Numerical simulations of frontal cloud systems caused the heavy rain in the warm clouds and heavy snowfalls in the cold clouds were fulfilled. Three-dimensional nowacasting and forecasting numerical models for flat and complex reliefs developed in UHRI were adapted for theoretical interpretation of the investigated phenomena. Influences of relief, updrafts and downdrafts, intensity of mechanism of cloud and precipitation formation were the objects of numerical experiments. Series of numerical experiments to study the relative role of ice particle in the formation of heavy rain in mountainous areas of Ukraine (Carpathian and Crimea) in the warm clouds and heavy snowfall in southern Ukraine in the cold season were conducted. As an example results of numerical simulation of catastrophic rainfall in the Crimea in August-September 2002 and heavy snowfall in December 2009 will be present.

Numerical experiments have been carried out with different relationships between ice particles and drops. Relationships varied by including or excluding from calculations of different mechanism of cloud and precipitation formation. Series of numerical experiments have been carried out for estimating of probability to getting of heavy precipitation that caused dangerous flood in mountains and nearest regions. Research of the key parameters caused heavy precipitation had been conducted.

Experiments have shown that coagulation of large drop with small drops depicted best probability of getting up of dangerous precipitation in warm clouds. Under certain conditions heavy precipitation can be obtained through the mechanism of Findayzen-Bergeron. Probability of these precipitations was increasing if one mechanism has been dominated only. The existence of equilibrium between the clouds droplets and crystal precipitation formation mechanisms decreases probability of dangerous precipitation.