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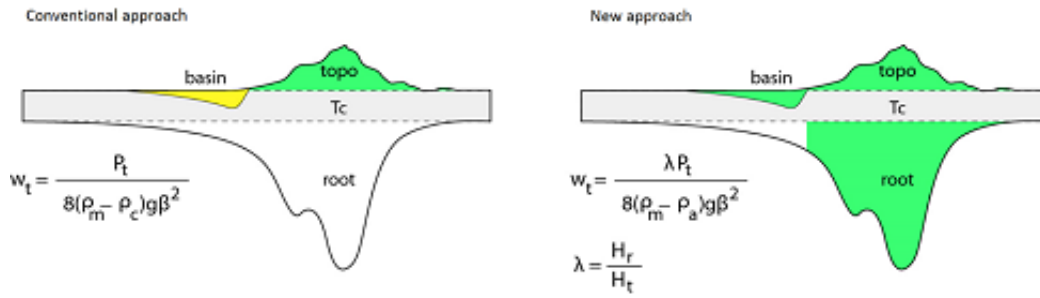


New Versus Conventional Approach for Modeling Flexure of Foreland Basins

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We constrain foreland basins geometry to assess the equivalent elastic thickness of the lithosphere and the loads that have originated due to the collisional process. Geometry of the foreland relates to the topography loading and hidden subsurface load based on simple 2D flexural models have been done for many foreland basins during 80 and 90s (for example for Zagros, Taiwan, and Colville foreland in Alaska) and most of them highlighted that present topographic and basin loads are not enough to provide such a deflection and extra buried loads are expected. Recent 3D flexure models using conventional approaches are used to estimate the elastic thickness of the lithosphere and may highlight a need for the buried loads. In the conventional approach, we apply topographic and basin loads and use the common assumption that the space created due to the deflection is filled with material of crustal density. This takes place in the deflection function by $\Delta\rho = \rho_{\text{mantle}} - \rho_{\text{crust}}$. The conventional approach thus includes the static subsurface load associated with the buoyancy of the crustal root. In the new approach, we assume that the deflection is filled with air $\Delta\rho = \rho_{\text{mantle}} - \rho_{\text{air}}$ and the sub-surface load is proportional to the topographic load. The load from topography and sub-surface loads is then simply λ times the topographic load. This approach allows accounting for quantifying all sub-surface loads correlated with topography, including the effect of the crustal root. In the new approach the Moho depth, representing the ratio between the root and topographic height, can be considered and the results give more clue about recognizing and quantifying buried load or mantle dynamics loads. With the new approach, we investigated Zagros, Taiwan, and Colville basin-Alaska foreland basins and obtained very precise models with less than 5% misfit between observations and predictions. Previous studies highlight that the buried loads are needed to obtain comparable results to the observations. However, our results show that the best models do not need extra buried loads with a reasonable ratio between topographic relief and crustal root using the new modeling approach.



Abbreviations: T_c , thickness of undeformed lithosphere; w_t , deflection due to topographic load; P_t , topographic load; ρ_m , density of Mantle; ρ_c , density of crust; ρ_a , density of air; g , gravity acceleration; β , flexural parameter; H_r , root thickness; H_t , topographic height, and λ , ratio between root thickness and topographic height.