Laboratory experiments on pulse current spreading from spherical electrodes and evolution of electrical breakdown of silica sand with different water contents under 15–20 kV pulse voltage have been performed. It is shown, that dramatic nonlinear decrease in pulse resistance of soil occurs when current density exceed a certain threshold value. Then ionization-overheating instability develops and leads to current contraction and plasma channels formation in soil. The method for determination of threshold electric field for ionization is proposed. It was found that electrical discharge in wet sand develops with significant delay time for long discharge gaps similar to thermal breakdown.