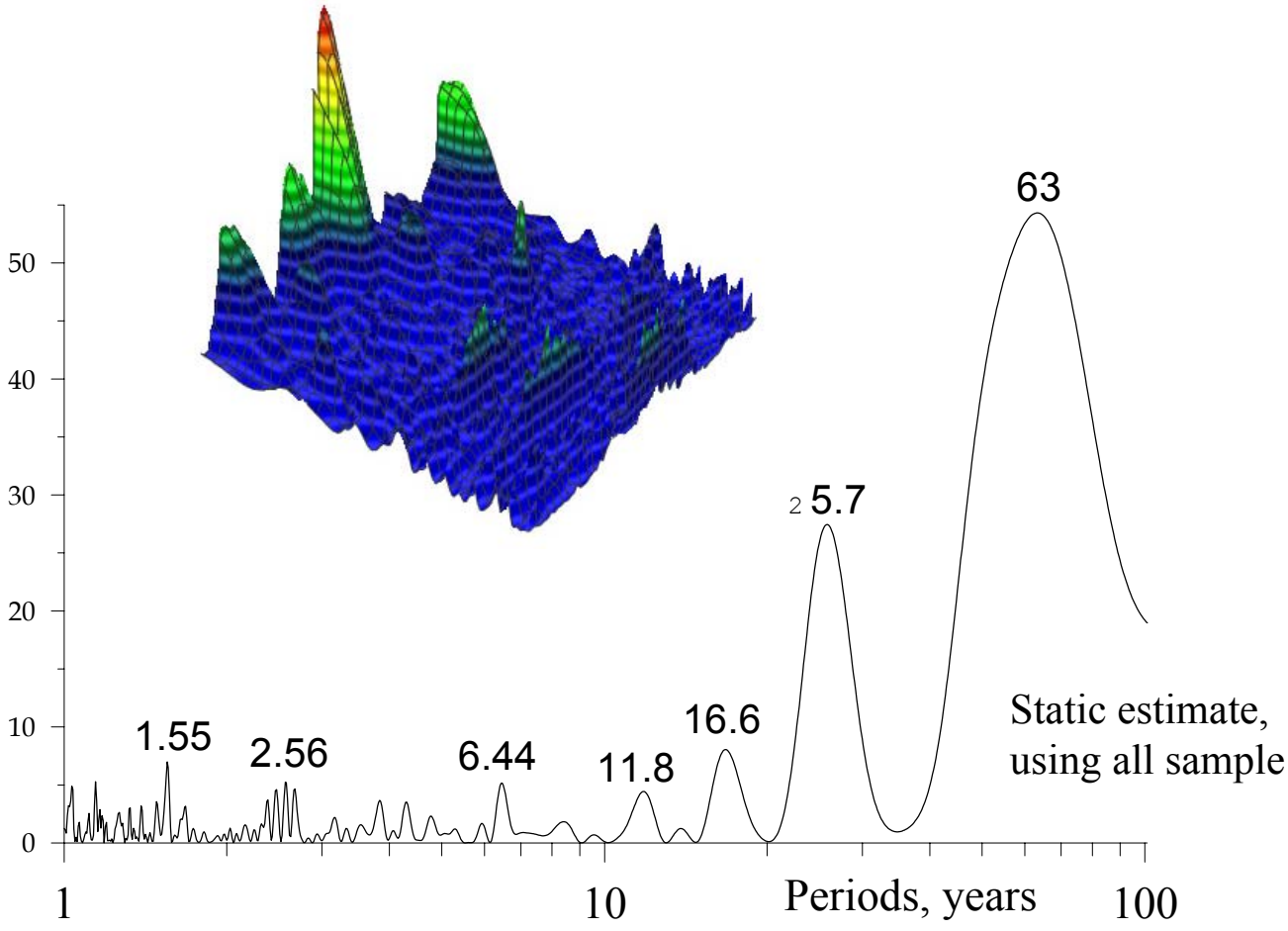
Parameters (μ, **a**, φ) are defined from maximum of partial Log-Likelihood function for events with magnitude **M** and hypocenters **H** satisfying the conditions: $M\geq M_0$, $H\leq H_{max}$ (further on $H_{max}=100$ km). The difference between the maximum value of Log-Likelihood for this periodic model and the maximum value of Log-Likelihood for the model of pure random (Poissonian) process is calculated. Thus, this difference $\Delta Log(Lik(T))\geq 0$ depends on the value of the period **T**. The big values of $\Delta Log(Lik(T))$ detect the presence of periodic component in seismic process with corresponding value of period.

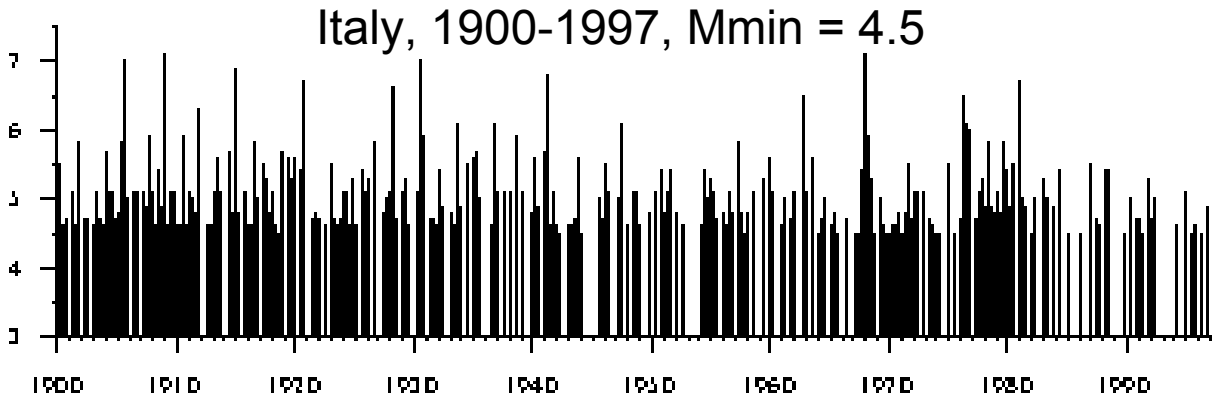
Estimating the value of $\Delta Log(Lik(T))$ in a moving time window gives the possibility to inspect temporal variations of periodic components of seismic process.

The whole world, 1901-2001,
Mmin = 7.0, Hmax = 100 km, Length = 20 years

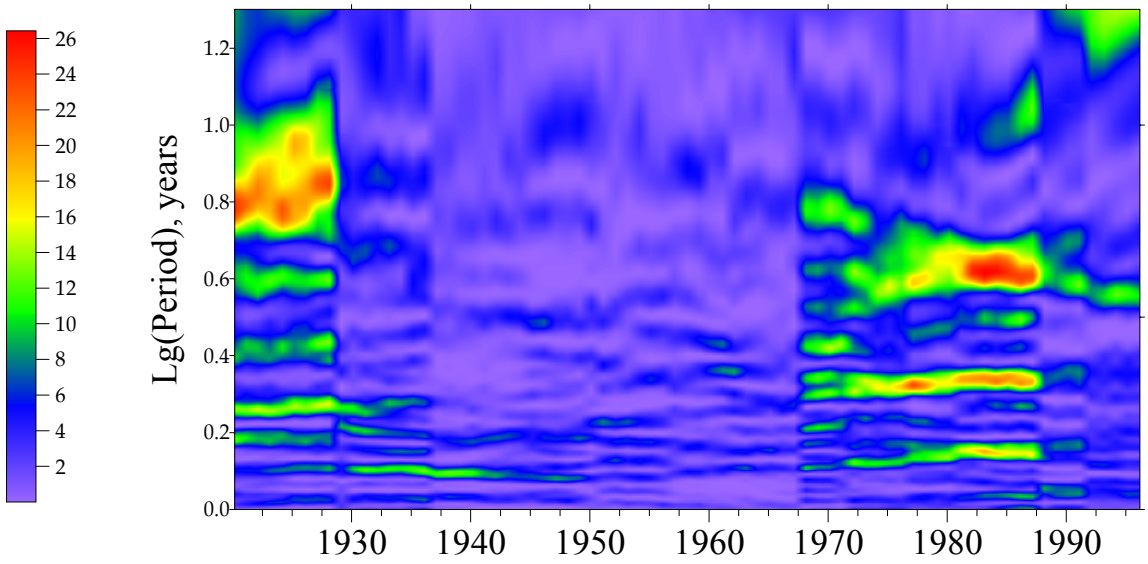


Right-hand end of moving time window of the length = 20 years

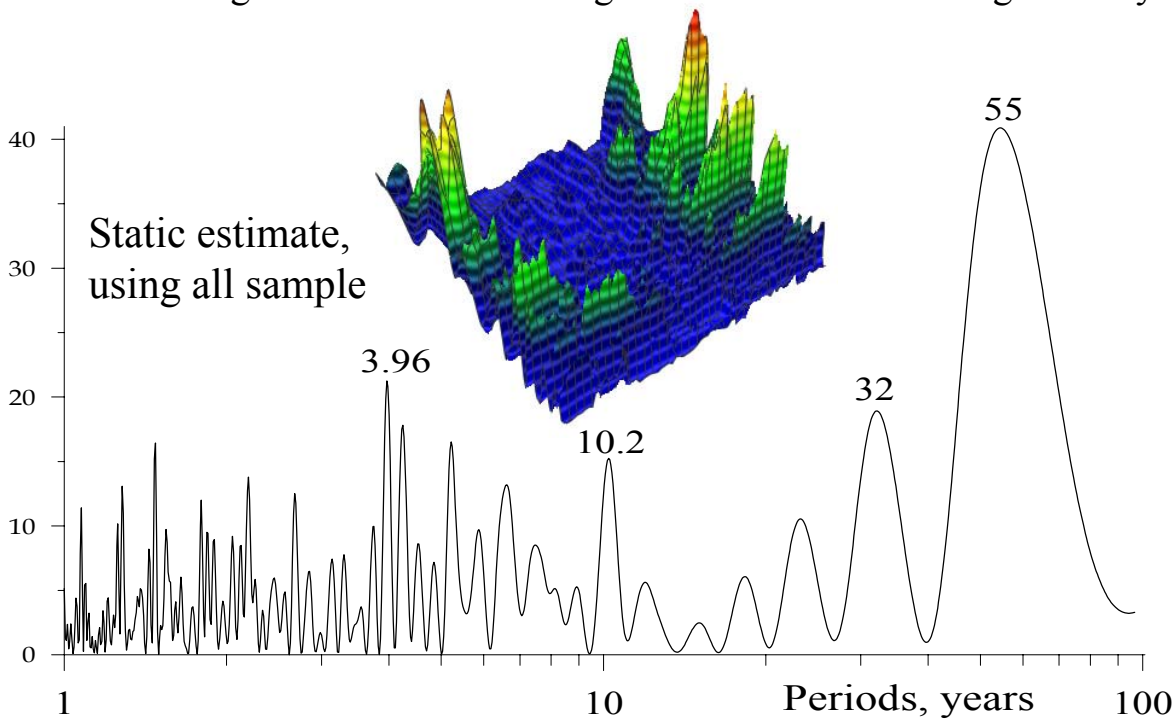


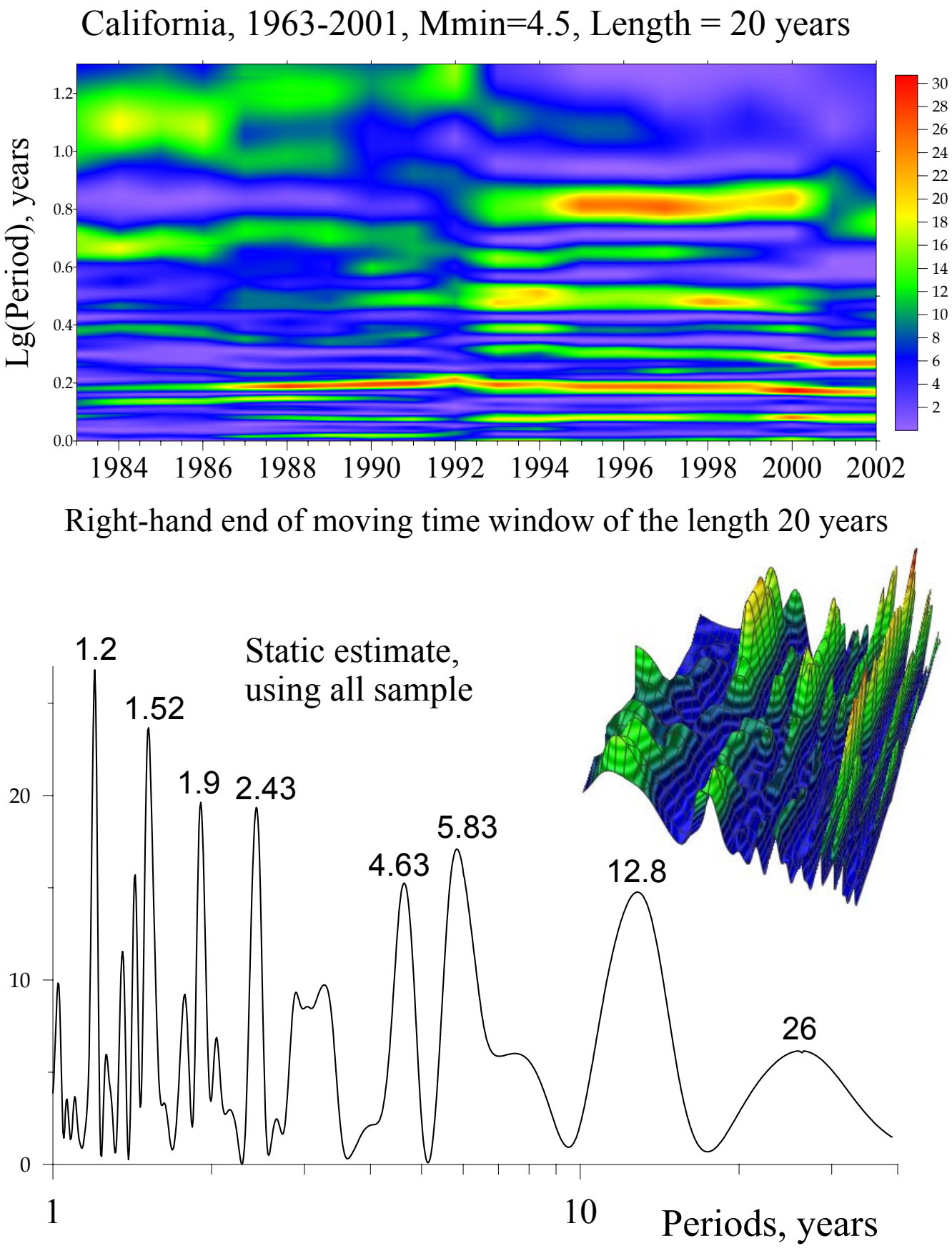


Italy, 1900-1997, Mmin = 4.5, Hmax = 100 km, Length = 20 years

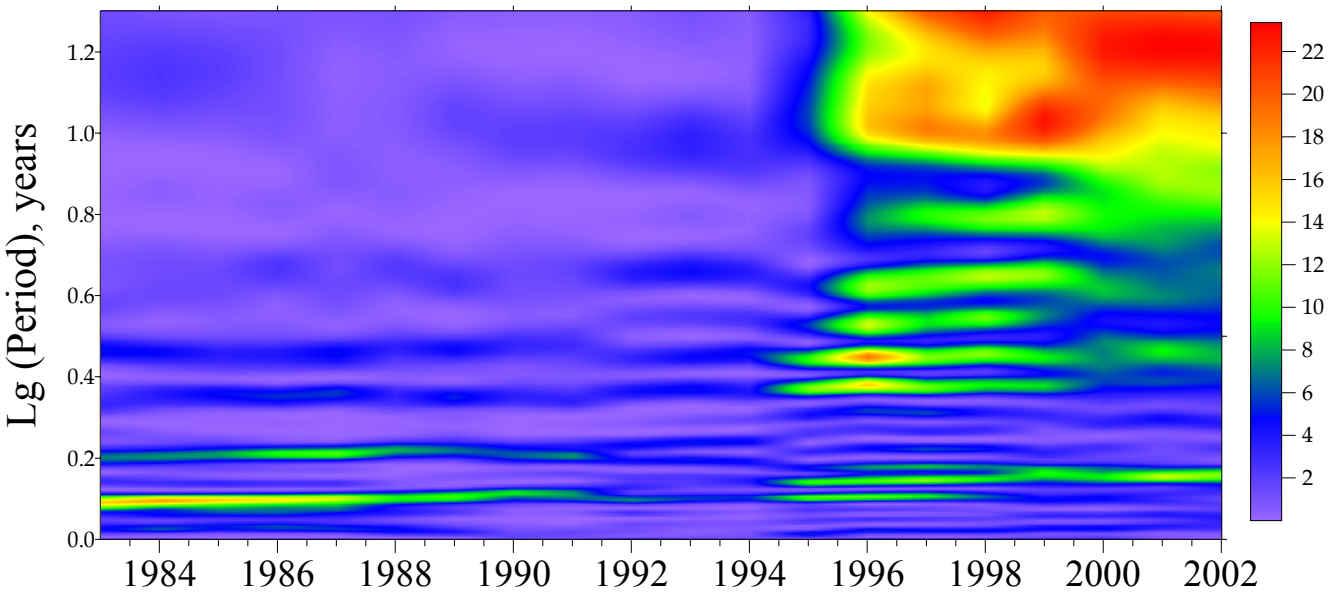


Right-hand end of moving time window of the length = 20 years

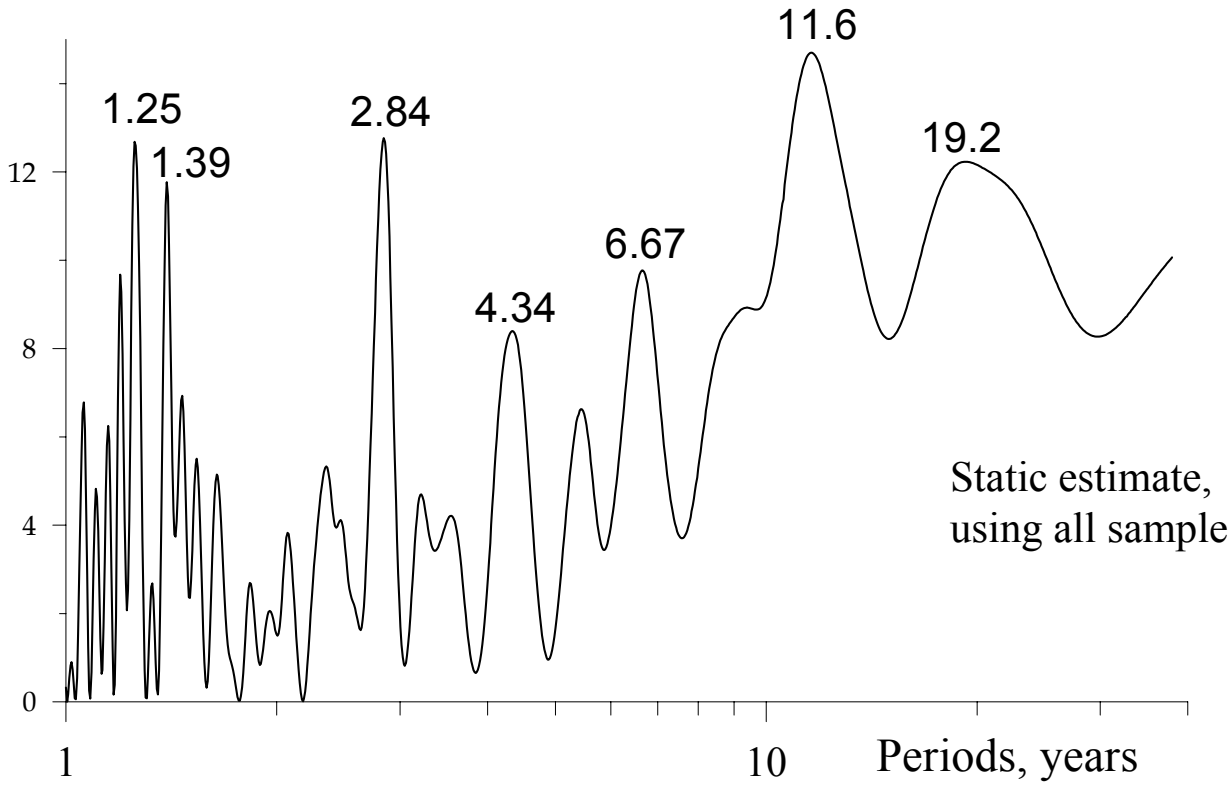



California, 1963-2001, Mmin=4.5, Length = 20 years
Lg(Period), years
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
Right-hand end of moving time window of the length 20 years
Static estimate,
using all sample
1.2
1.52
1.9
2.43
4.63
5.83
12.8
26
20
10
0
1
10
Periods, years

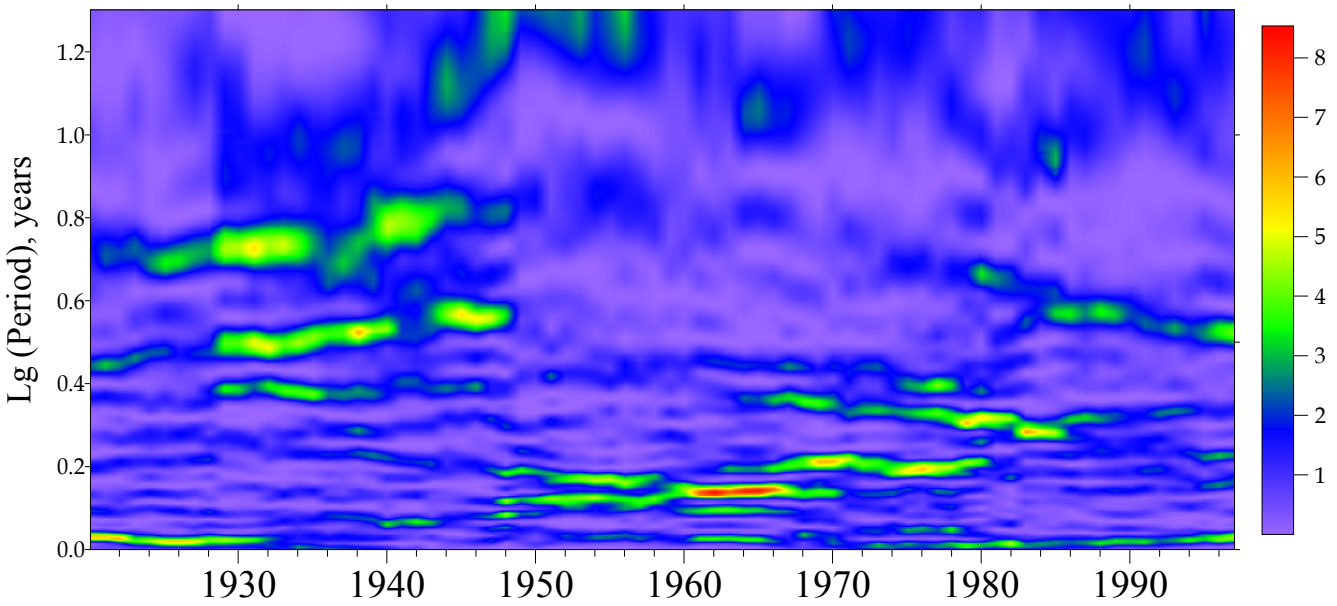
Japan+Kurils+Kamchatka, 1963-2001, Mmin = 6.0, Hmax = 100 km
Length of the moving time window = 20 years.



Right-hand end of the moving time window of the length 20 years



West (Pacific) coast of America (South and North),
1900-1996, Mmin = 7.0, Hmax=100 km, Length = 20 years



Right-hand end of the moving time window of the length 20 years