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Predicting in-situ stress and thrusting sequences in accretionary wedges

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A two-parts procedure is proposed to determine the active thrust and the stress distribution in accretionary wedges. Validation is done with laboratory sand experiments, with force measurement and particule-image velocimetry to assess the thrust activity. The *first* part estimates the least upper bound on the tectonic force associated to the dominant mode of folding. The *second* part provides the optimum stress field, obtained by spatial discretisation, leading to the best lower bound on the tectonic force. The *first* and *second* parts are the external and internal approaches of limit analysis.
The *first* part is applied to predict the life span of a thrust within a supercritical wedge, from its onset, through its relief build-up, to its arrest because of the onset of a new, dominant thrust. This life span is sensitive to the friction angles over the ramp and the décollement. Continuing this construction leads to the prediction of a normal sequence ending with the first out-of sequence thrust. The *second* part shows that the active back thrust is a narrow fan which dip is sensitive to the friction angle over the ramp and the amount of relief build up. The stress state is dominated by the concentration at the root of the active ramp and the presence of the back thrust. The two parts of the procedure are applied to a section at the front of Nankaï's wedge, Southeast Japon, confirming the relative weakness of the basal décollement. From the *first* part, the active thrust is shown to be necessarily weaker than the incipient thrust and that the frontal section is likely to be inhomogeneous. The wedge is close to criticality and the *second* part shows the complexity of the incipient thrust which can occur at very different locations, controlled by minutes changes in the décollement friction and

stress concentrations generated by relief irregularities.