Floods in Greece: From Forecasting to Resilience
By I. Kardara

The recent intense rainfall and the alarming phenomena recorded in areas such as Pikrodafni urgently revive a critical question: Why does Greece continue to "drown" despite timely and often accurate meteorological forecasts? The answer, according to experts, lies in the fact that rainfall represents only half of the risk equation.

The Invisible Equation: "Attack" Factor vs. "Reception" Factor
As explained by Mr. Dimitris Emmanouloudis, Professor at the Democritus University of Thrace (DUTH), the occurrence of a flood event is always the result of two distinct factors. The first is rainfall (intensity, torrentiality, duration), which he characterizes as the "attack" factor. The second, and extremely decisive one, is the "reception" factor, namely the natural substrate that receives the water. "The magnitude and hazard of a flood are not determined solely by how much it rains," notes Mr. Emmanouloudis, "but by the way in which the waters move through space and time." This movement depends on a combination of soil-related factors: the type of soil, its morphology, existing vegetation, as well as its moisture levels at a given moment. In Greece today, a significant gap is observed: while agencies such as the Hellenic National Meteorological Service (HNMS) provide accurate information on the "attack" factor, there is a lack of data regarding the state of the substrate. "The same amount of rainfall can cause destruction in an area with saturated soil and pass unnoticed in another," the professor emphasizes, concluding that without knowledge of the substrate, hazard assessment remains incomplete.

"INACHOS": A Digital Safety Net
This is precisely the gap that the INACHOS flood risk forecasting system seeks to fill—an innovative operational model developed by the "ASSIST" Laboratory of DUTH. The system's operation is based on the synthesis of two levels of information: a stable "digital substrate" that includes geology and the historical record of 30,000 flood episodes in the country, and dynamic rainfall data that are continuously updated. By combining these elements, INACHOS processes in real time how rainfall is transformed into runoff, taking into account the current condition of the soil. Its value lies in its ability to provide realistic forecasts for the next 72 hours, translating meteorological data into hazard maps, while system capabilities for the urban environment are also at a pilot stage. According to Mr. Emmanouloudis, the adoption of such tools allows Civil Protection, Regions, and Municipalities to know not merely that "it will rain," but where and how dangerously a phenomenon is expected to manifest. In this way, the country's resilience is strengthened and response times are reduced, placing Greece on the European map of digital climate-risk prevention.

However, forecasting is only the first step. The real test of the system's and infrastructures' resilience takes place in large urban centers, with Attica constituting the most complex challenge.

Attica Under the Microscope: Why Does the Basin "Suffocate"?
If forecasting represents the first step of defense, the reality of Attica's urban fabric is what determines the final outcome of the battle with the forces of nature. The recent incident in Pikrodafni, which alarmed citizens, was not an isolated failure but a symptom of a deeper problem. As Hydrologist Dr. Elissavet Feloni points out, the problem in Attica is structural and long-standing. Its root lies in the gap between existing infrastructure and contemporary

climatic reality. Flood-control conduits were designed based on data from past decades; as a result, today—under the pressure of rainfall of extreme intensity—they are unable to "receive" the volume of water. It is characteristic, as she notes, that flood phenomena now occur even during rainfall considered ordinary, with an "extremely short return period" (as little as 2 or 5 years). The situation is exacerbated by the way the basin historically developed, leaving no "space for streams." Extensive concretization has nullified the soil's natural capacity to absorb water, turning streets into torrential flows.

The Threat from the Mountains and the Need for "Mobilization"

The mountainous massifs surrounding Attica also play a critical role in the equation. Ms. Feloni emphasizes that repeated forest fires have weakened the natural defense of these areas. A burned forest loses its retention capacity, allowing water to rush toward inhabited areas at tremendous speed and carrying large quantities of sediment. For this reason, the stewardship of mountainous areas and interventions to retain flow constitute an integral part of any serious flood-mitigation planning.

What, then, are the solutions for a region as densely populated as Athens? Ms. Feloni notes that a "mobilization" of interventions at multiple levels is required. This includes large-scale works on main collectors and targeted care for mountainous areas, as well as green interventions within cities, where Municipalities must be supported to promote small-scale solutions, such as the use of permeable materials and the creation of sustainable stormwater management systems in public spaces that will function as pressure-release valves. And, of course, systematic monitoring, as one of the greatest "thorny issues" remains the lack of long-term data. Dr. Feloni proposes investing in dense sensor networks and establishing an open-access "Stream Observatory." Continuous monitoring and public awareness are as important as technical works. "The combination of technological infrastructure, systematic observations, and advanced systems such as INACHOS provides us with the tools to issue timely and accurate warnings," concludes Dr. Feloni. However, she clarifies that technology is the compass, but the design of public space and the protection of the natural environment are what will determine whether the next downpour will remain merely a rain or turn into a disaster.