Seismicity of an Area

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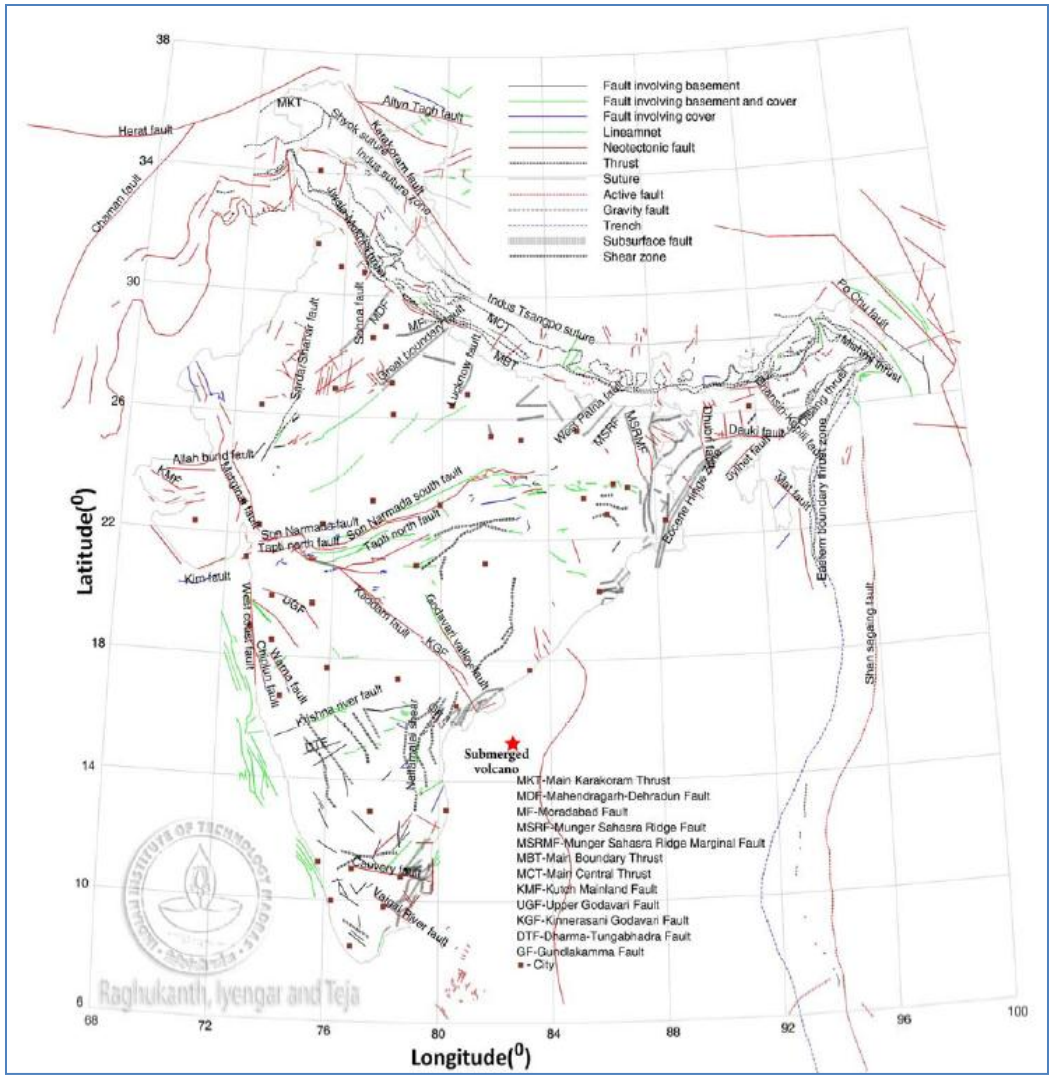
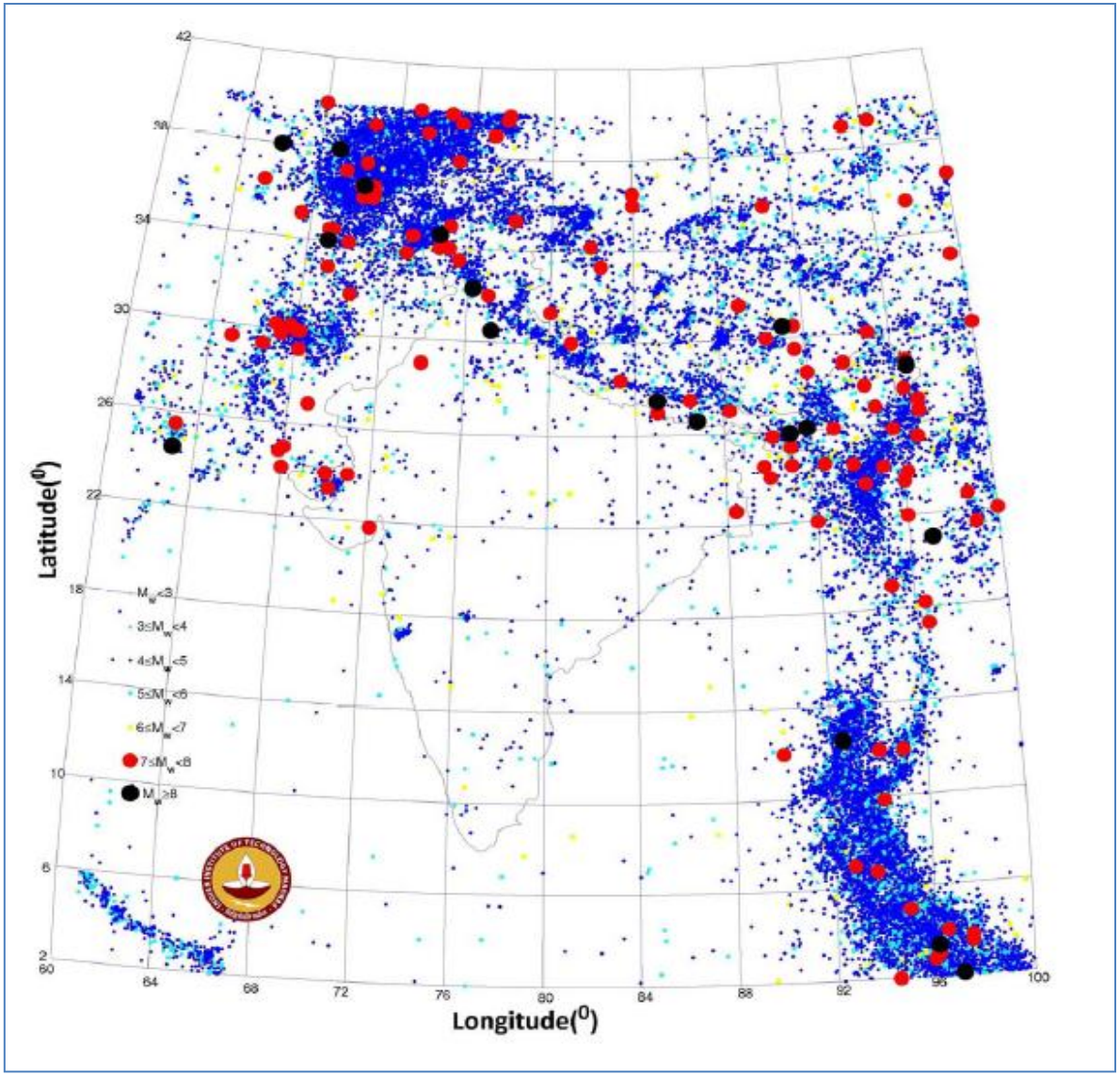
Faults in India

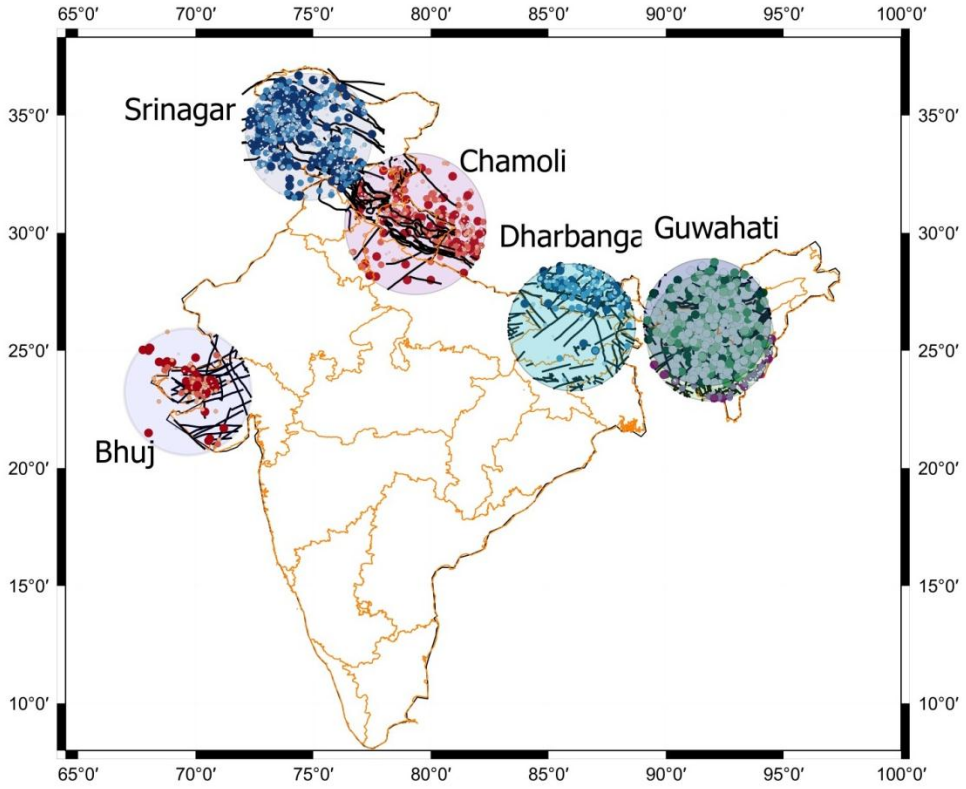


Earthquakes in India



Calculation of Seismicity

1. Selection of city (Lat Long)
2. Consider all the earthquakes and faults in the radius of 300km from the city.



Calculation of Seismicity (Cont…)

3. Assigning each earthquake to the fault by calculating the distance between earthquake and fault.
4. Defining number of earthquakes of each magnitude class for each fault.

Magnitude Class	Fault ID				
	F1	F2	F3	F4	F5
3.5	4	18	31	7	7
4.5	2	7	17	2	3
5.5	1	6	9	1	1
6.5	1	5	5	1	1

Calculation of Seismicity (Cont…)

5. Get number of years.

Magnitude Class	Fault ID				
	F1	F2	F3	F4	F5
3.5	5	1	2	3	4
4.5	2	5	1	5	5
5.5	1	1	4	4	1
6.5	1	3	2	1	2

6. Mean annual rate of occurrence, $\lambda_{lk} = \frac{No.of\ \ Earthquakes}{No\ of\ Years}$

Calculation of Seismicity (Cont…)

Magnitude Class (M_k)	Fault ID				
	F1	F2	F3	F4	F5
3.5	0.02	0.09	0.155	0.035	0.035
4.5	0.01	0.035	0.085	0.01	0.015
5.5	0.005	0.03	0.045	0.005	0.005
6.5	0.005	0.025	0.025	0.005	0.005

7. Seismicity variable 'a' and 'b' from Gutenberg and Richter (1942) relationship.

$$\log \lambda_{lk} = a_1 + b_1 M_k$$

- Get final **a** and **b** values based on regression analysis for each fault.

Seismicity variable	Fault ID				
	1	2	3	4	5
a	-1.02	-0.54	0.12	-0.60	-0.46
b	-0.21	-0.17	-0.27	-0.28	-0.30

Calculation of Seismicity (Cont…)

8. Recalculate the mean annual rate of occurrence from **a, b** and $\mathbf{M_k}$.
9. Return period, $T_{lk} = 1 / \lambda_{lk}$

Magnitude Class (M_k)	Fault ID				
	F1	F2	F3	F4	F5
3.5	38				
4.5	64				
5.5	136				
6.5	227				

Calculation of Seismicity (Cont…)

10. Hazard rate

- Non Uniform Probability

$$h_{lk}(t) = \frac{\phi[X]}{(1 - \Phi[X])}$$

$$\phi[X] = \frac{}{t\ \xi_{lk}\sqrt{2\pi}} e^{-\left(\frac{1}{2}\left(\frac{\ln t - \lambda_{lk}}{\xi_{lk}}\right)^2\right)}$$

Where,

λ_{lk} = Mean

ξ_{lk} = Standard Deviation of random variable = **0.2**

$\phi[]$ = Standard normal density

$\Phi[]$ = Cumulative distribution functions

Calculation of Seismicity (Cont…)

11. Future Seismicity

$$n_{lk}(T_0 + Y|T_0) = \int_{T_0}^{T_0+Y} h_{lk}(\tau)d\tau$$


Thank you for your attention…
Jai Hind…