Oral | Symbol S (Solid Earth Sciences) | S-CG Complex & General

[S-CG66_30AM1]Toward the integrated understanding of crustal deformation in plate convergence zones

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Wed. Apr 30, 2014 9:00 AM - 10:45 AM 414 (4F)

In plate convergence zones, crustal deformation, such as coseismic deformation, post-seismic movement, uplift of marine terraces, geomorphic evolution, and so on, have a wide range in its time scale. Since they are strongly related with each other, in this session, we aim to integrate the knowledge of seismology, geodesy, geomorphology and geology, in order to fully understand these phenomena.

10:30 AM - 10:45 AM

[SCG66-P03_PG]Self-affinities for Amplitude and Wavelength of Folds

3-min talk in an oral session

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Keywords:Fold, Self-affinity, Buckingham's Pi-theorem, Incomplete self-similarity theory

In general, many folds are apparently curved or jagged on a wide range of scales, so that their geometries appear to be similar when viewed at different magnifications. By Matsushita and Ouchi (1989a, b)'s method, we also analyzed the self-affinities of folds in the North Honshu Arc, Japan (Kikuchi et al., 2013). Based on this analysis, geometries were found to be self-affine and can be differently scaled in different directions. We recognize the self-affinities for the amplitude and the wavelength of folds and a crossover from local to global altitude (vertical) variation of the geometries of folds in the Northeast Honshu Arc. Buckingham's Pi-theorem is sufficient to the first problems of fold systems (Shimamoto, 1974). However, the complete similarity cannot give us the self-affinities of folds. A general renormalization-group argument is proposed to the applicability of the incomplete self-similarity theory (Barenblatt, 1979). Based on the general renormalization-group argument, we derive the self-affinities for the wavelength (L) and the amplitude (a) of folds: $L^{(1-d)} \propto a$.The relationship between Hurst exponents H of fold (Kikuchi et al., 2013) and d are equation: $1-d=H$,where H is index of the continuity of a given fold curve and obtained by the ratio between horizontal scaling exponent and vertical scaling exponent. d is an exponent of a given incomplete self-similarity theorem. In $d \neq 0$ case, the Hurst exponent $H \neq 1$ indicates self-affinities for the given fold curve. In this case, scale invariance of the fold might be affected by a variety of tectonic processes under the anisotropic stress field. In $d = 0$ particular case, the Hurst exponent $H = 1$ indicates self-similarity for the given fold curve. In this case, scale invariance of the fold might not be affected by a variety of tectonic processes under the

anisotropic stress field. These results imply that anisotropic stress fields by gravitation and tectonic stresses might cause self-affinities of folds. Self-similarity and self-affinities of the fold might be affected and by a variety of tectonic processes under the isotropy or anisotropic stress field.ReferenceBarenblatt, G.I. (1979)*Consultants Bureau*, New York.Kikuchi, K., K. Abiko, H. Nagahama, H. Kitazato, and J. Muto (2013) *Acta Geophysica*, **61**, 6, pp. 1642-1658.Matsushita, M. and S. Ouchi (1989a) *Physica D*, **38**, 1, pp. 246-251.Matsushita, M. and S. Ouchi (1989b) *Journal of the Physical Society of Japan*, **58**, 5, pp. 1489-1492.