Some generalizations of the Calabi-Yau theorem

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Let M be a compact n-dimensional Kähler manifold with the fundamental form ω. An upper semicontinuous function u on M is called ω-plurisubharmonic if $dd^c u + \omega \geq 0$. We look for ω-plurisubharmonic solutions u of the complex Monge-Ampère equation

$$(\omega + dd^c u)^n = f\omega^n,$$

where $f \in L^1(M), f \geq 0, \int_M f\omega^n = \int_M \omega^n$ is a given function. For smooth positive f the equation was solved by S.-T. Yau and it provided the proof of the famous Calabi conjecture. Since that time the equation has also been studied with weaker assumptions on the right hand side. In this talk we shall review the results concerning existence, stability and regularity of the solutions.