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We study compact operator equations with noisy data in Hilbert space. Instead of assuming that the error in the data converges strongly to 0, we only assume a type of weak convergence. Under the source conditions that are usually assumed in the presence of convex constraints, we derive optimal convergence rates for convexly constrained Phillips-Tikhonov regularization. We also discuss a version of the Lepskiĭ method for selecting the regularization parameter. (Received September 22, 2009)