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Are methods of stress inversion appropriate when applied to fractal geometry objects?

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The stress inversion methods from slip-fault analysis and earthquakes focal mechanisms, already have a large number of works in very different tectonic settings. Nevertheless it is necessary to indicate that we have not advanced significantly in the analysis procedures during the last 20 years, and just from the beginning, this type of methodology has relied on numerous detractors. Also one can see a very typical process, from the investigative young man who begins to use the methods enthusiastically, until he becomes sceptical with the passage of time. Why does it happen?

We think that mostly it takes place for a few excessively mechanistic concepts and determinist use on an object, the faults, with a not Euclidean geometry. Under this perspective, we will try in this work to indicate the most suitable analysis strategies of stress inversion.

A) In the objects that show geometric statistical properties invariants in a wide scale ranges, as faults, there are neither more representative information, more suitable nor scales. Since the determination of stress tensors regimes (orientation and R value) stems from the orientation of the faults and its slides, it is of hoping that these show also a similar type of invariance. On having extrapolated the results of local measurement stations to the set of a chain or basin (path maps) we realize a scale change that it implies to very different "information windows". This change implies that the R distributions and *sy* orientations cannot be realists. What we will obtain is the *style* of the deformation and of the types of implied stresses (it is the same property that we apply, in a very practical way, to the construction of balanced cross sections). Thus it turns

out to be suitable, for example, to analyse all the information measured in a "tectonically homogeneous" zone (a chain, a basin) in a joint way. That is to say, to extract the tensors that explain the information set as if there should treat itself of only a single "measurement station". The stress tensorial solutions, obtained this way, will represent the typical tensors associated with the deformation of the analysed zone (style of deformation), which can be given in a wide scale ranges referred to fault sizes. What we will not be able to obtain is a spatial concrete distribution for every stress tensor type (R) (but probably of the distribution characteristics) except for a certain scale. If we extend or reduce the scale, the R distribution will change.

B) Other one of the emergent properties of the upper crust fault system refers to the deformation partitioning, so that in a wide range of scales pure structures predominate (pitch close to 90º or 0º) opposite to the oblique ones. This property is appreciated in active tectonics, very clearly in the limit types of major plates, but also in global earthquake focal mechanism populations. In transpresive or transtensive mapped areas it is very frequent the predominance of pure strike-slip and releasing and restraining steps opposite to strike-slip-reverse faults (or strike-slip-normal). It seems to be clear that there are hoped stress tensorial solutions of the inversion methods with a common *sy*, without this representing different deformation events, not even progressive changes of the value of R throughout the time. It is evident that, if on the same measurement station, mixed faults appear with high and low pitches; the solution average of the inversion will contribute to a shape factor (R), different from 1, 0.5, and 0, though the stress tensor adjustment errors will be worse than decomposing the solution in two pure tensors. Only with oblique slikenslides majority with slide senses very different from 0º and 90º, we should deduce stress tensors that produce a not planar deformation (triaxial), without partition.

C) But this emergent process of deformation partitioning implies also to mechanically incompatible stress tensors. One of the main problems that derive on considering, in the application conditions of the principal inversion methods, the number of possible movement planes as infinite. It is translated to a finite object (the faults of the upper crust) and, in last instance to the length invariance of the terrestrial diameter. It produces the appearance of a "conduced" kinematics that, frequently gives dynamically incompatible stress tensor solutions. In general, the movement of several faults can be considered like 1) dynamically compatible or 2) cinematically compatible. The inversion methods only consider the first case (deformation of an infinite object), whereas our experience shows us the presence, to all the scales, of both (deformation of a finite object). If it is true, it is hoped for the appearance of tensorial solutions, not only on individual stations, but especially in a joint analysis, dynamically incompatible. Nevertheless, our experience demonstrates also that these tensorial incompatible solutions use to be coaxial (permutations in the main stress axes character, keeping its orientations), implying to primary permutations of main axes (interchange of s_2 for s_1 or s_3), but specially to the secondary ones (interchange of s_1 for s_3). This criteria (coaxially of the stress tensorial, dynamically incompatible, solutions) should be applied to identify single deformation events.