Novel conception of short-term earthquake forecast based on Lithosphere-Atmosphere-Ionosphere Coupling (LAIC) model

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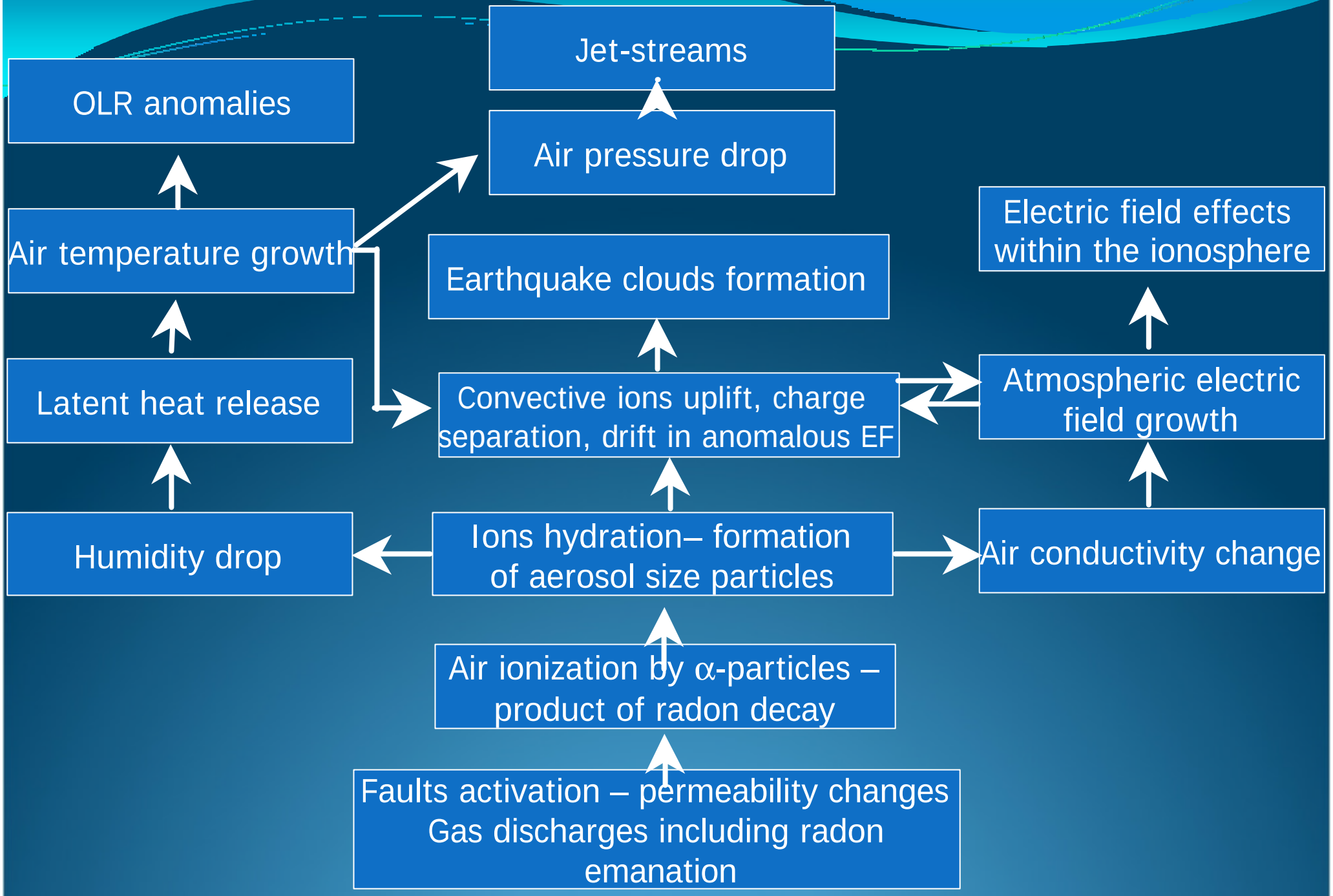
Outline

1. LAIC model schematic presentation
2. The nature of the thermal anomalies
3. Connection with Global Electric Circuit and Ionosphere
4. Validation scheme
5. Conclusions

Schematic presentation of the LAIC model



What are criteria to explain the thermal anomalies morphology?

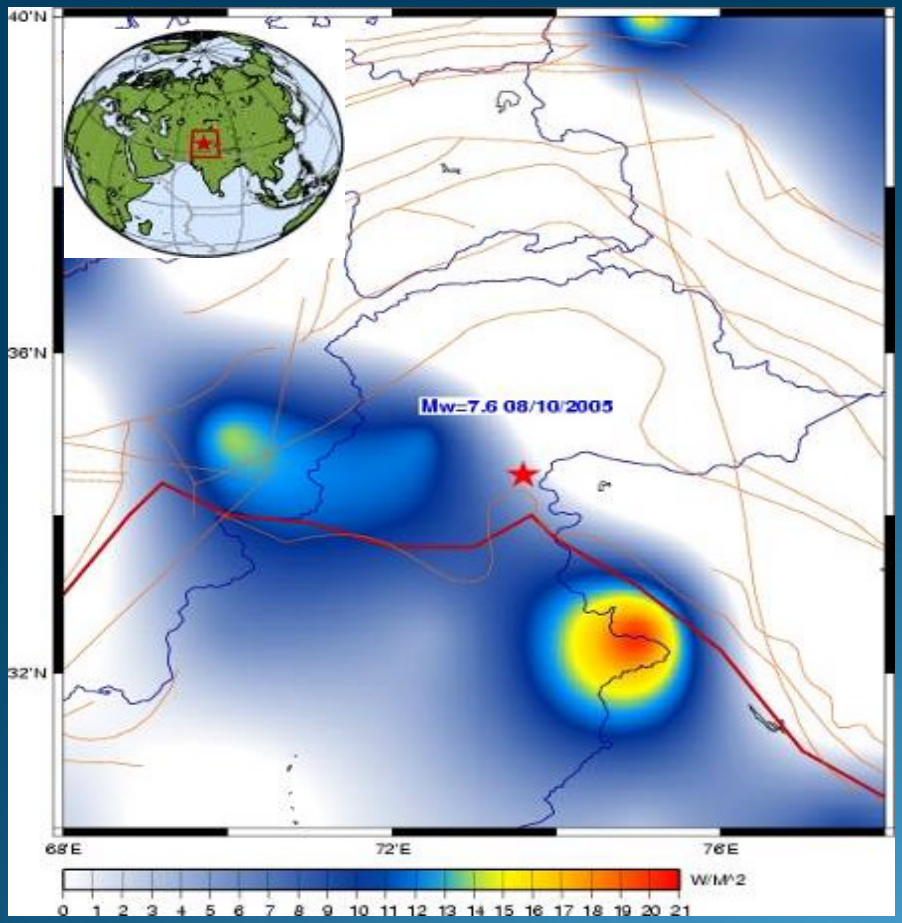
- Mechanism should be connected with the processes of water evaporation and condensation (anomalous latent heat fluxes are observed)
- Extremely high energy effectiveness producing the effects of meteorological scale
- Air humidity drop should be explained
- The process is very dynamic in space and time
- Does not depend on land or ocean epicenter position

Anomalous latent heat flux

Ouzounov et al, 2008

Cervone et al., 2007

Kashmir, 08 Oct. 2005 M 7.6



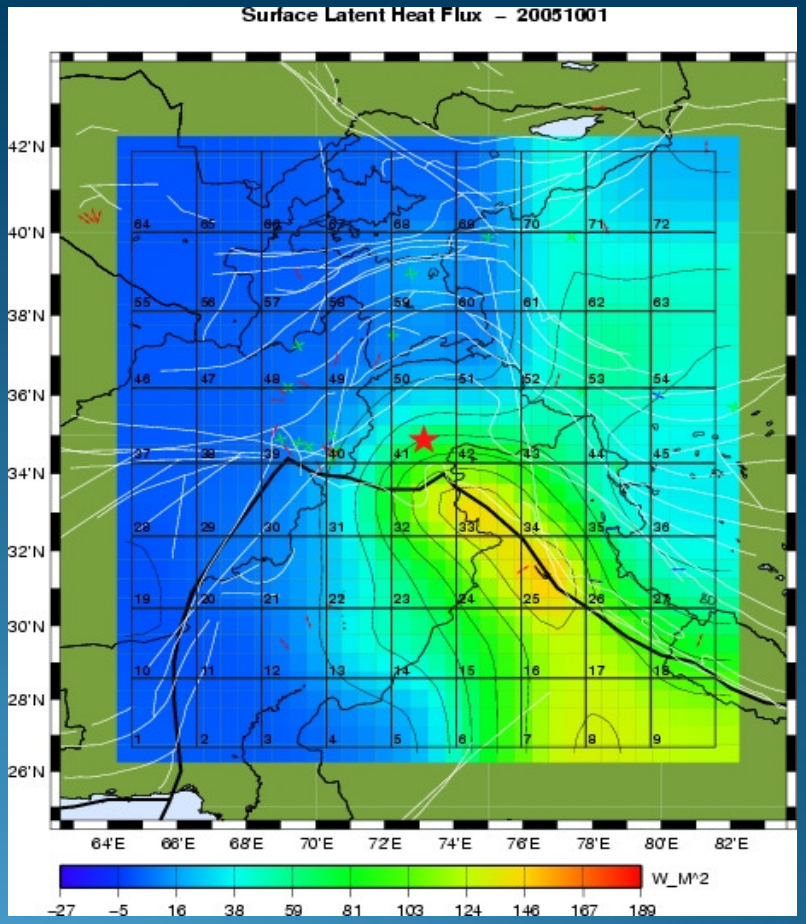
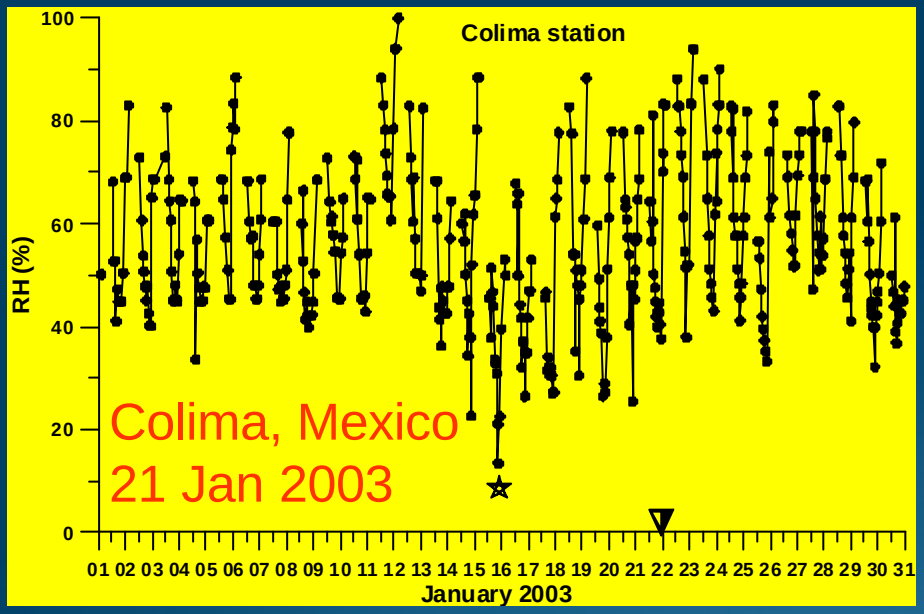


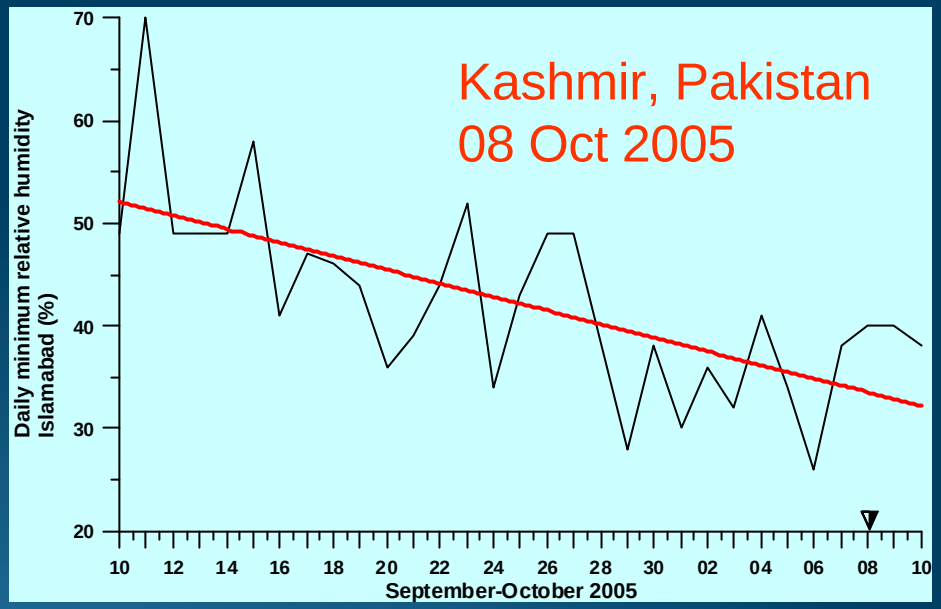
Table of Energies for Sumatra Dec 2004 and March 2005 earthquakes

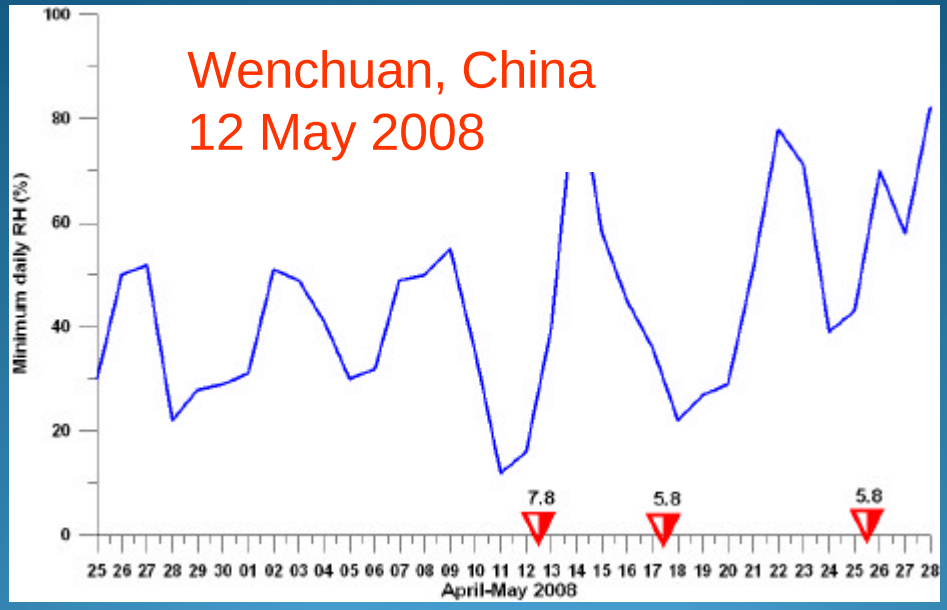
Param	Magnitude	Comments
E_Q	4.3×10^{18} J - 5.5×10^{17} J	M ~ 9.3 earthquake, and 8.7, respectively
$\mathbf{E_{LH}}$	**3.1×10^{19} - 8×10^{18} J**	Latent heat anomalies of ~ 80 Wm^{-2} persisting for 5 days, over six, 200 km x 200 km grids; and ~ 100 Wm^{-2} persisting for 10 days, over nine, 200 km x 200 km grids, respectively for the 8.7 and 9.3 associated anomalies, respectively
E_{TS}	$<1.5 \times 10^{17}$ - 5×10^{17} J	KE of tsunami for 30-100 km^3 displaced water (probably an upper limit)
E_M	$< 5 \times 10^{19}$ J	From yield strength & molecular binding forces involved in rupture of land
δE_R	6×10^{18} J	From change of rotational energy of the Earth

Kafatos et al., 2007

Humidity drop



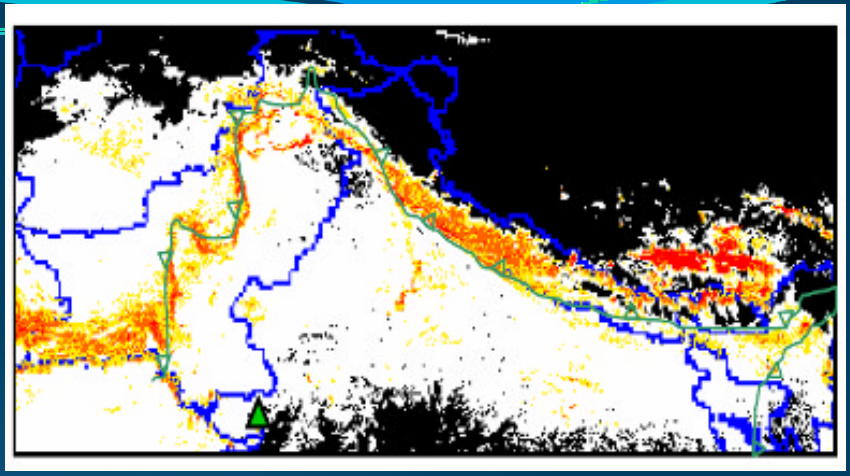


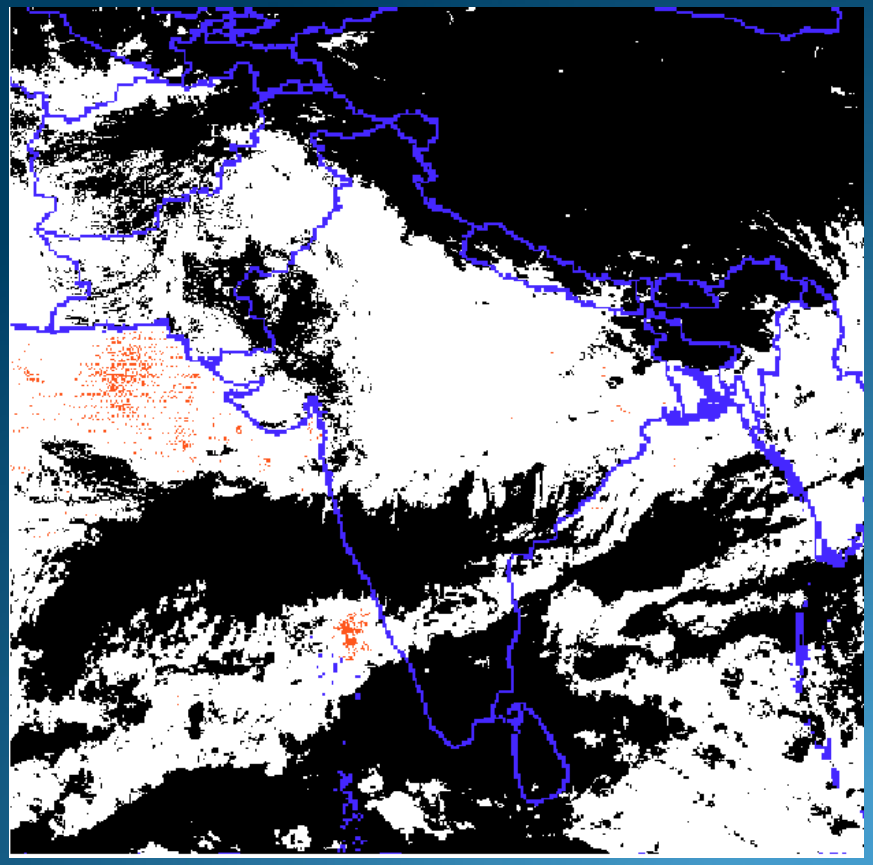


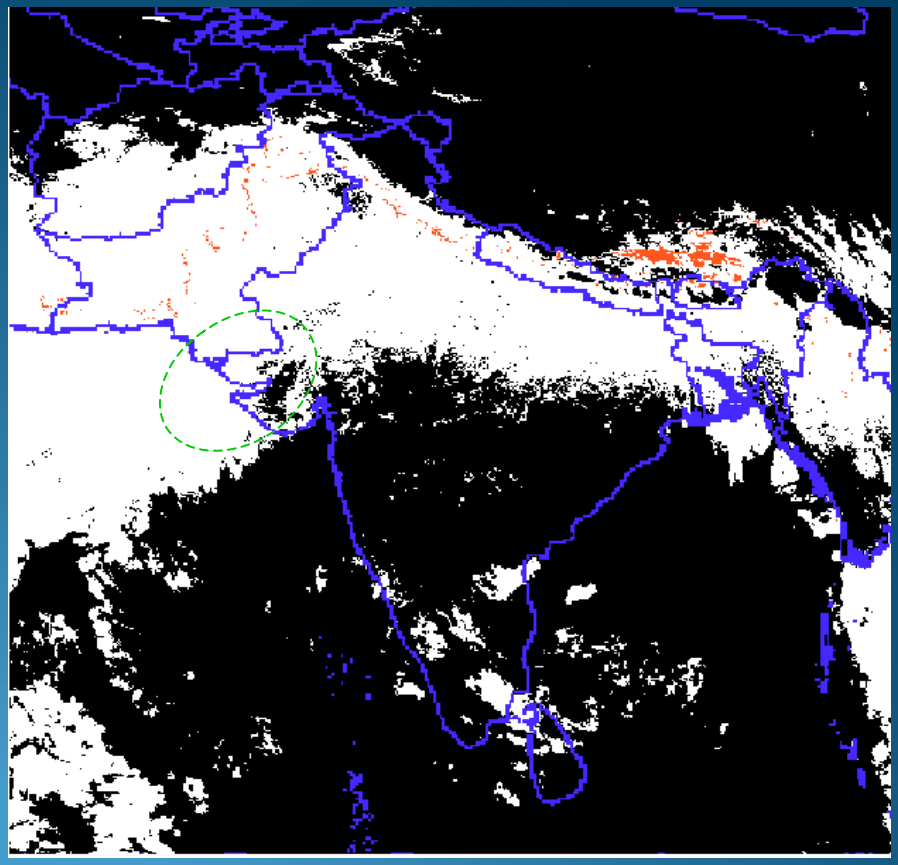
scale

Genzano et al., 2007

Gujarat, India
26 Jan 2001



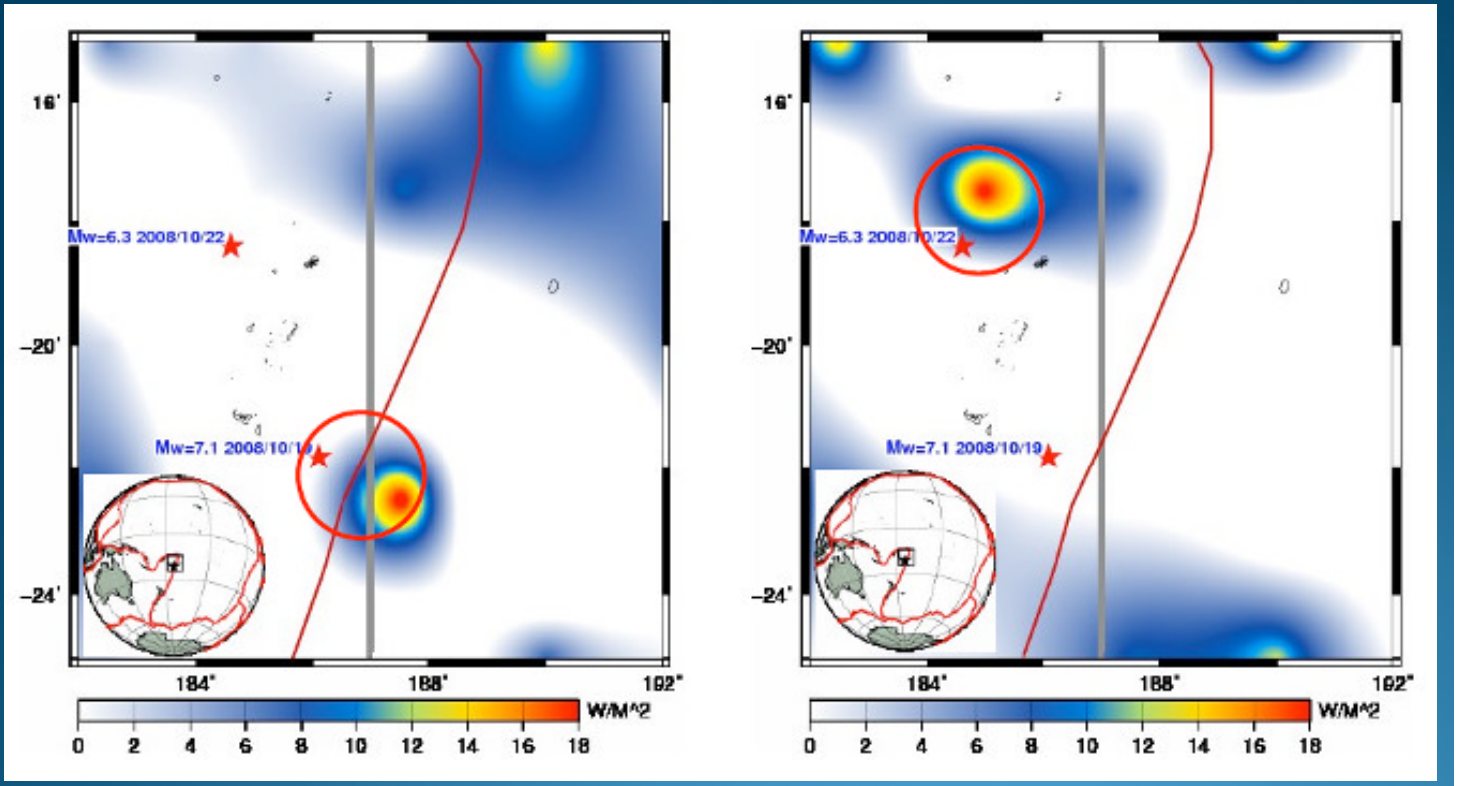


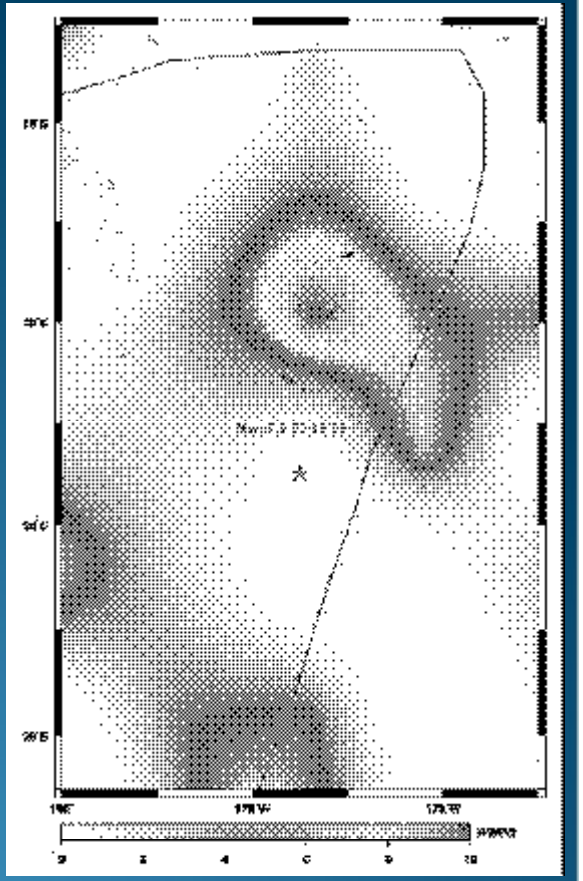


OLR in open ocean (Tonga island 2008-2009)

M7.1- 19 Oct, 2008; M6.3 – 22 Oct, 2008; M7.9 19 Mar.2009

1-4 Oct 2008 5-8 Oct 2008 1-18 Mar 2009





What can produce meteorological effects?

Svensmark, 1998

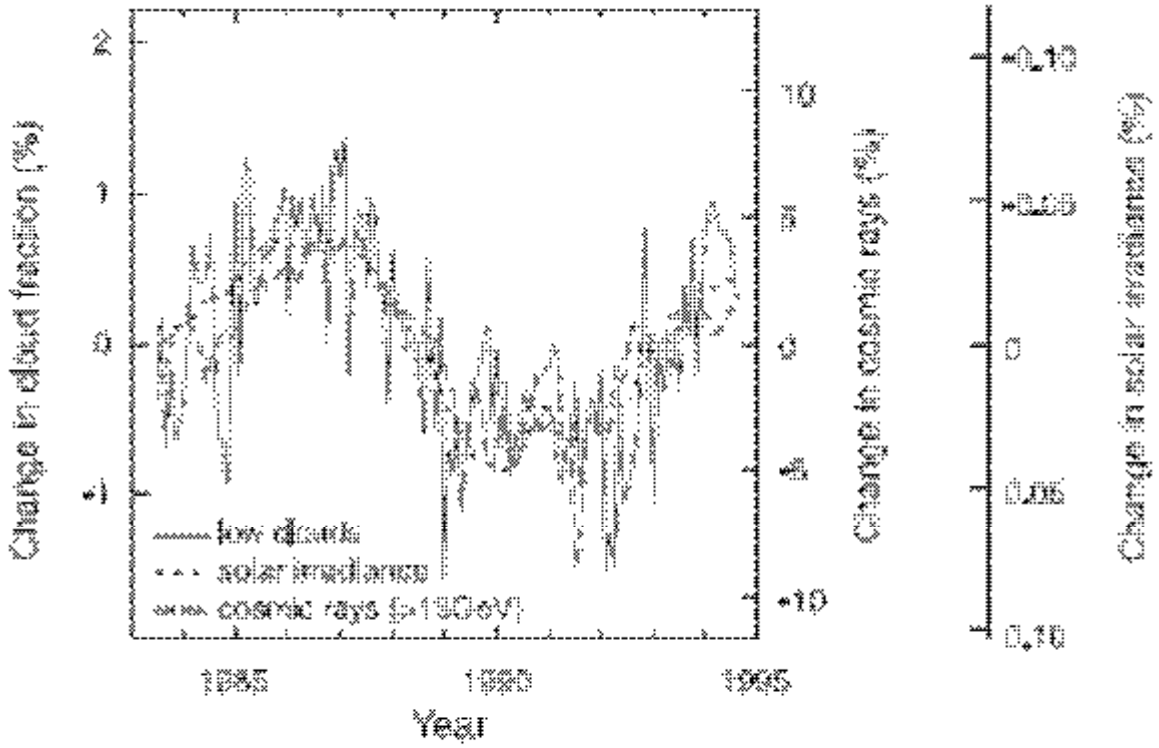
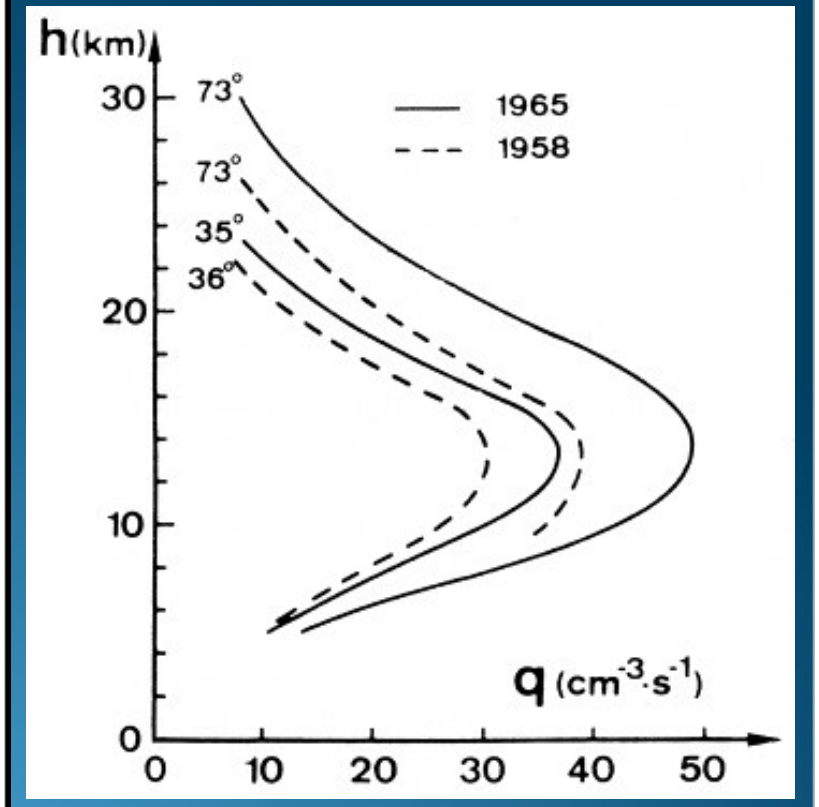
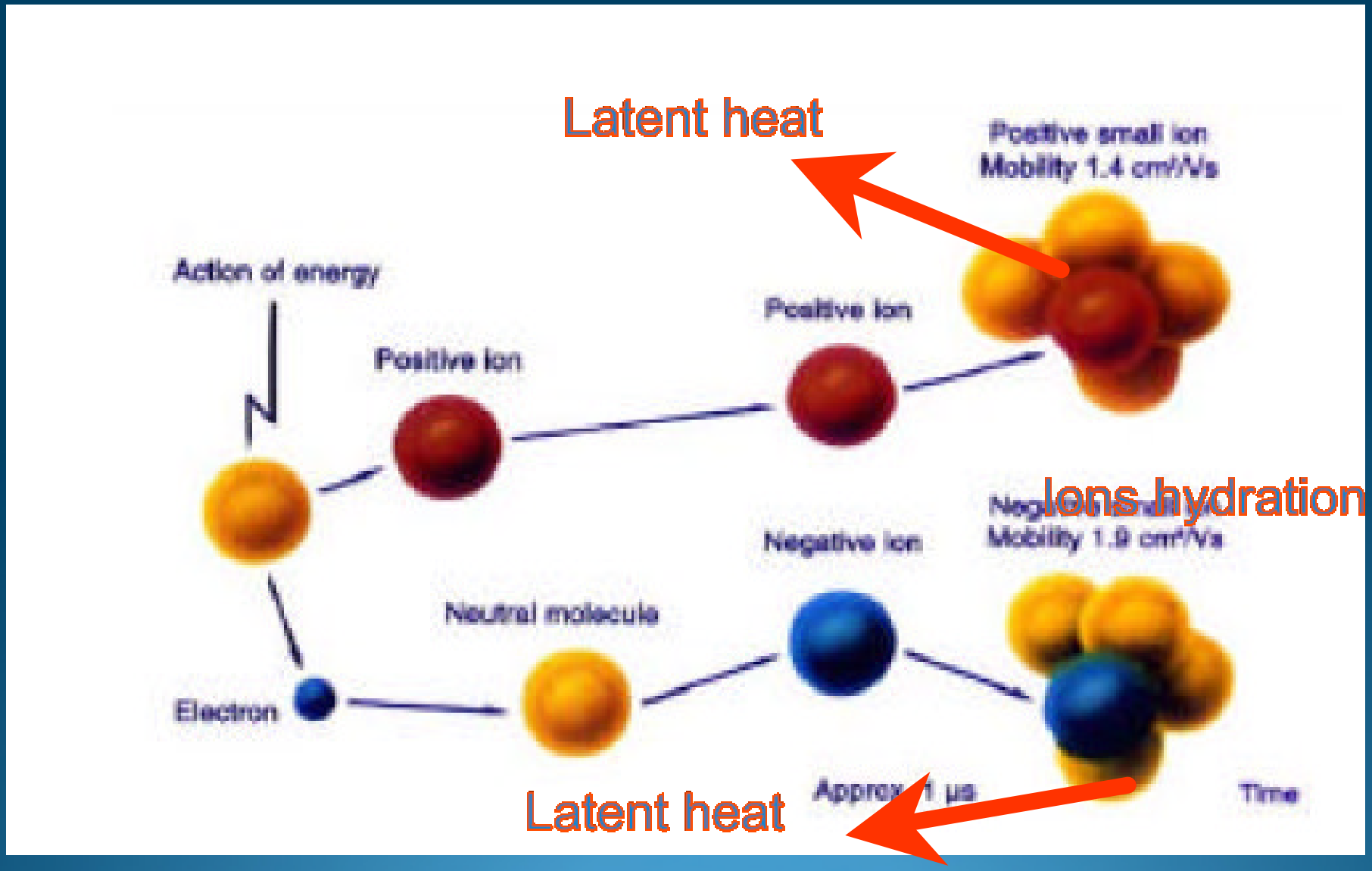


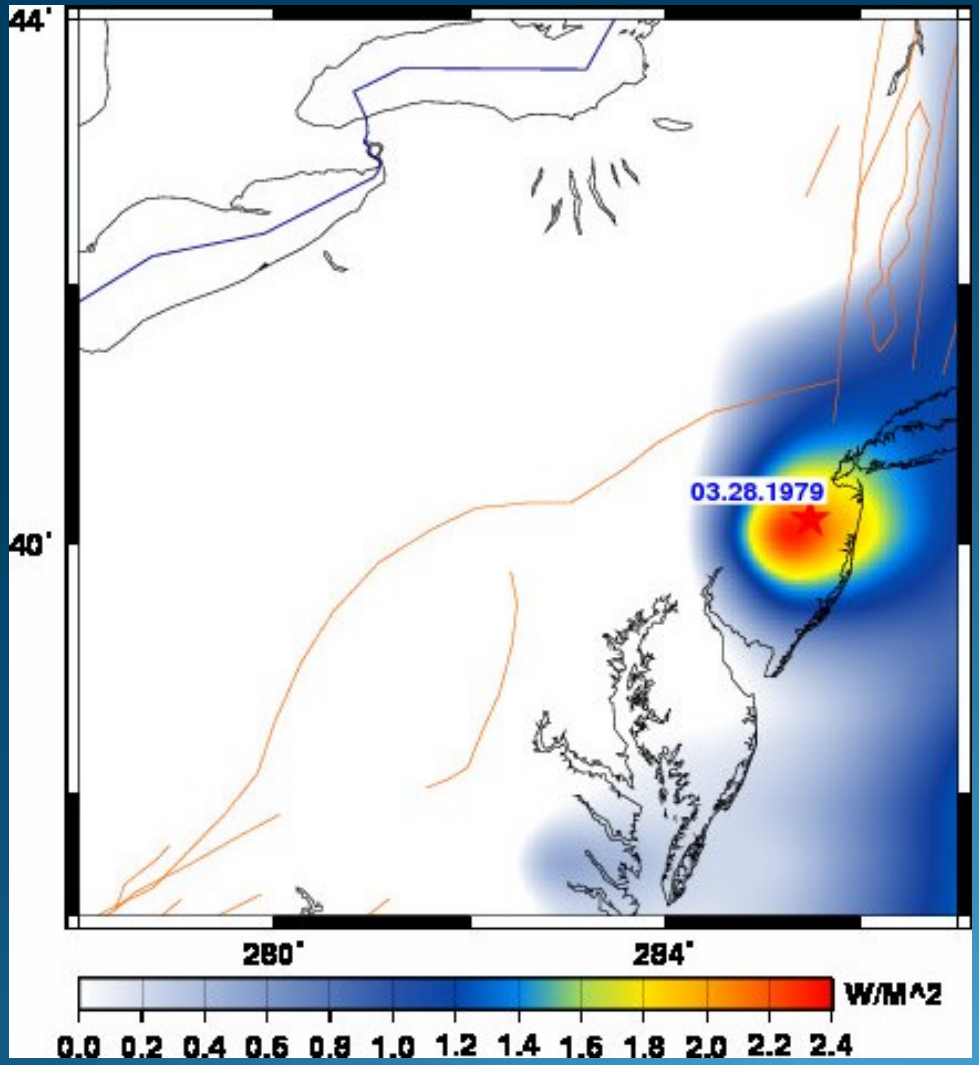
Fig. 1. Variation of low-altitude cloud cover, cosmic rays, and total solar irradiance between 1984 and 1994. The cosmic ray intensity is from Huancayo observatory, Hawaii. [Adapted from [4]]

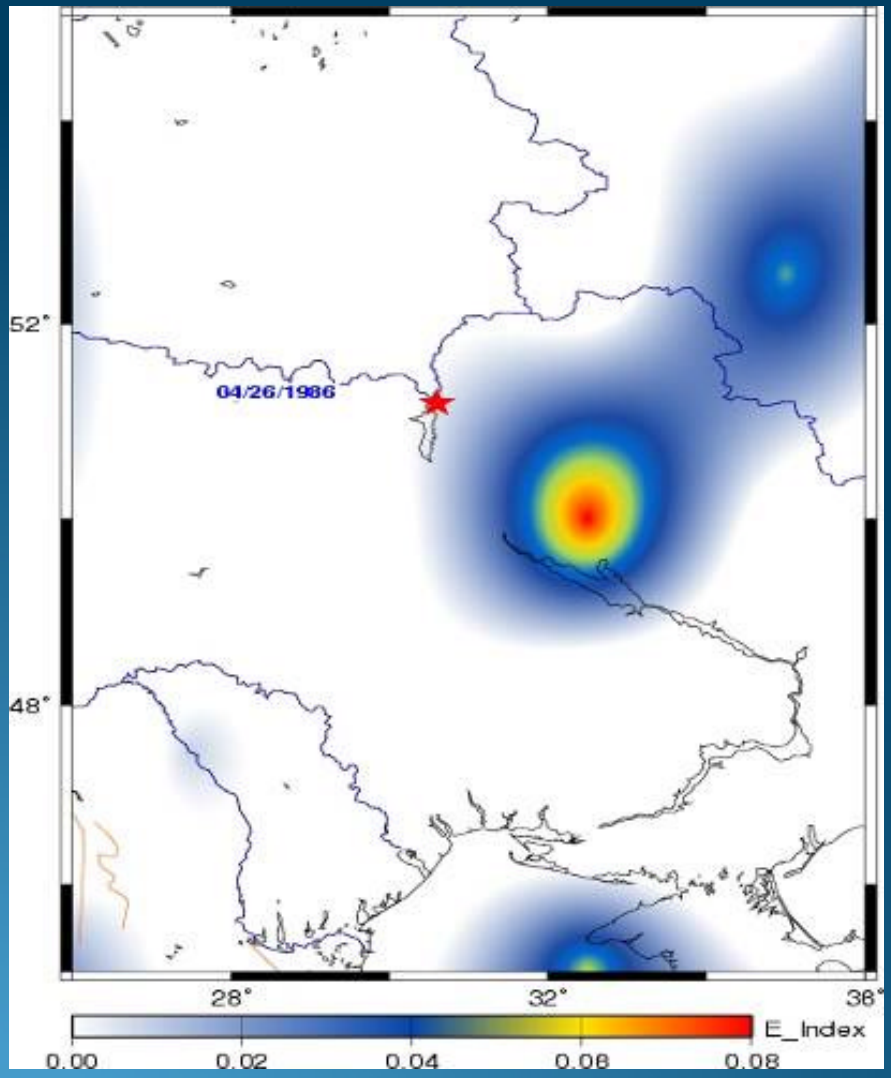


What processes connected with ionization and condensation can produce thermal anomalies?

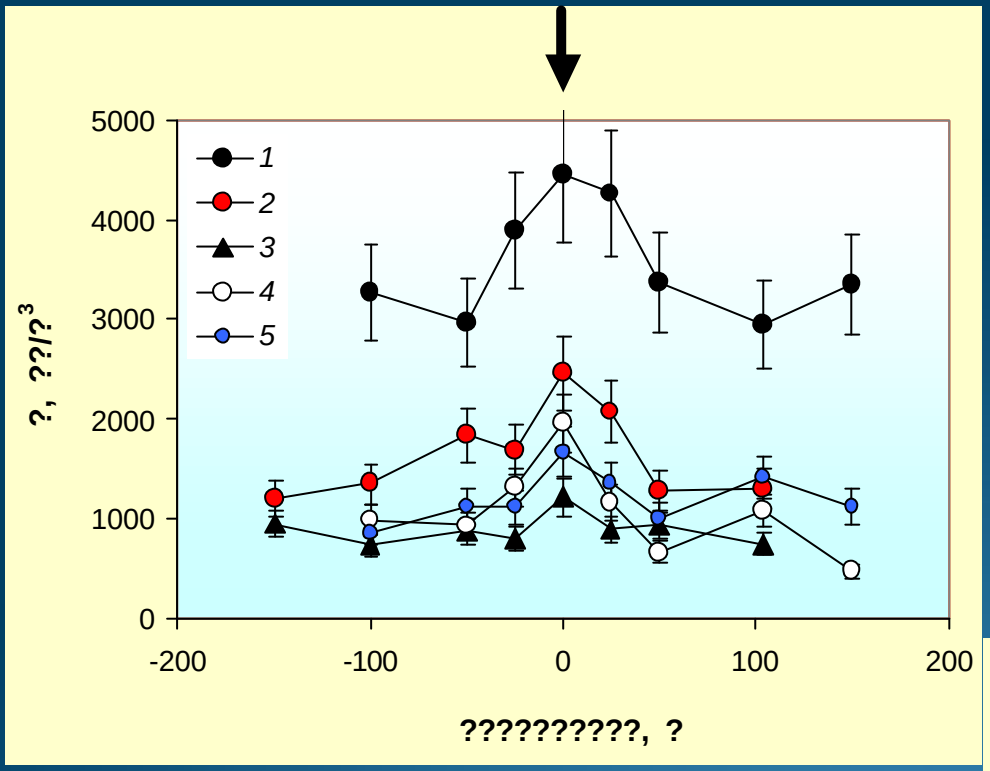


Radiative pollution – emergencies at Three-Mile island (1979) and Chernobyl (1986) atomic electric power plants



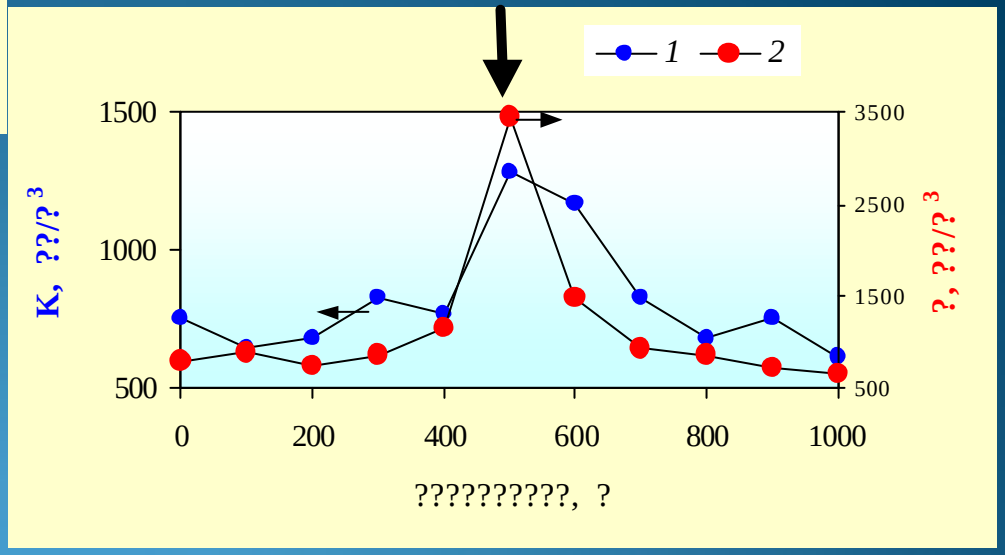


Tectonic faults - the channels of gas migration



Volume radon activity along the pass crossing the tectonic fault.

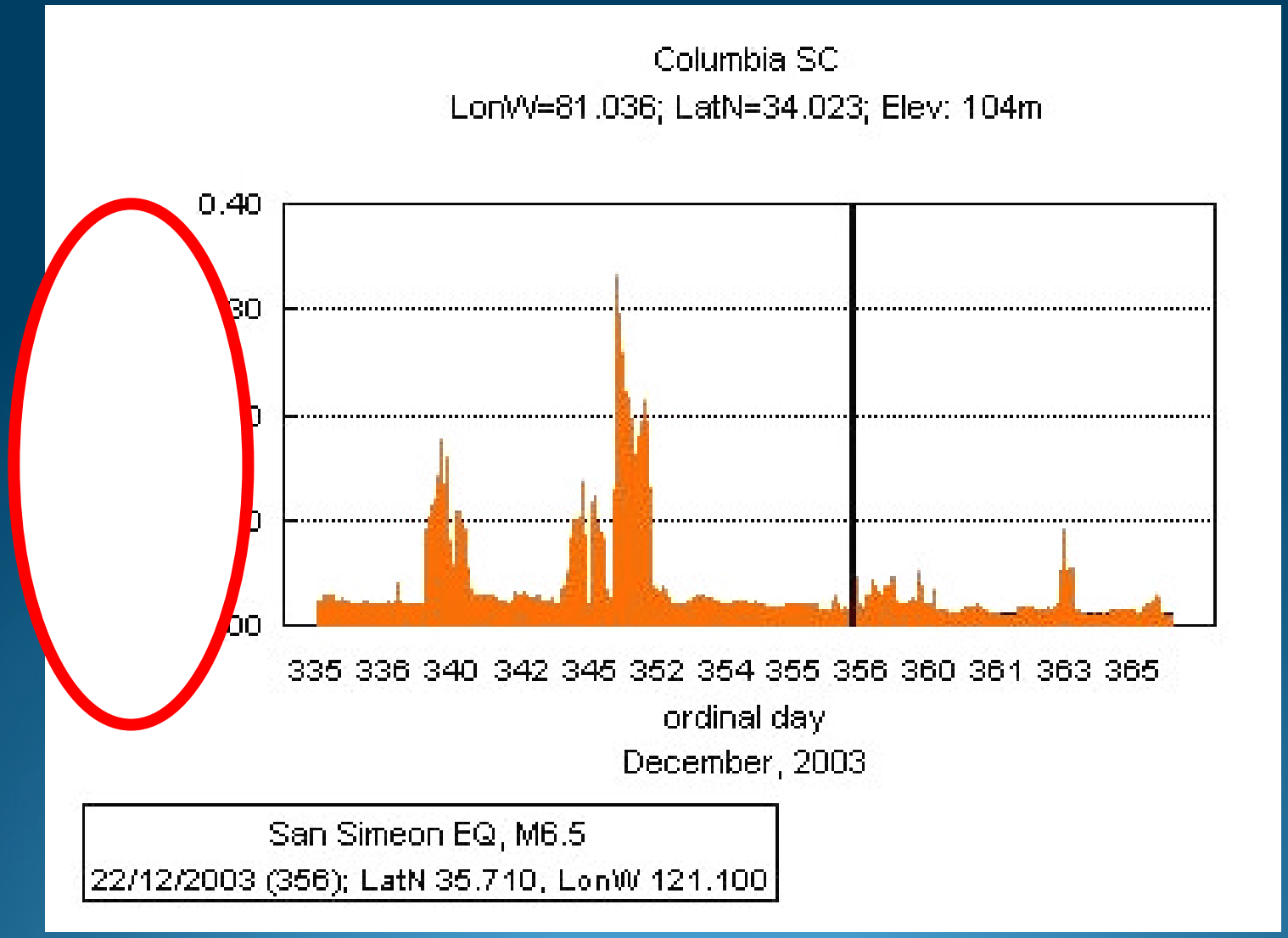
28-29 June 2004.



20 May 2003.

Spivak, 2008

What particle size we observe before earthquakes?



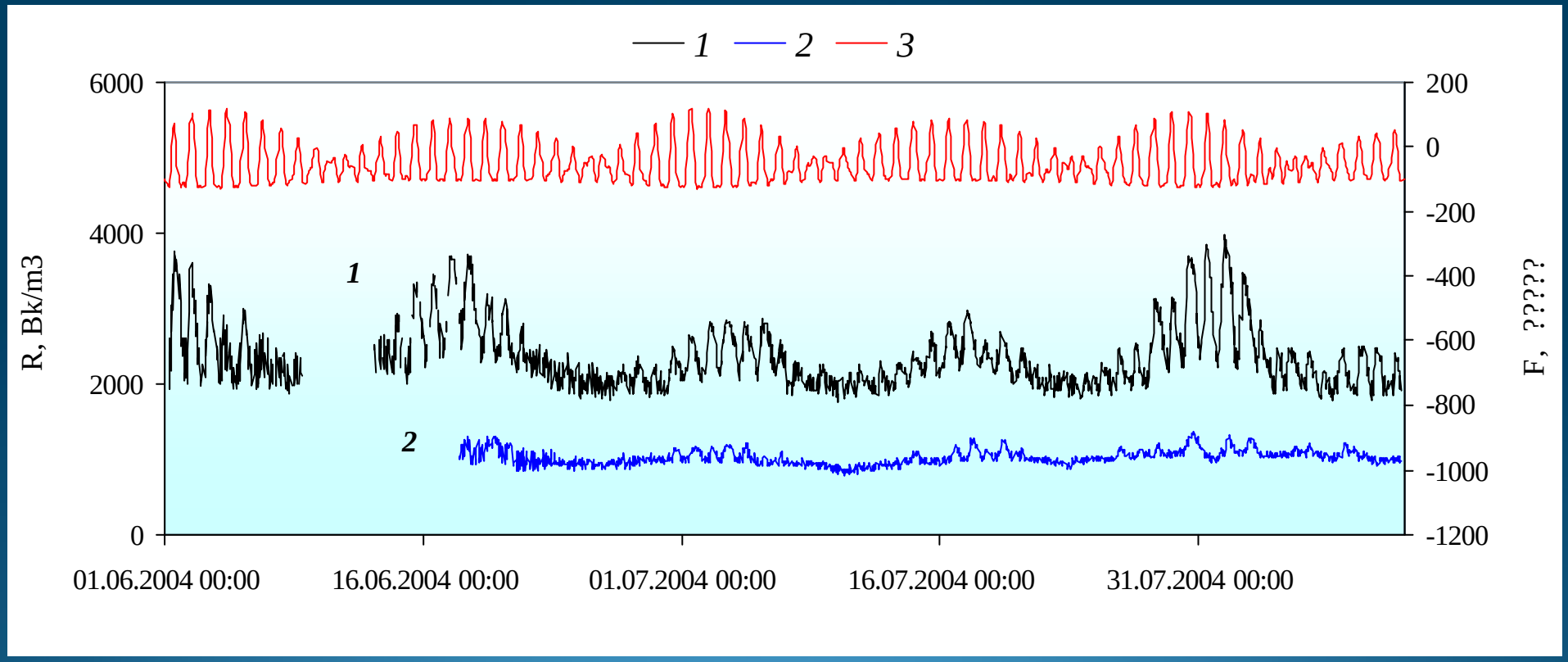
Final selection

1. ~~Tectonic heat flow~~
2. ~~Thermal waters~~
3. ~~Greenhouse gases~~
4. ~~Possibilities~~
5. Ionization by radon as one of the degassing components

Q<1

Q>>1

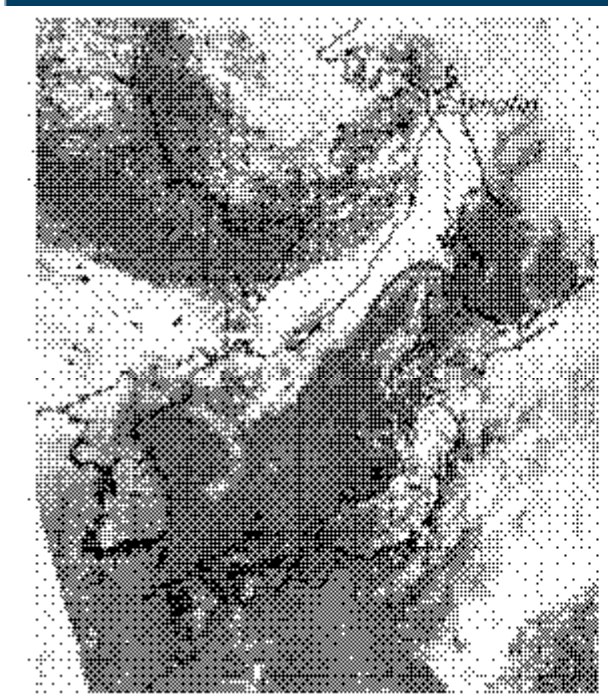
Validation: false alarms – support for our model and mechanism selection

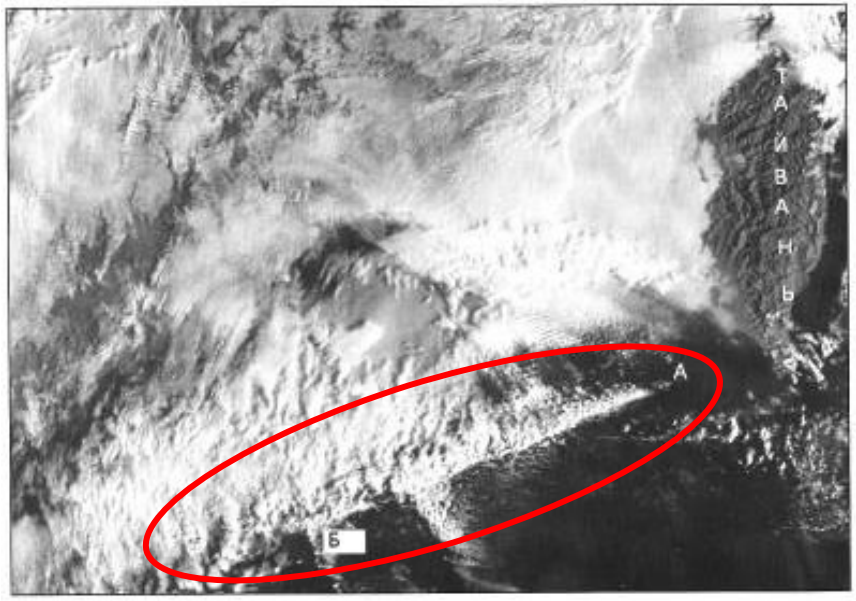


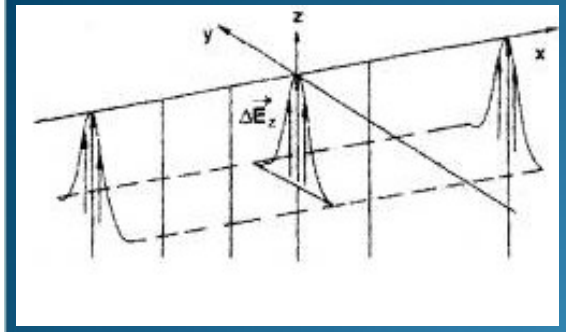
Spivak, 2008

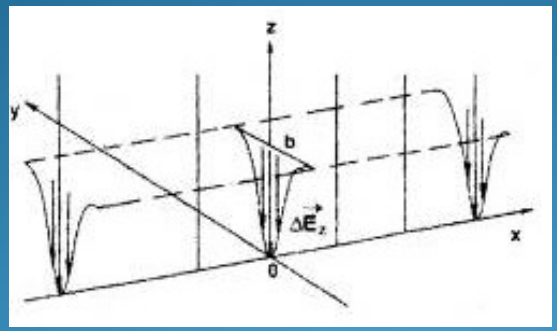
Tides and radon emanation

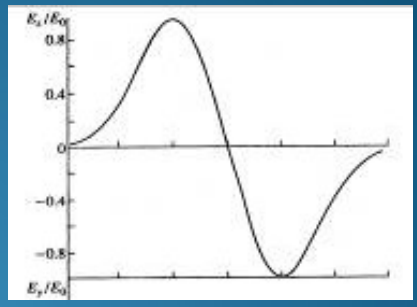
– confirmation of their seismo-electric nature





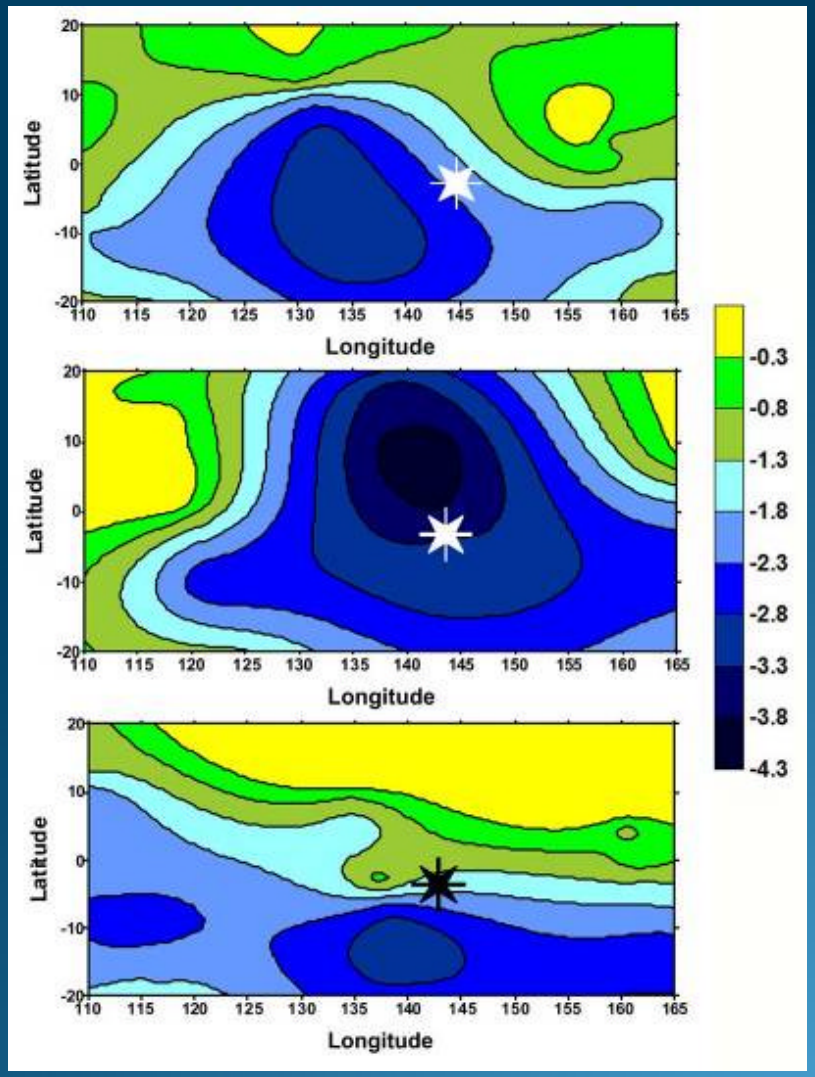




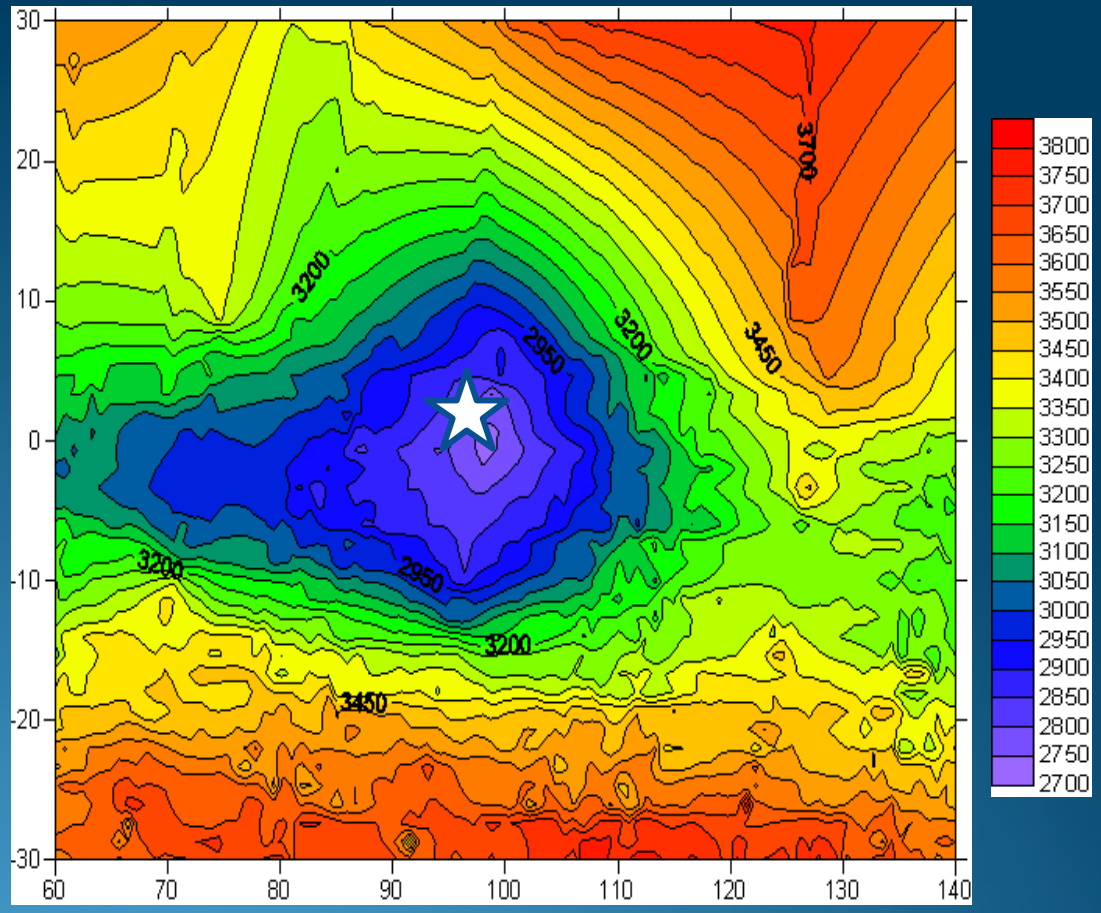


What about ionosphere?

M=7.3, New Guinea Islands, ΔfoF2
16.07.1980, Intercosmos-19

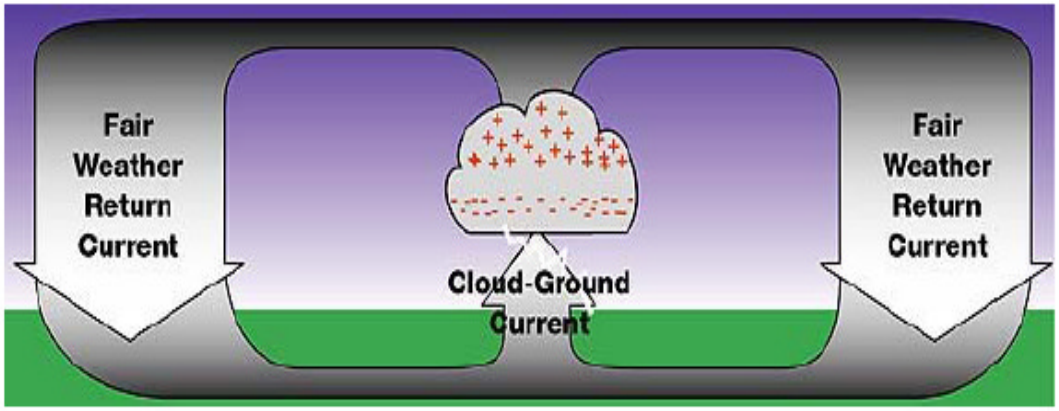


M9.3 Sumatra, electron temperature
26.12.2004, DMSP satellite



Global electric circuit and EM coupling with the ionosphere

The Global Electric Circuit

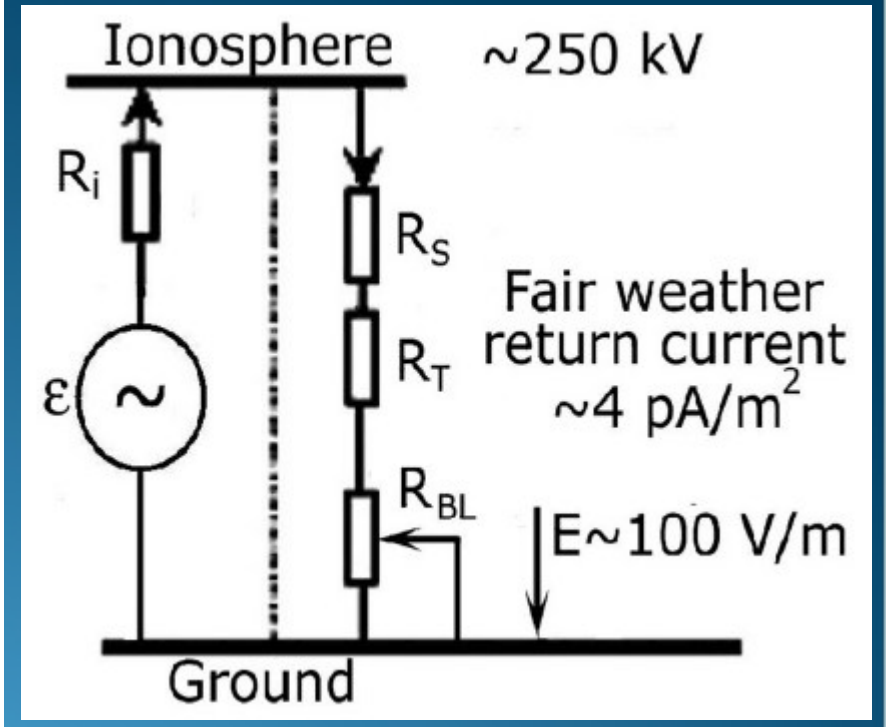


Voltage gradient from surface to ionosphere :

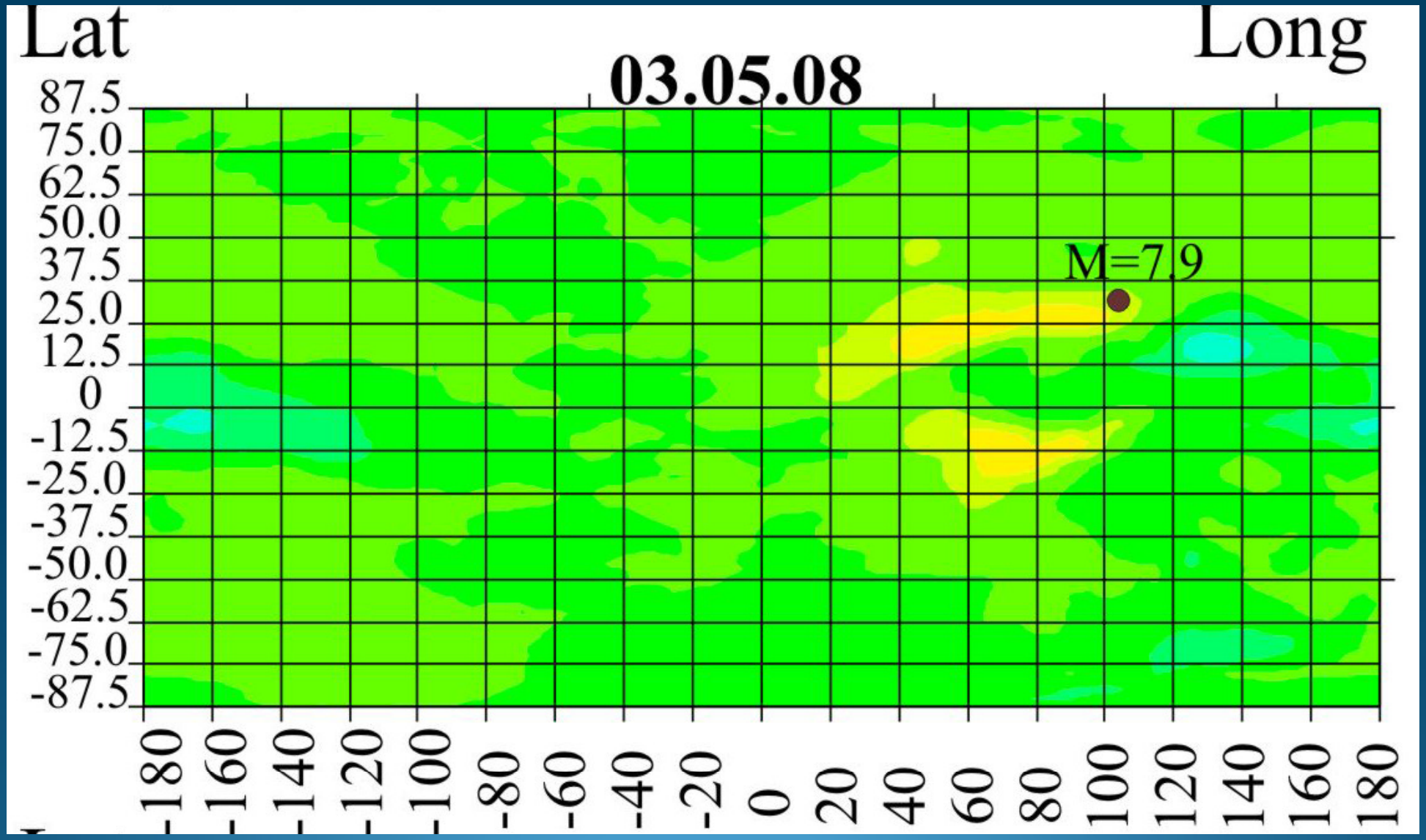
200,000 – 500,000 V or 100-140 V/m

Fair weather current return :

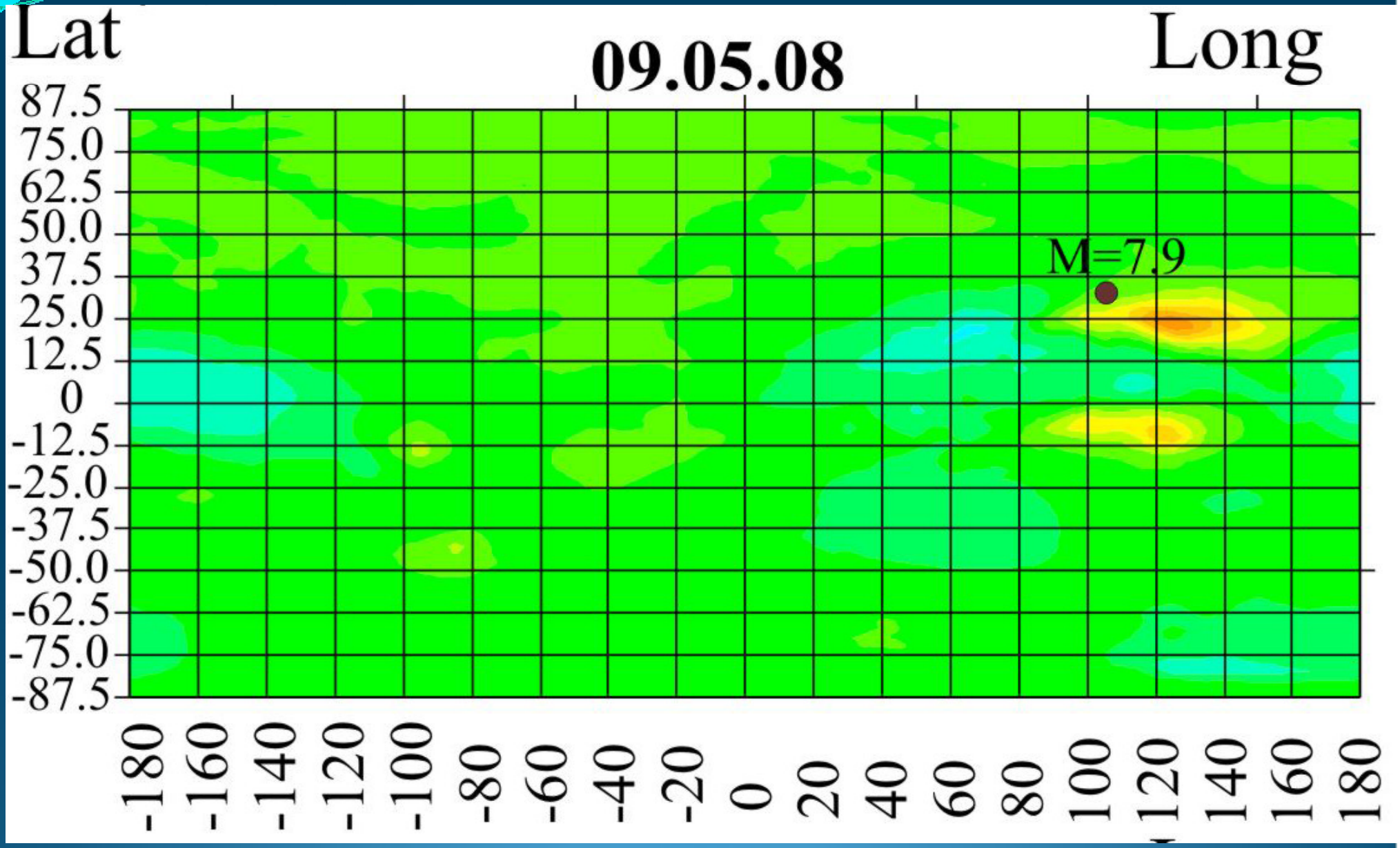
1,000-1,500 A or 3 x 10^{-12} A m^{-2}



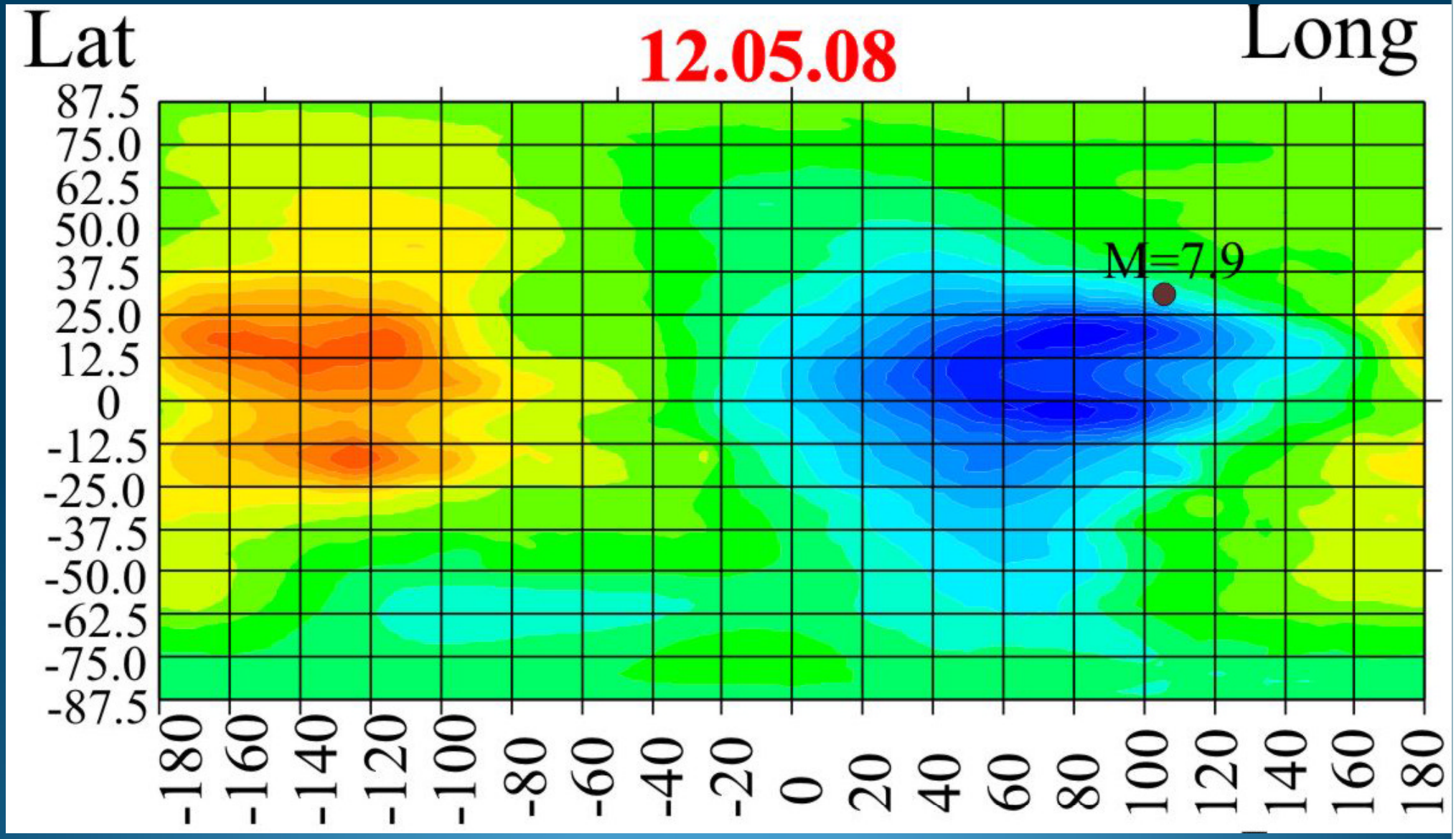
Increased conductivity



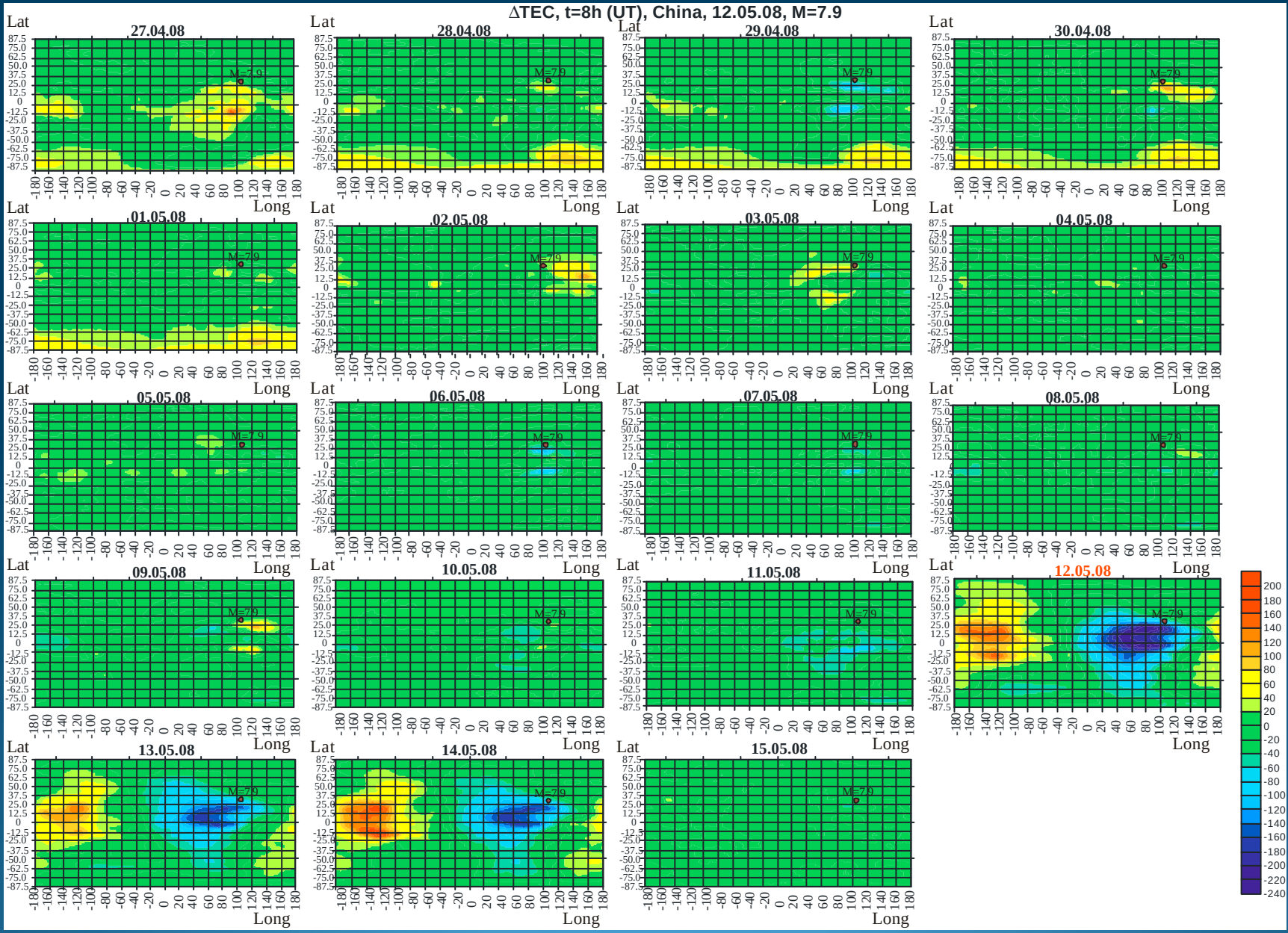
Decreased conductivity



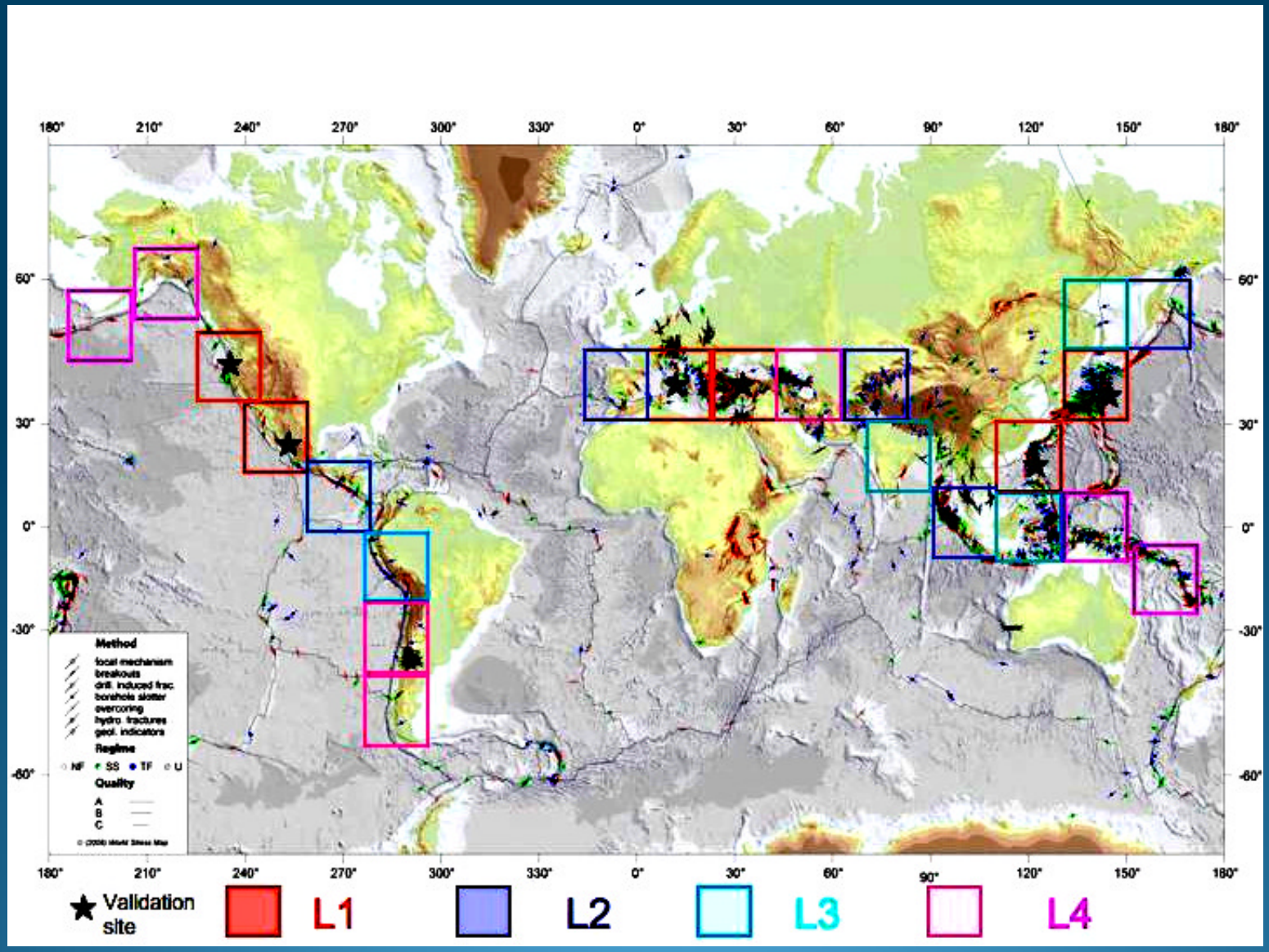
2 hours after the seismic shock



Global GPS ΔTEC maps for May 2008



Technology testing areas



Conclusions

- Further LAIC model perfection to obtain quantitative correspondence, inclusion of new elements (jet streams, etc.)
- Intensification of the field works to “catch” the key factors of atmospheric chemistry, atmospheric electricity and atmospheric thermodynamics
- Real-time validation – the next step of technology development
- After real-time validation (in case of success) it could be distributed for practical application in short-term earthquake prediction