Atmosphere-Ionosphere Coupling: The role of boundary layer in generation of ionospheric precursors of earthquakes

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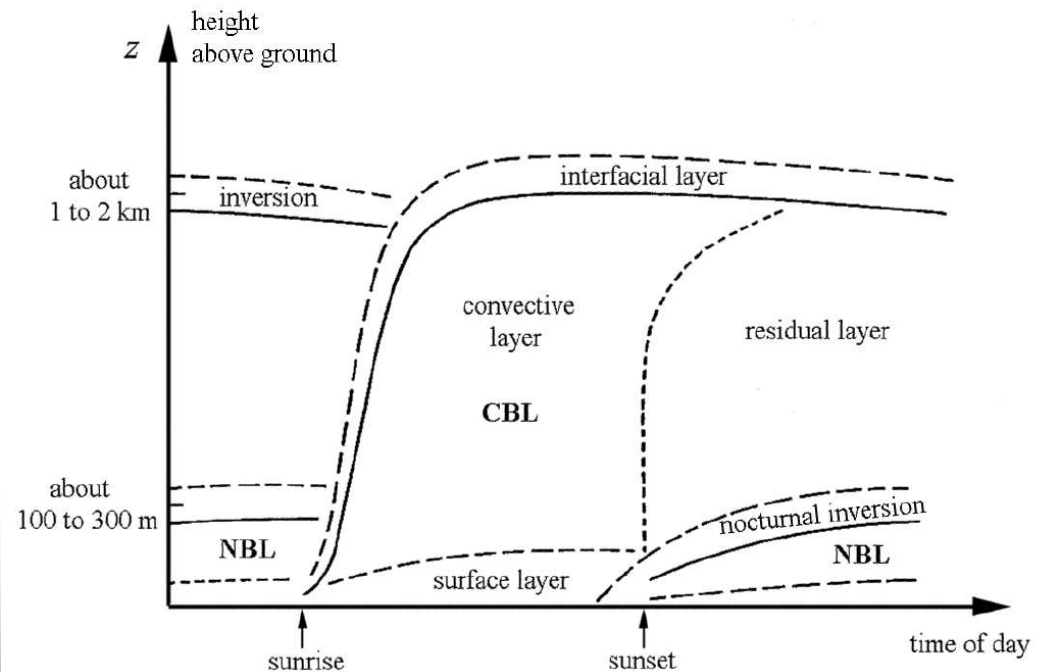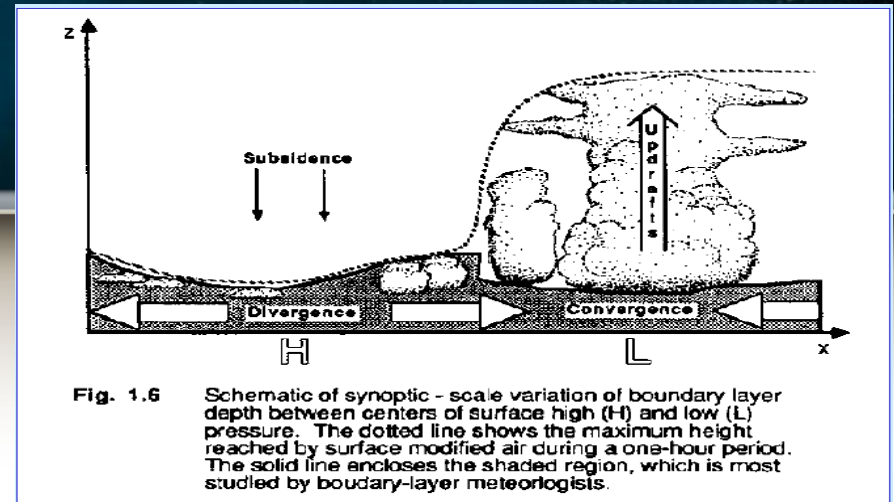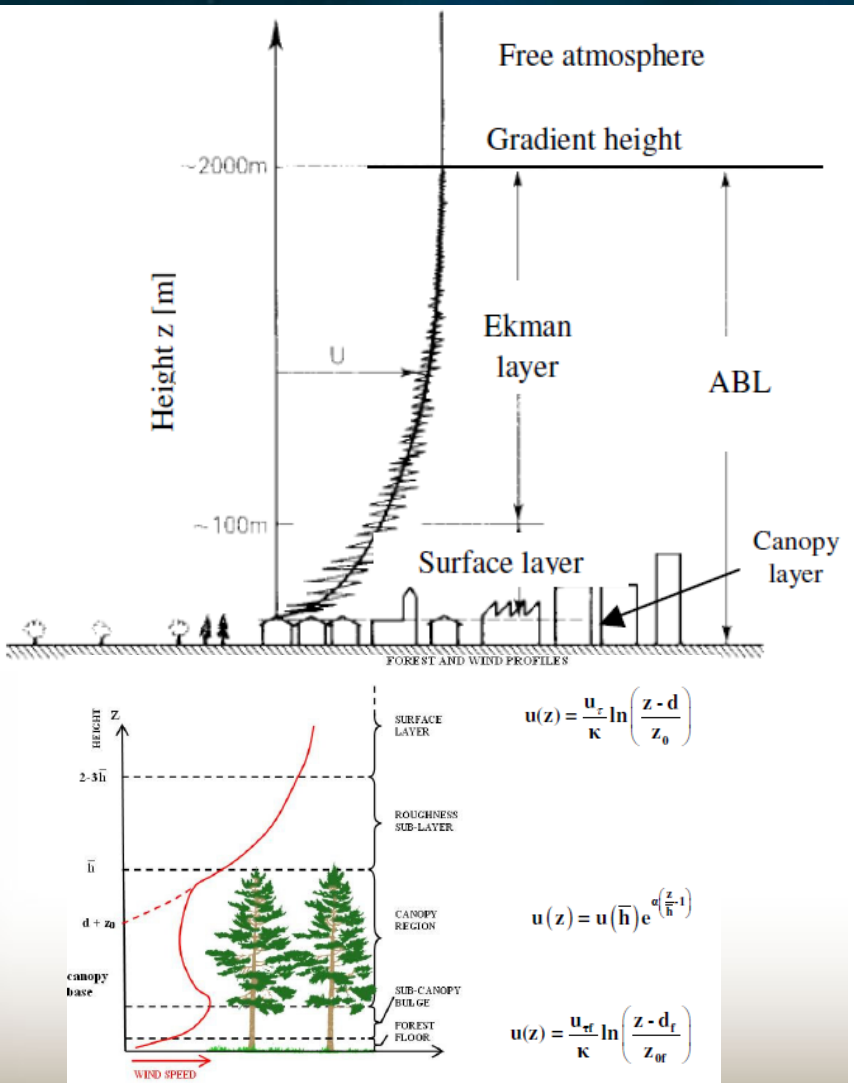
Outline

- Atmosphere boundary layer (ABL): determination and morphology

- Aerosols and radon in BL

- The Global Electric Circuit (GEC) and pre-earthquake effects in the ionosphere modeling

- Local time dependence of the ionospheric precursors

- Case studies and conclusions
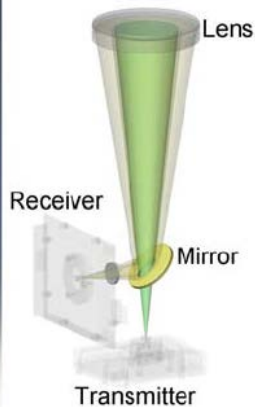
Atmospheric Boundary Layer
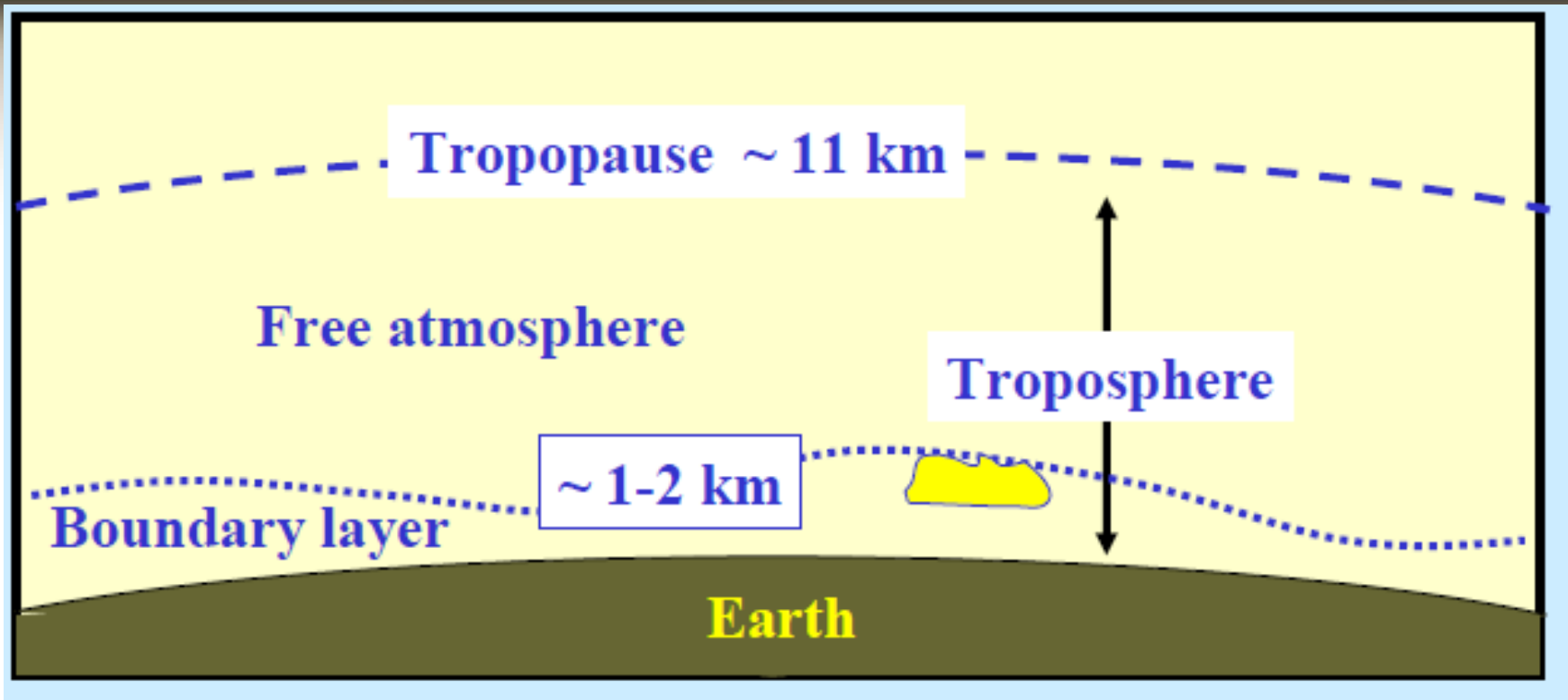
The boundary layer is that part of the troposphere that is directly influenced by the presence of the earth's surface, and responds to surface forcing with a timescale of about an hour or less.
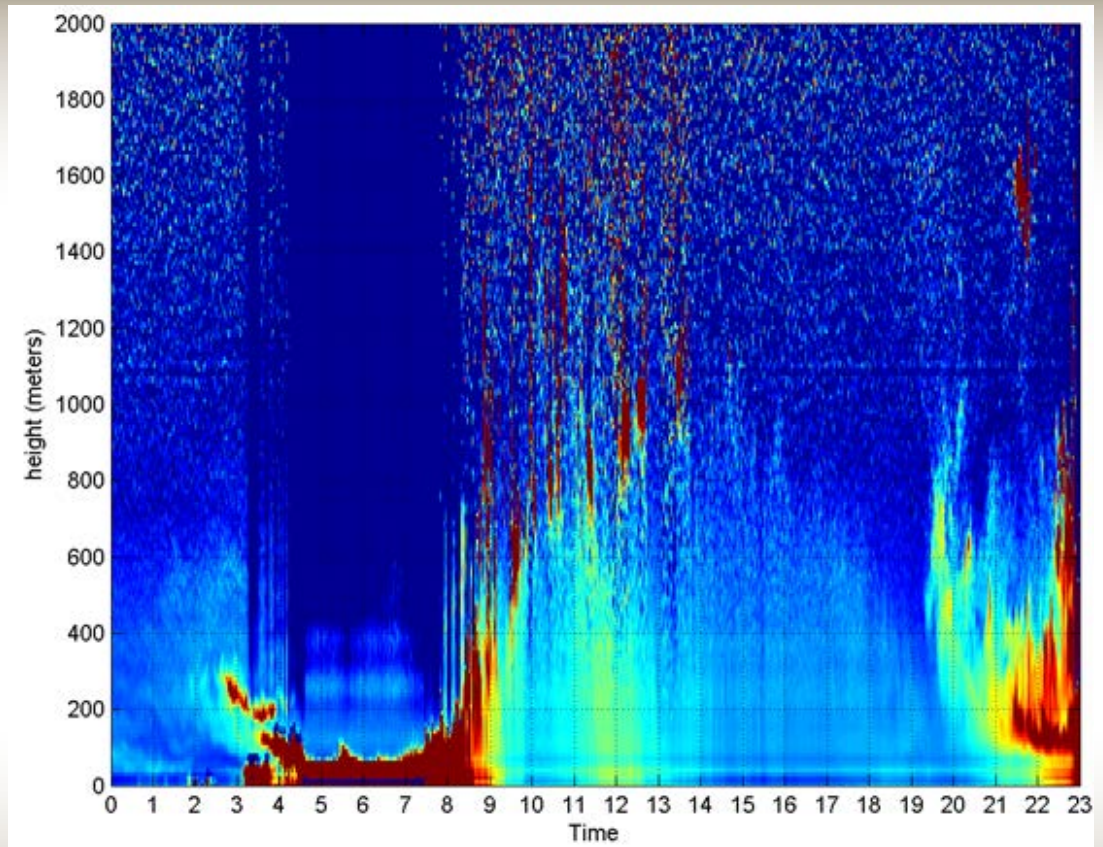
Structure and LT evolution of ABL

Fig. 1.6 Schematic of synoptic - scale variation of boundary layer depth between centers of surface high (H) and low (L) pressure. The dotted line shows the maximum height reached by surface modified air during a one-hour period. The solid line encloses the shaded region, which is most studied by boundary-layer meteorlogists.
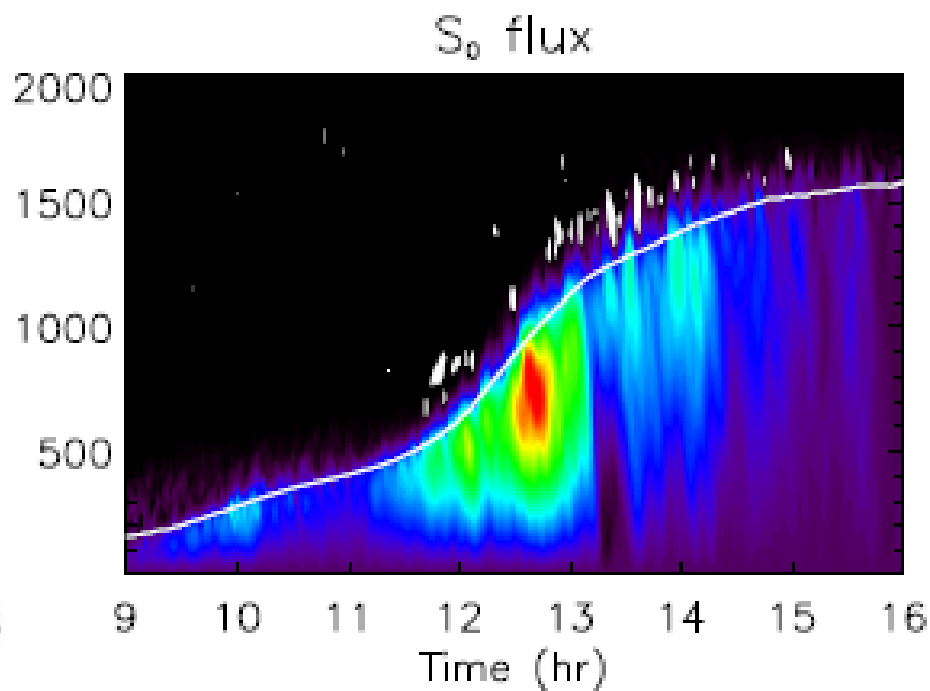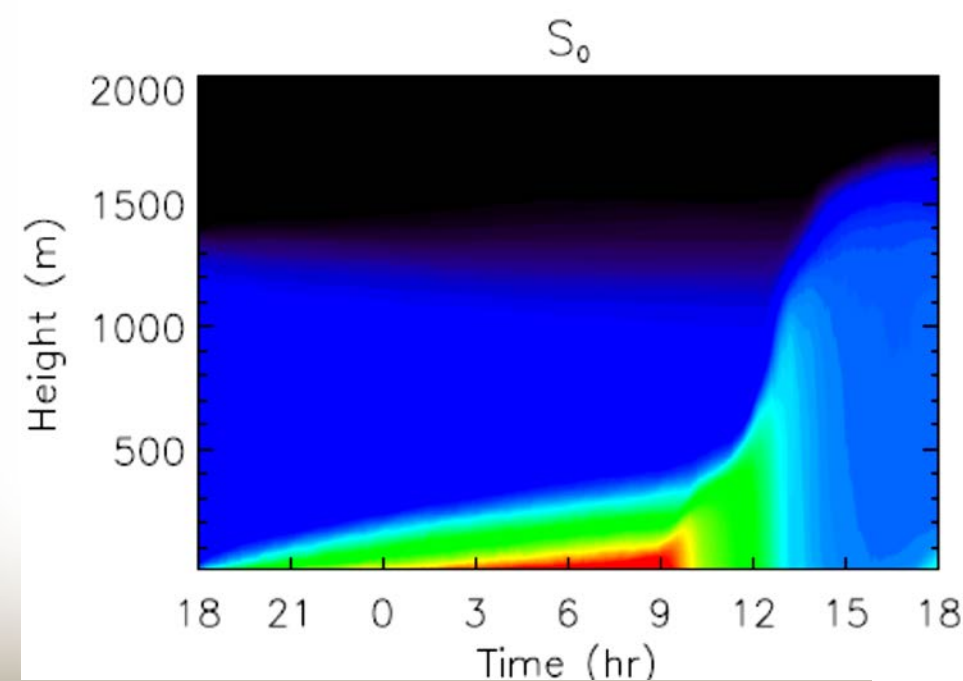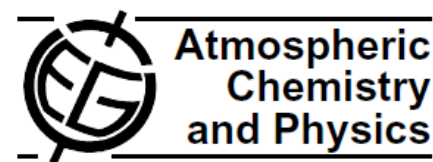
Miximg height assesment

Figure 1: Vaisala Ceilometer CL31 and its single lens optical concept.
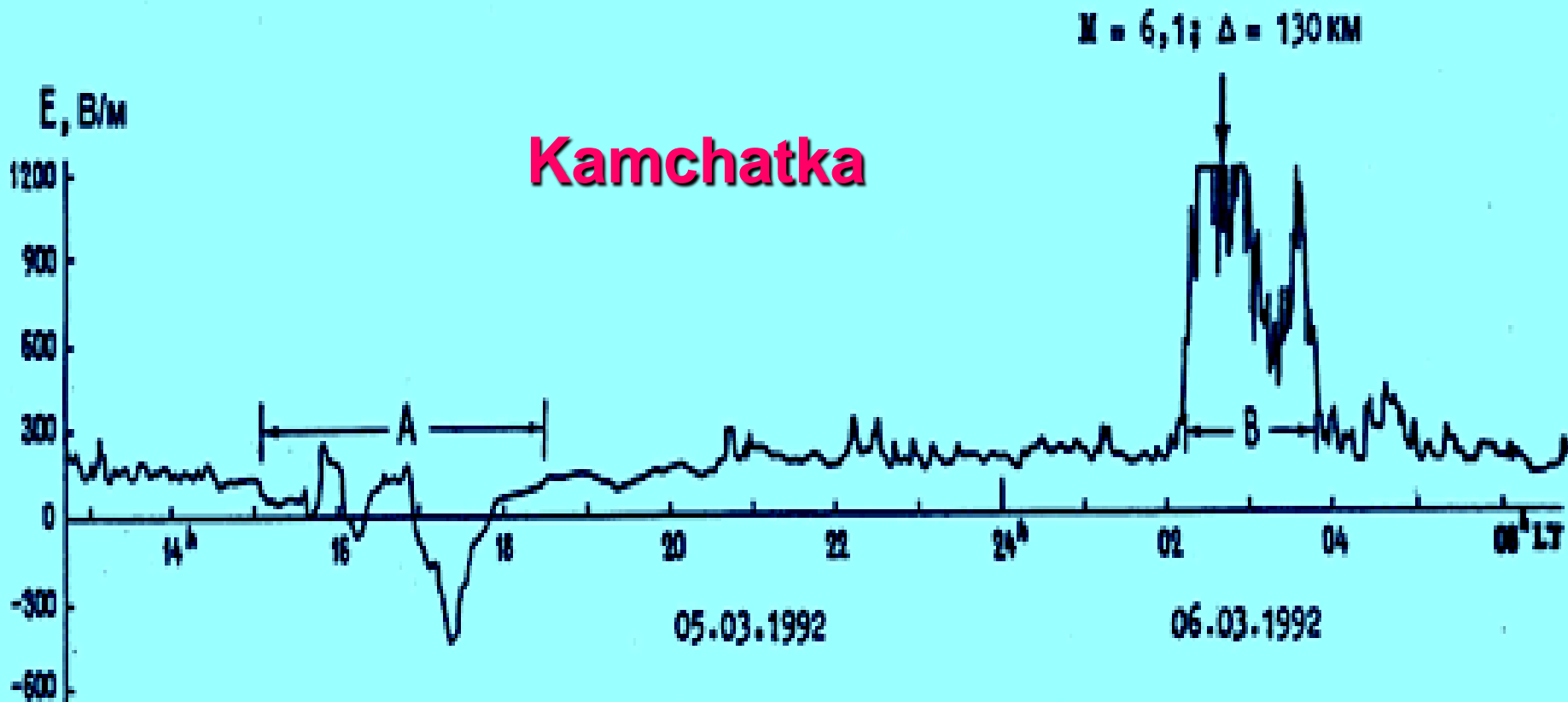
Radon in boundary layer

The diurnal evolution of ^{222}Rn and its progeny in the atmospheric boundary layer during the Wangara experiment

J.-F. Vinuesa[1], S. Basu[2], and S. Galmarini[1] Atmos. Chem. Phys., 7, 5003–5019, 2007
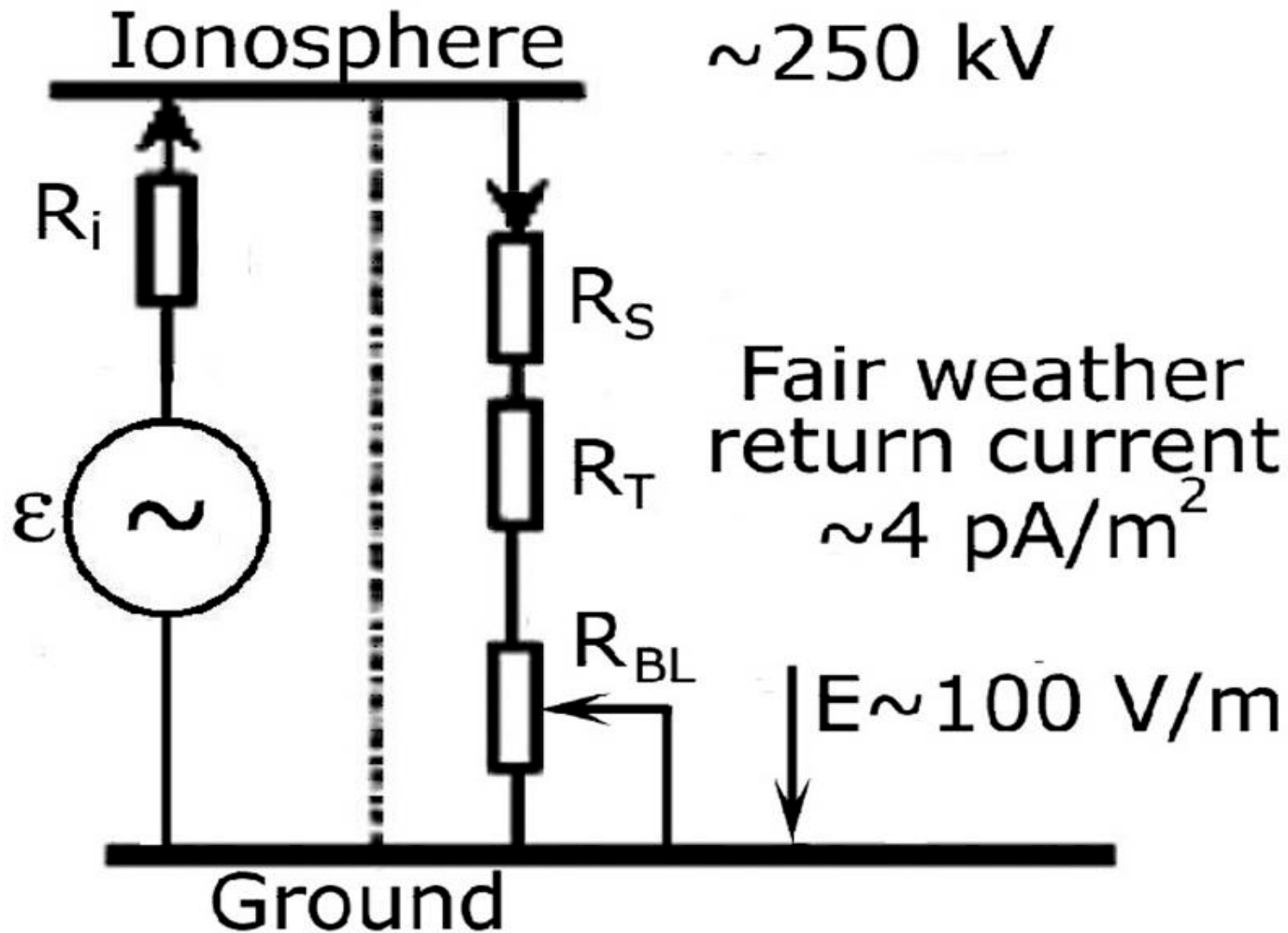
Atmospheric
Chemistry
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# Electric field registered before M6.1 earthquake at Kamchatka

Clobal Electric Circuit concept

Electric field generation mechanism

It is shown that if the ion-ion recombination velocity of the cluster ions H+(H2O)5, H+(H2O)6, N+(H2O), O8+, CO3-(H2O) и NO2-(H2O) is by 3-4 order magnitude lower than the standard Langevin ion-ion recombination constant which is $2 \cdot 10^{-6}$ sm^3/s, in conditions of ionization velocity in wet air (mist) of order 10 sm-3s-1 it is possible to provide the charge separation up to vertical electric field values of order of several kV/m.
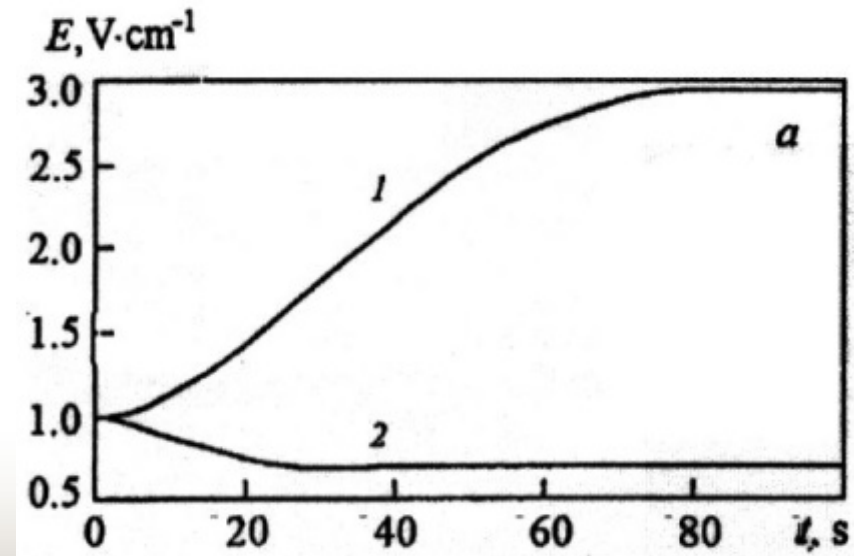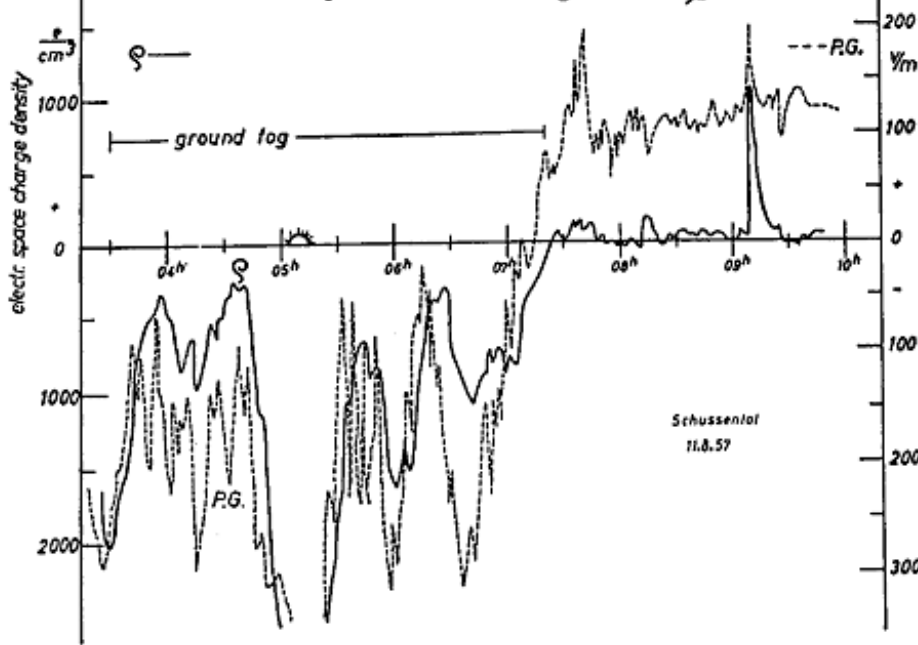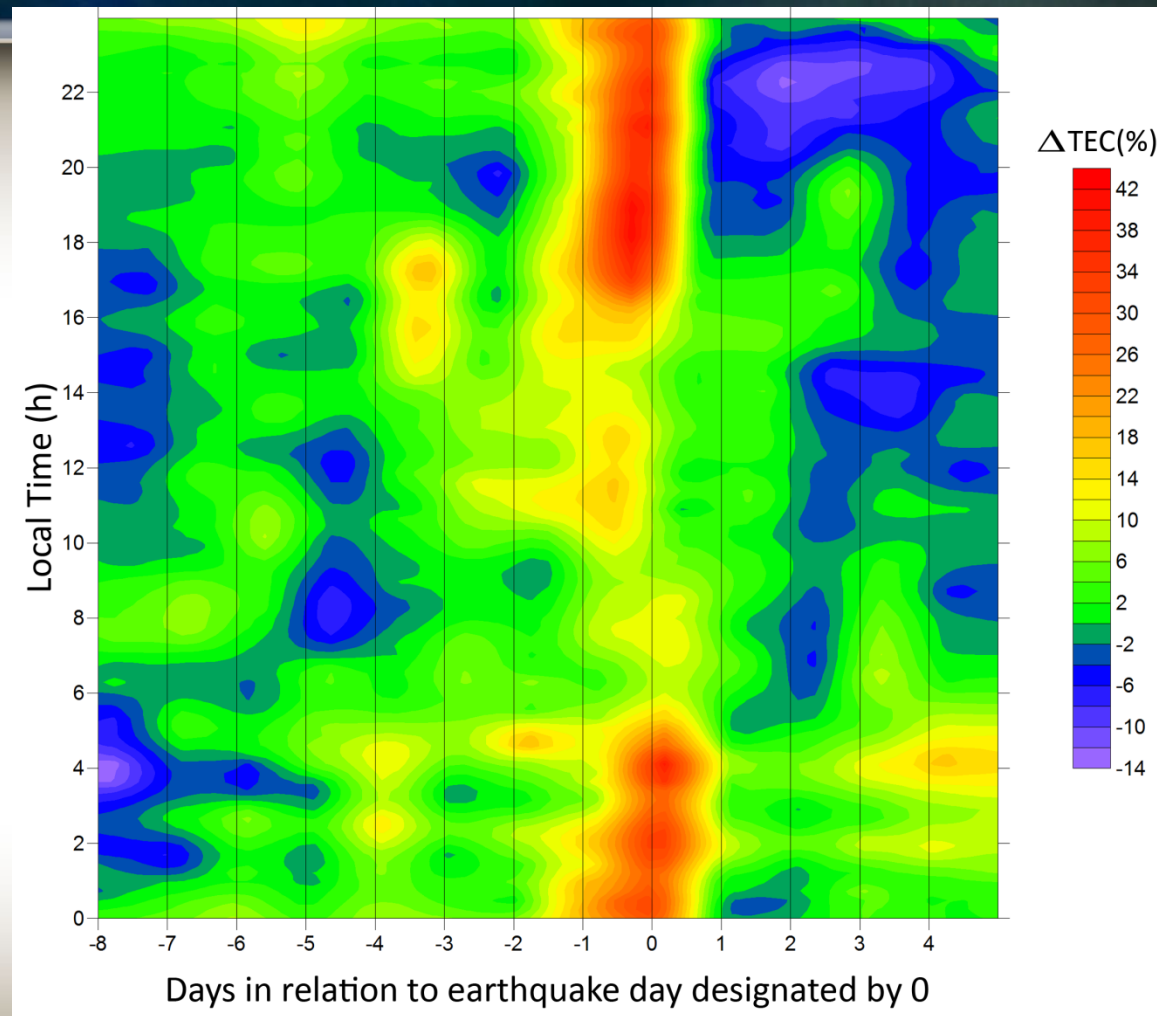
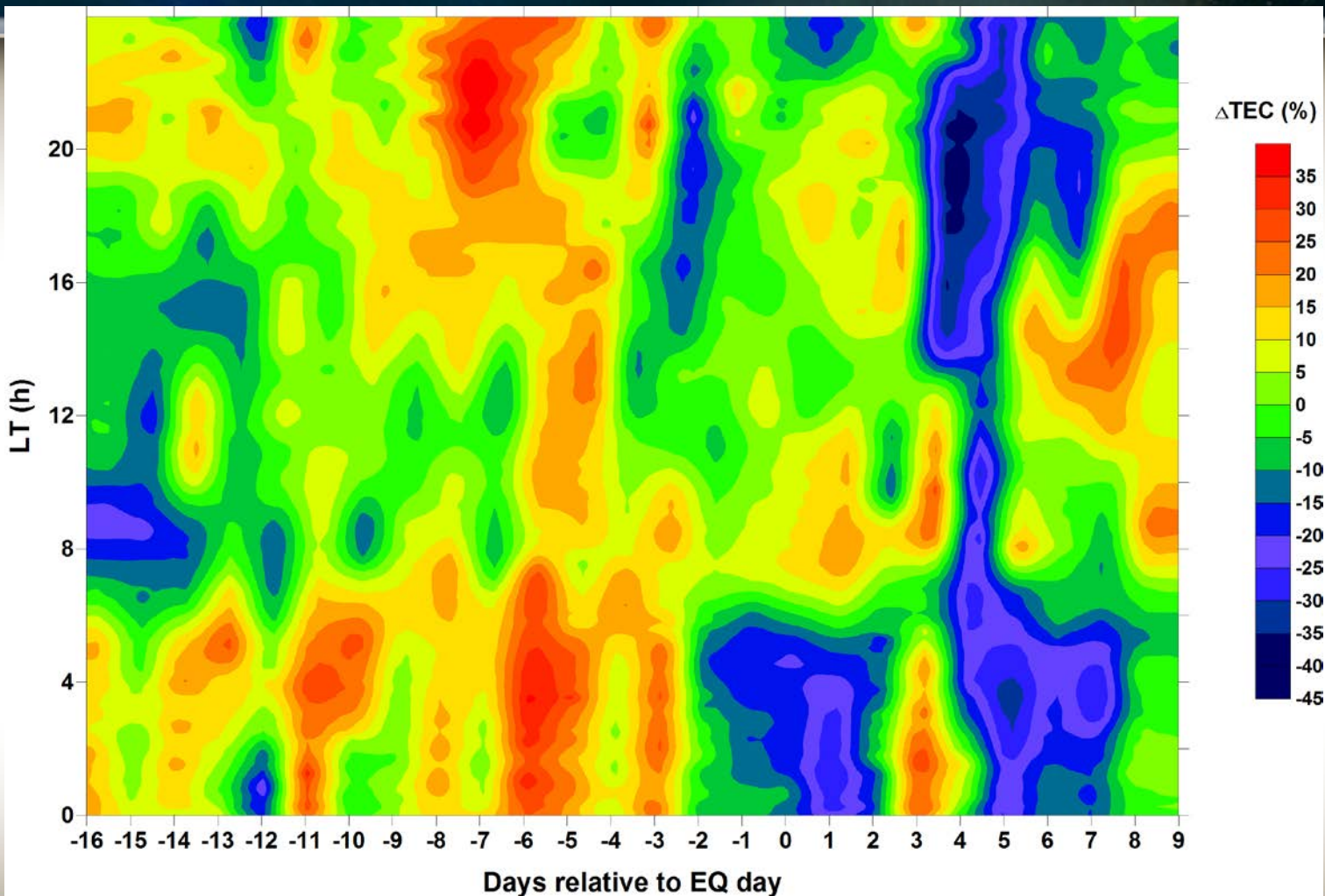# Electric field penetration into the ionosphere
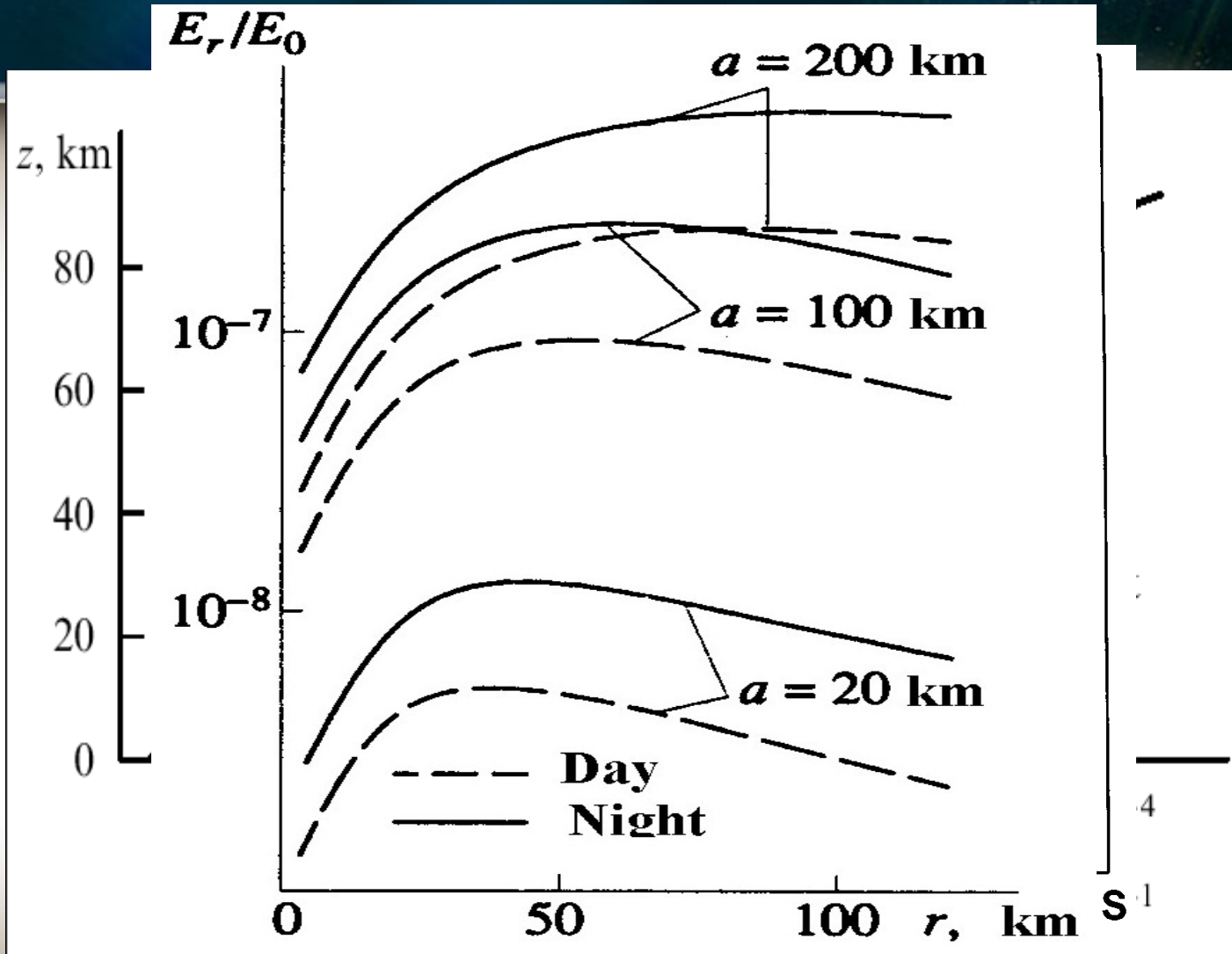
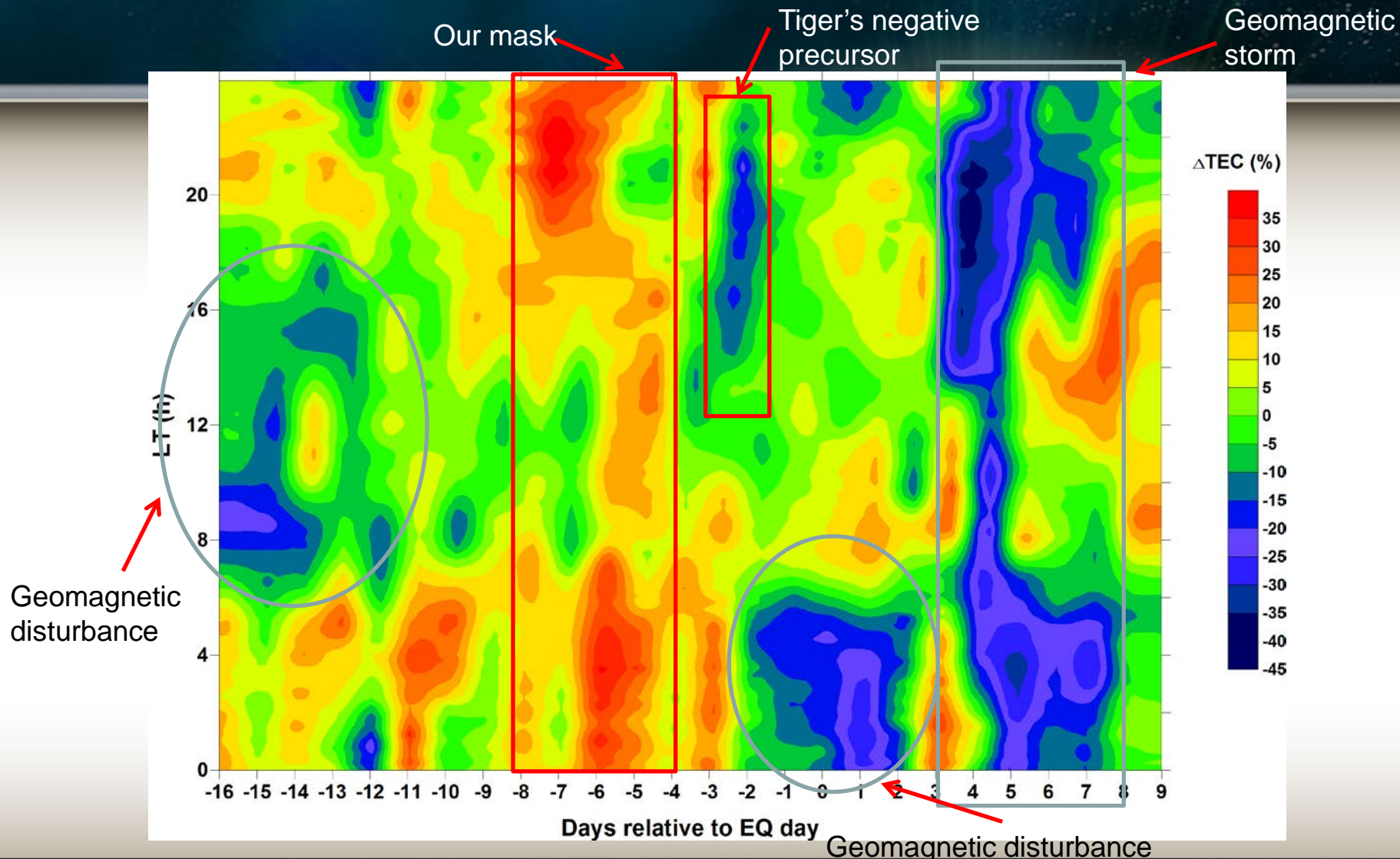# Night-time positive anomalies before M>6 earthquakes in Greece
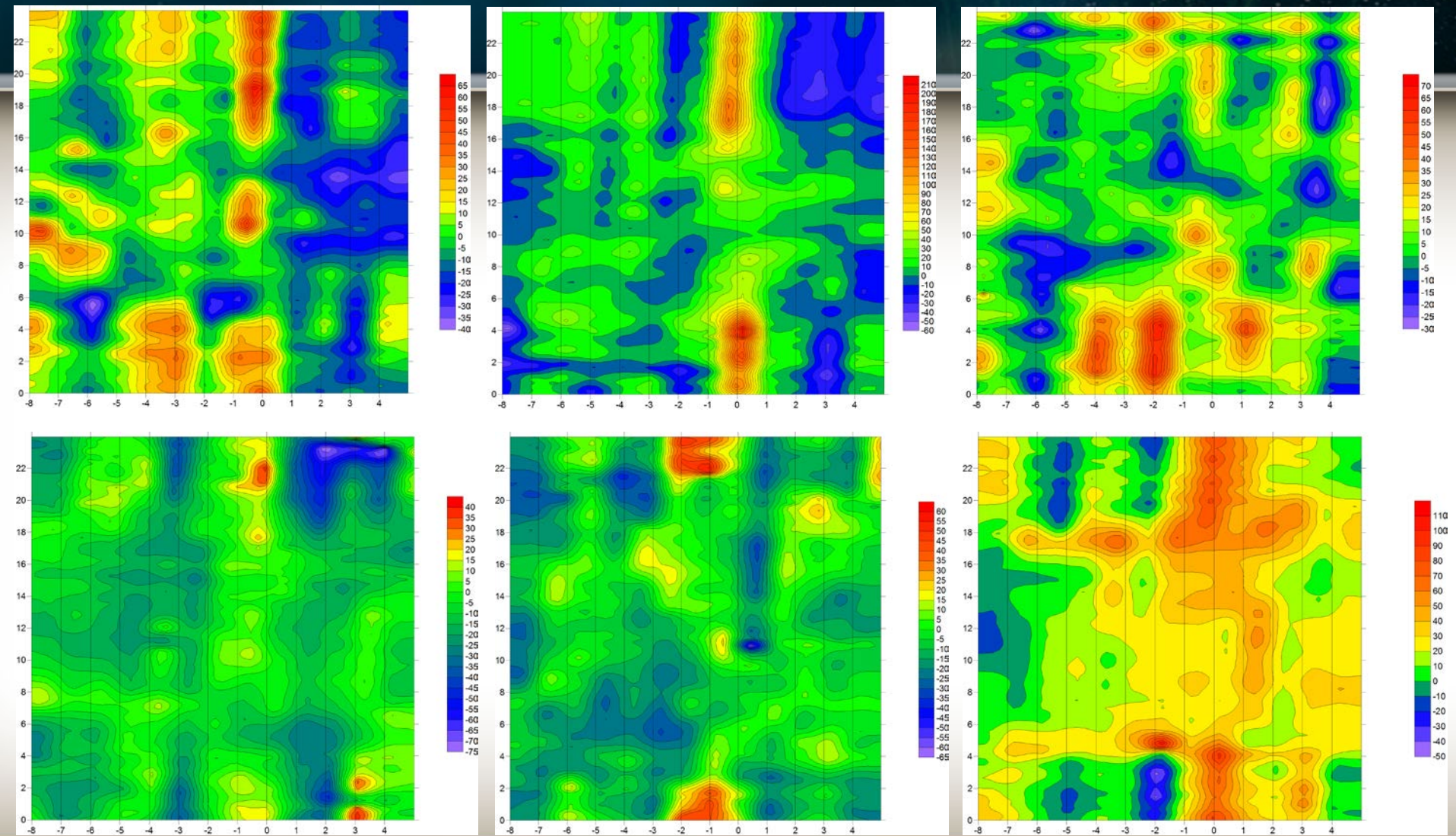
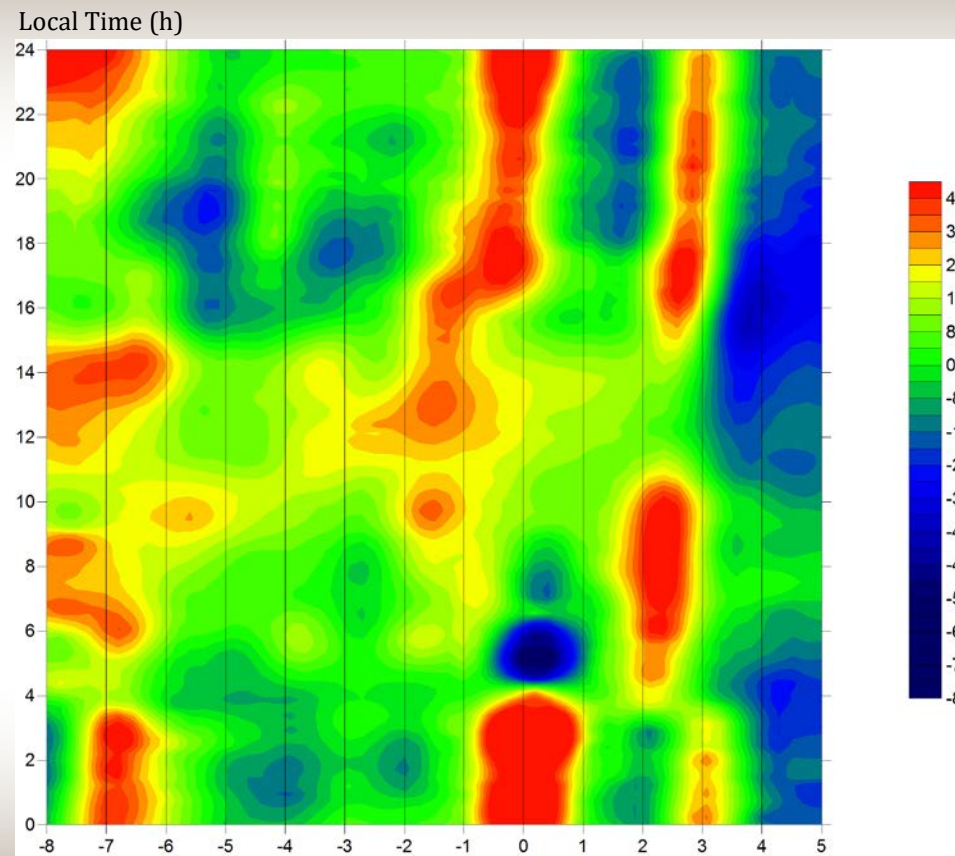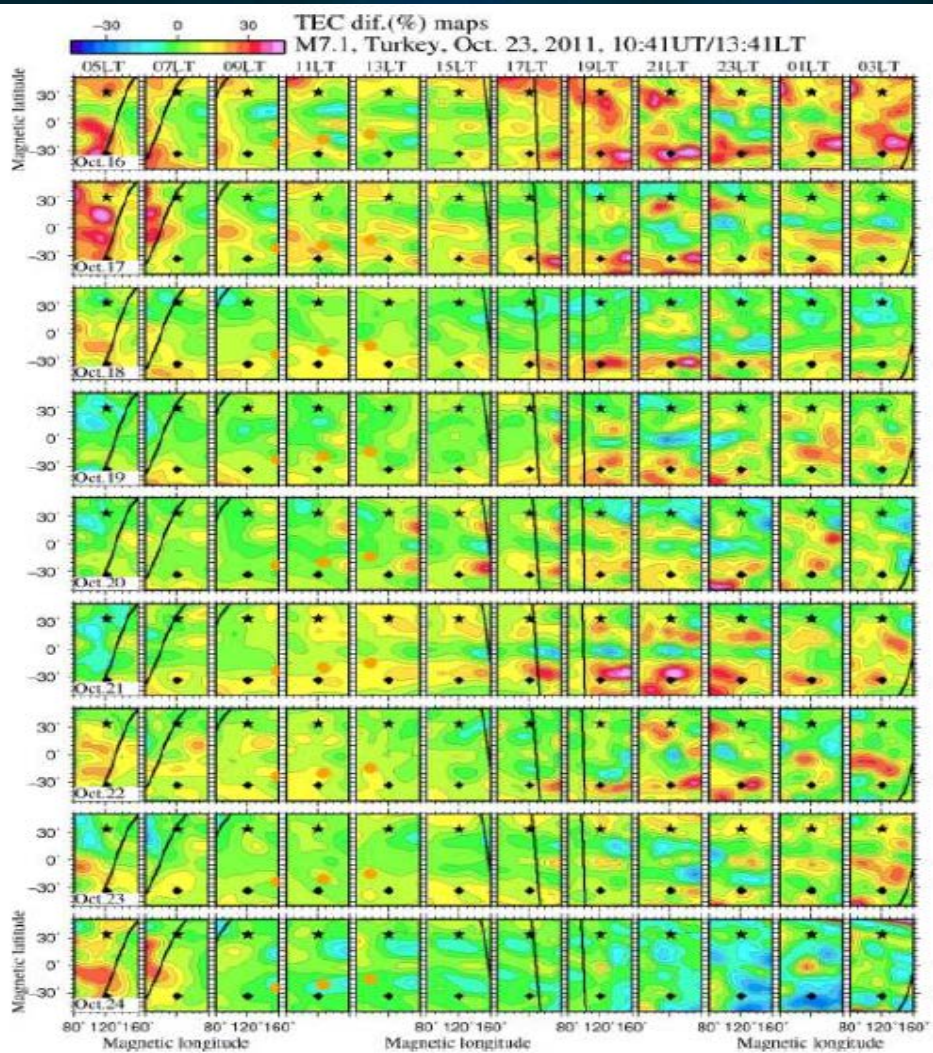# Mask of the night-time ionospheric precursor

South Napa M6 earthquake 24 August 2014 in California, USA
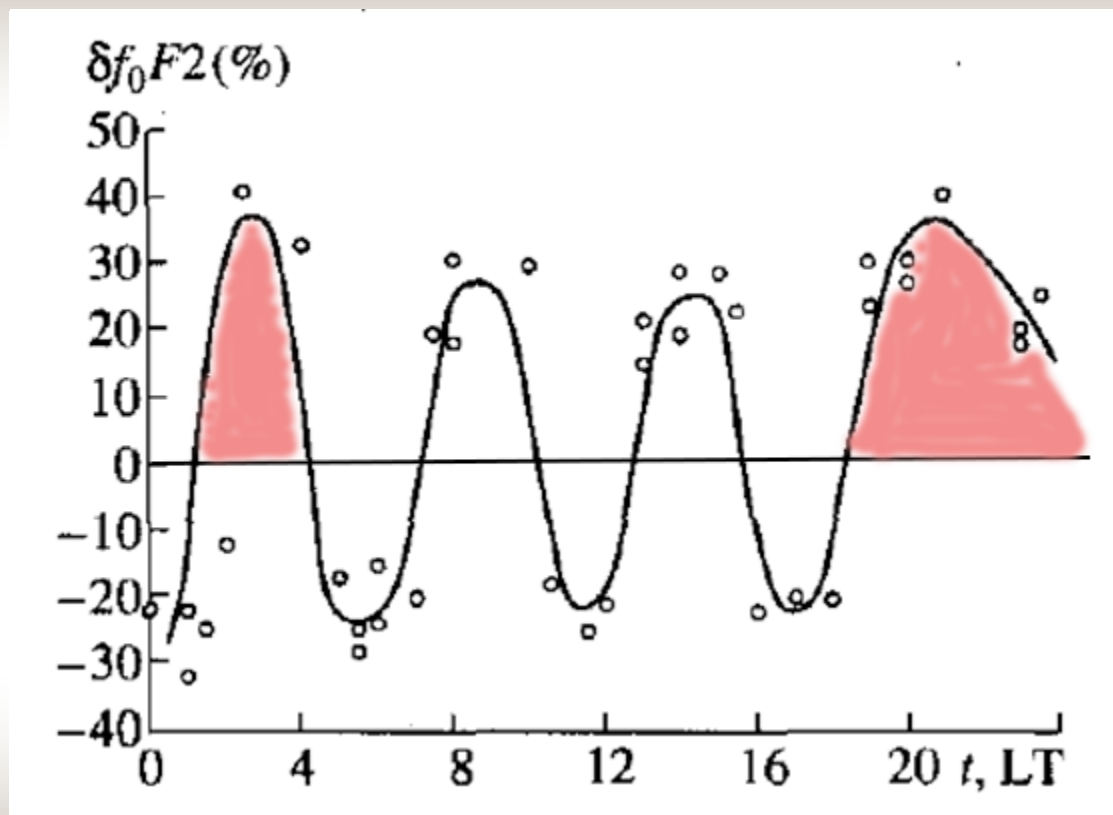
Interpretation of Napa mask

Van earthquake, M7.1, Turkey

Local-Time Dependence of Seismo-Ionospheric Variations at the *F*-Layer Maximum

S. A. Pulinets, A. D. Legen'ka, and T. I. Zelenova

Conclusions

✓ ABL pinned to the ground surface during night-time create conditions for large concentration of radon, large rate of ionization, large ion's concentration and formation of large surface negative charge

✓ All this creates the favorable conditions for the anomalous electric field penetration into ionosphere and formation of positive anomalies before earthquakes

✓ Effect stability permits to use it as a practical application for the short-term earthquake forecast