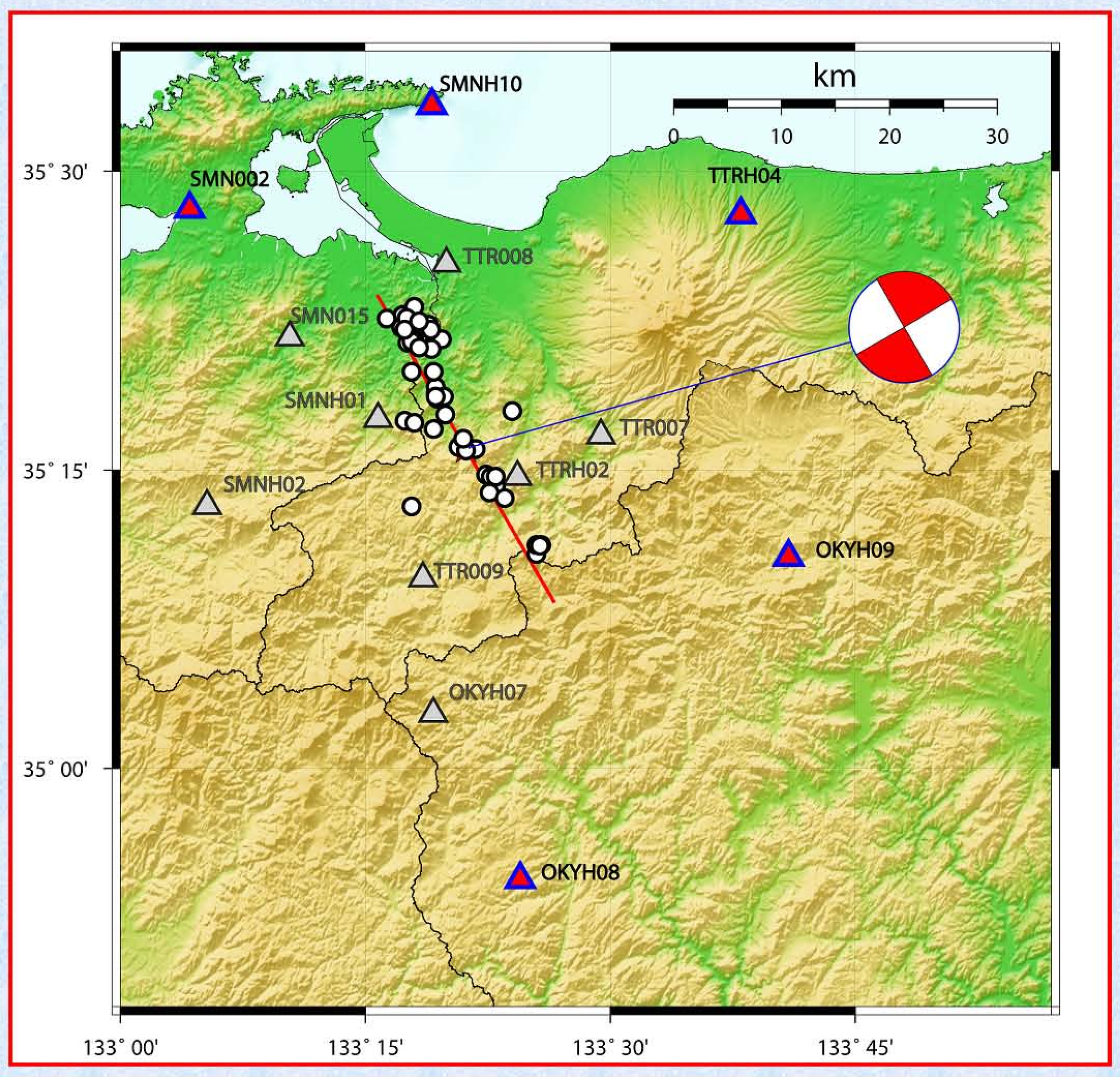
High Frequency Radiation of the 2000 Tottori earthquake (Japan)

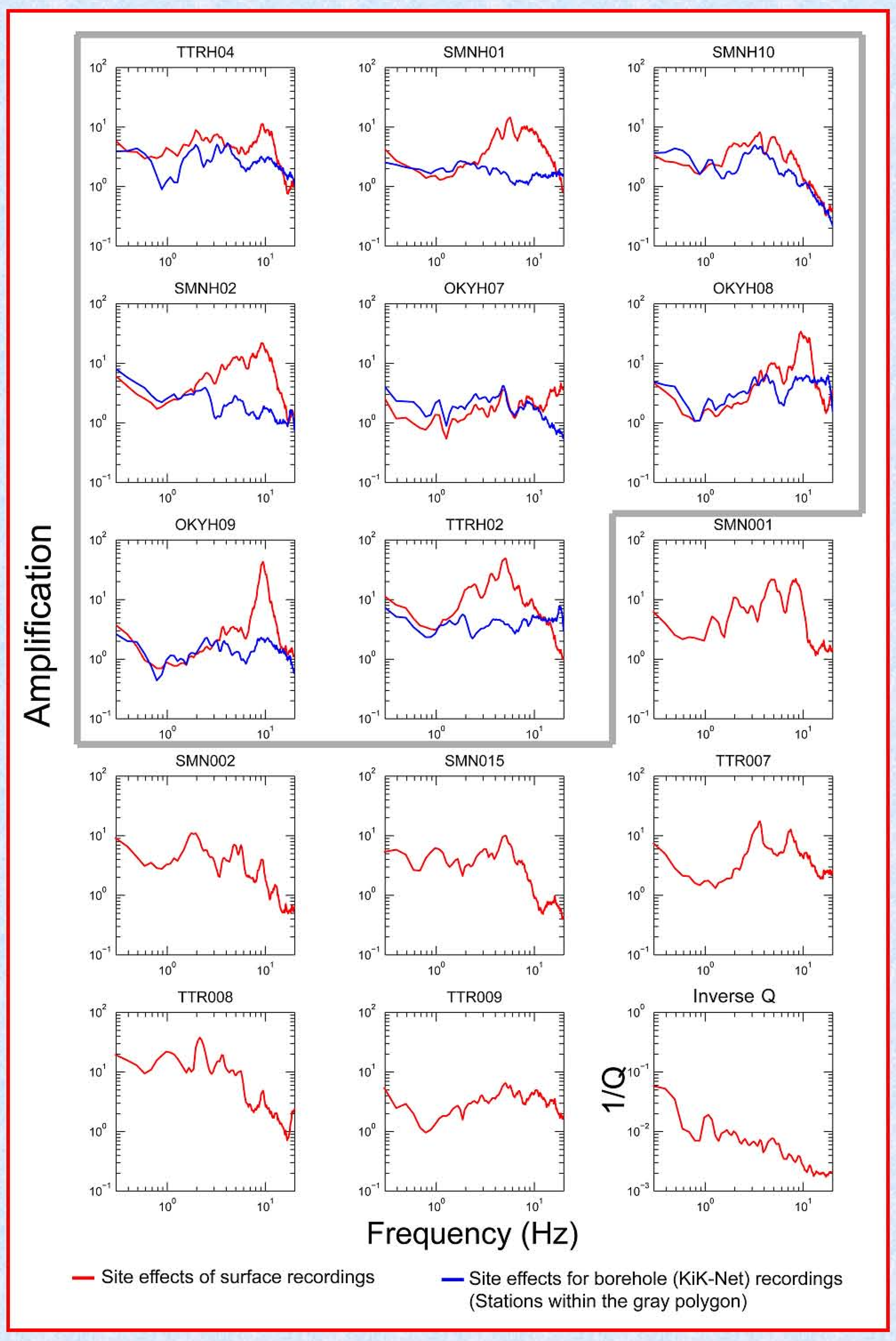
III Stations used for HF inversion



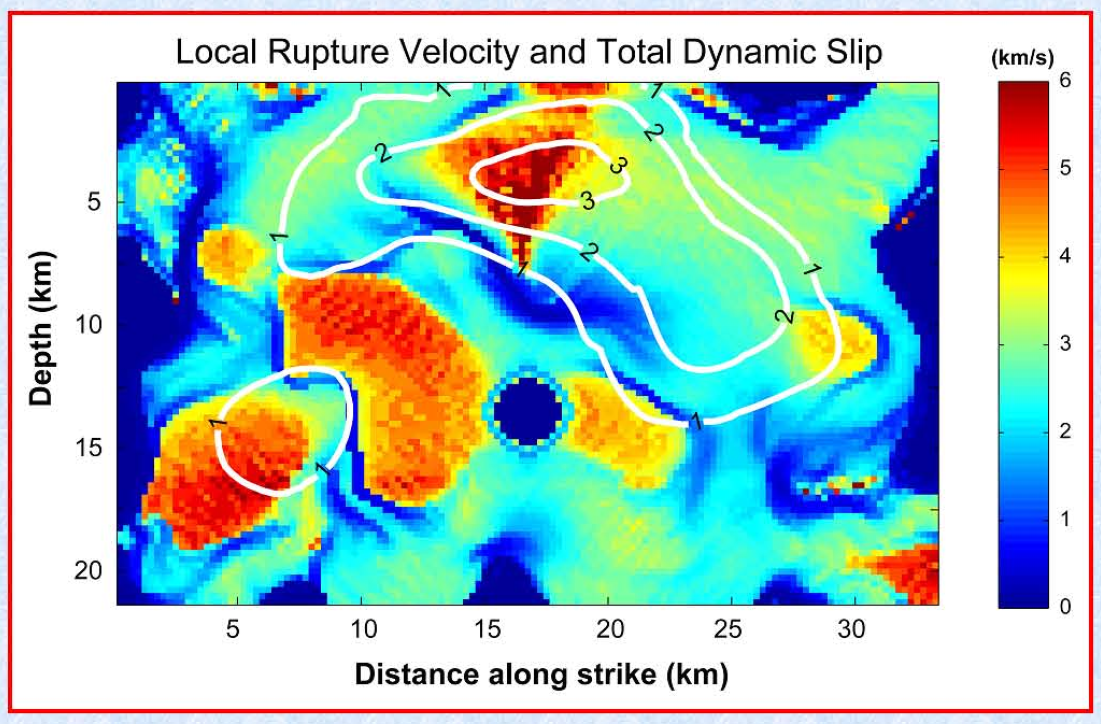
For the HF inversion we used only the sites in red because the nearest sites to the fault (in gray), might have non-linear effects.

Site effects were estimated at 14 K-Net and KiK-Net stations within 50 km from the epicenter of the Tottori earthquake. We applied the spectral inversion technique of Moya and Irikura (2003) to records from 55 aftershocks of the Tottori earthquake with magnitudes between 3 to 5 (810 horizontal components). We constrained the inversion by assuming an omega square model and seismic moment for 7 "reference events".

The figure to the left shows an important amplification at all the sites obtained from the inversion. The borehole sites from KiK-Net sites (blue lines) also show amplification.



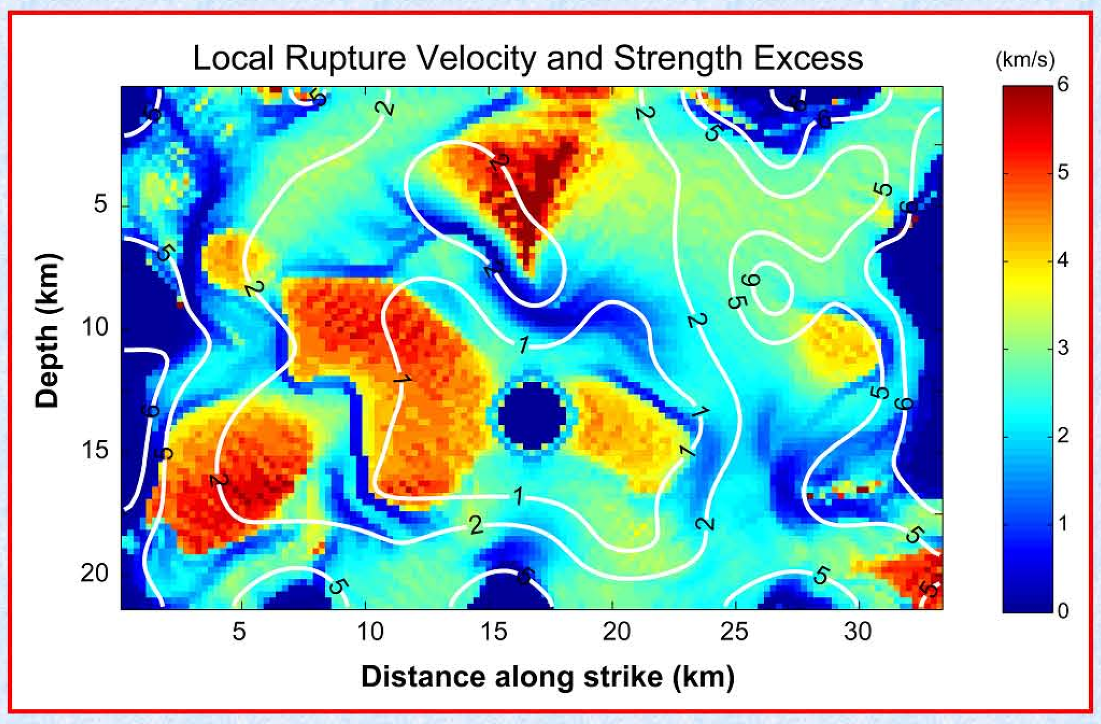
IV Local Rupture velocity distribution from dynamic model



White lines denote the total slip from dynamic model (in mts)

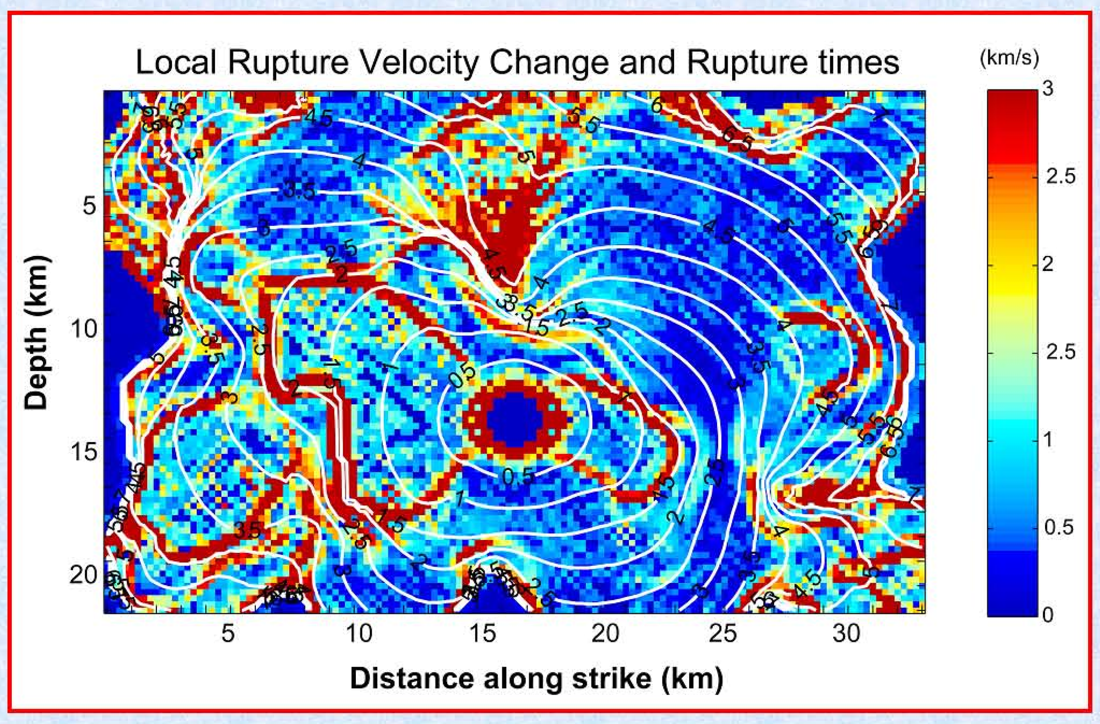
These panels show the calculation of the local rupture velocity obtained as the inverse of the gradient of rupture times from the dynamic model. They reveal a large heterogeneity of the rupture velocity across the fault plane.

In the left panel it is interesting to note that Vr is very unevenly distributed inside asperities. Large values of Vr look concentrated in small patches that seem triggered from very localized points. The right panel shows the local rupture velocity overlapped by the strength excess.



White lines denote the strength excess from dynamic model (in MPa).

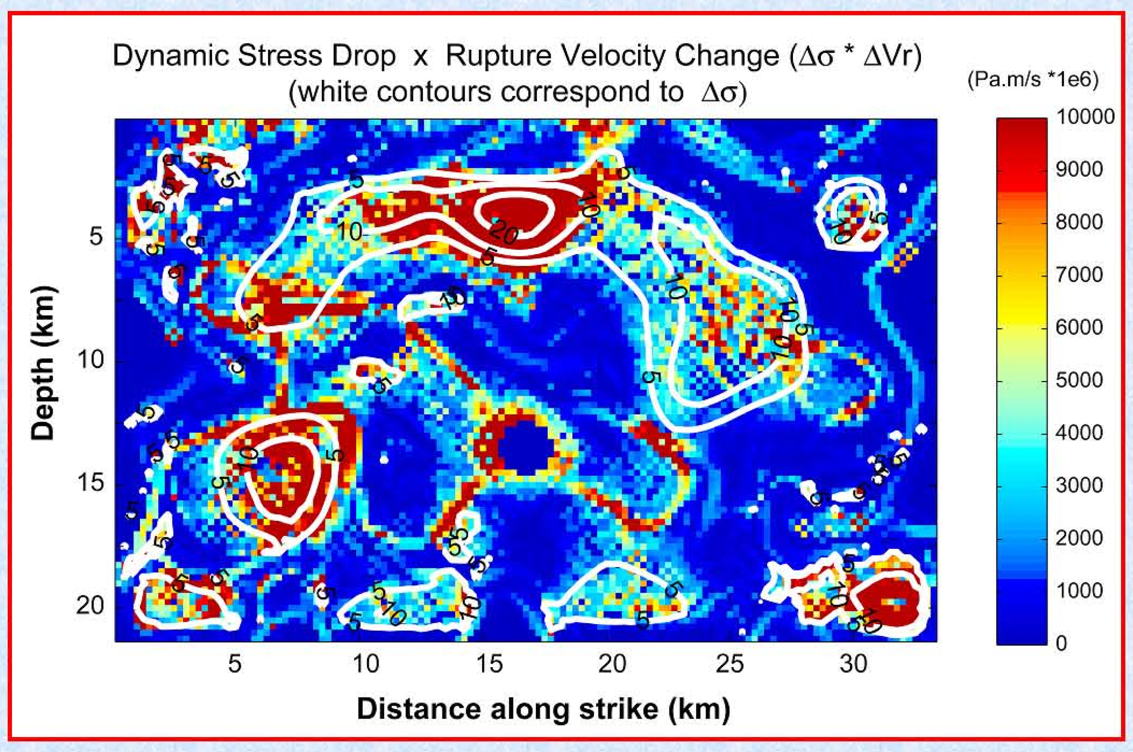
V Rupture velocity gradient from dynamic model



This picture shows the change in rupture velocity across the fault plane. We can observe that the largest slip region in the fault plane has a very strong rupture velocity gradient.

Rupture velocity also changes in narrow strips around high velocity areas within the fault plane, and also at the fault edges where the rupture stops.

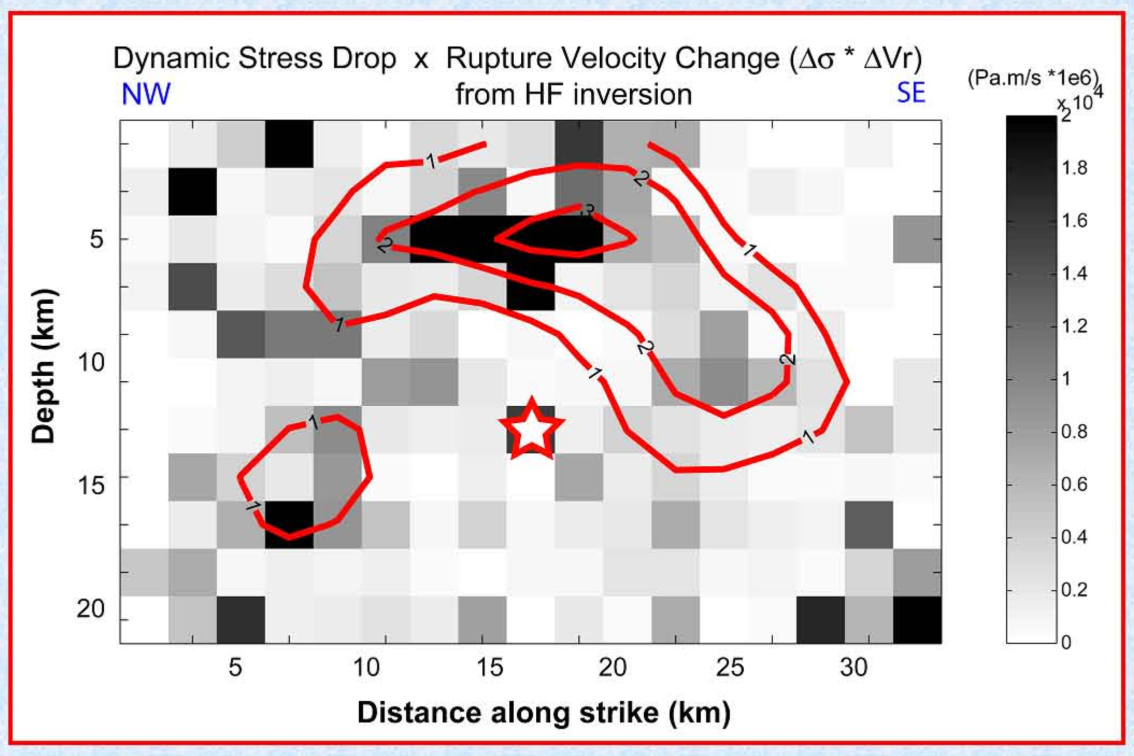
VI High Frequency radiation inferred from dynamic model



White lines correspond to dynamic stress drop

This picture shows the product of rupture velocity gradient with dynamic stress drop. It indicates the regions in the fault plane that contribute to the HF radiation as this product represents the flat level of radiated acceleration Fourier spectra. It is interesting to observe that the HF radiation is basically radiated from high stress drop regions with large velocity gradient.

VII Preliminary High Frequency radiation inferred from inversion of Near-Fault ground motion



This picture shows a preliminary result of the HF radiation from the source obtained by inversion of HF near-fault ground motion (gray shading). The red lines correspond to the total slip from dynamic model.

VIII Discussion

We have estimated the HF radiation from the source by using constrains from a dynamic fault rupture model. Results from the dynamic model as well as inversion of HF near fault ground motions suggest that the HF radiation from the source is originated from regions with a large dynamic stress drop and at the same time a large rupture velocity gradient. Regions in the fault plane with an uniform (smooth) rupture do not basically radiate HF, even if they have an important stress drop (like the region south-west from the hypocenter)