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HEAVY PRECIPITATION EVENT IN ROMANIA ON 6-9 OCTOBER 2025: ANALYSIS OF KEY SYNOPTIC CONDITIONS

Abstract. Recently, climate change has led to the intensification of heavy precipitation, often responsible for flash floods. The impact of these hydrological events has been observed at both global and regional scales. In recent years, Romania has experienced some several extreme precipitation events, such as the one recorded in the period 28–31 August 2024, when at the Mangalia weather station, a record of 325.7 mm of rainfall quantities was registered. Another event with huge amounts of precipitation occurred the following year, between 6 and 9 October 2025, when the passage of a Mediterranean cyclone led to substantial cumulative precipitation, especially in the southeastern part of Romania. The purpose of this study is to identify the synoptic context which made this hydro-meteorological event possible. The southeastern part of Romania is normally characterized by low annual precipitation quantities (generally less than 500-600 mm/year), but there are some exceptions when Mediterranean cyclones successively cross the mentioned area or when they reach the Black Sea, following a retrograde trajectory.

Keywords: heavy precipitation, specific synoptic contexts, „Barbara” Mediterranean cyclone, southeastern Romania

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Introduction

In the past century, climate change has led to an intensification of hazardous weather phenomena, which involve severe hydrological events, such as flash-floods (Constantin et al., 2024; Ilea et al., 2025). These usually occur at a local scale, but can be observed anywhere in the world, having a significant socio-economic impact (Constantin et al., 2022).

In the history of meteorological measurements in Romania, extreme precipitations have been registered both in short time intervals and by accumulation (Dragotă, 2006; Croitoru et al., 2016). A recent example in this regard can be represented by the value of 325.7 mm recorded in the period 28-31 August 2024, at Mangalia weather station (southeastern part of Romania, on the Black Sea coast) (Ilea et al., 2025). A similar situation occurred between 6 and 9 October 2025, when Mediterranean cyclone „Barbara” (named by the Italian Meteorological Service) produced very large quantities of water, yet this time these were recorded through accumulation, not in short intervals of time. The southeastern region of Romania is typically characterized by low annual precipitation, generally less than 500-600 mm/year. On the other hand, when Mediterranean cyclones successively traverse this part of the country or when they reach the Black Sea, loading with moisture and taking a retrograde trajectory, significant amounts of precipitation can be recorded in short periods of time (Tolika et al., 2024).

The purpose of this study is to identify the synoptic context that made such hydro-meteorological event possible. The respective analysis was carried out for the period 6-9 October 2025, in order to better understand the mechanism that produced the large amounts of precipitation, registered especially at Giurgiu (210.5 mm), Hârşova (125.4 mm), Constanţa-dig (120.2 mm) and Feteşti (118.6 mm) weather stations.

Materials and methods

As already mentioned, the synoptic analysis was carried out for the period 6-9 October 2025. It is mainly based on synoptic maps (ECMWF, COSMO and ICON forecast models) at the surface and different tropospheric

levels (850 hPa, 700 hPa and 500 hPa). These maps provide information on air temperature, atmospheric pressure, geopotential height and relative humidity (Deutscher Wetterdienst, 2026) across the European continent and the amount of precipitation in Romania (Romania's National Meteorological Administration – NMA, 2025). Moreover, daily precipitation data recorded at ten weather stations (WS), being representative for the study area and belonging to NMA were used. The selected WS were: Giurgiu, București-Băneasa, București-Filaret, București-Afumați, Oltenița, Slobozia, Grivița, Fetești, Hârșova and Constanța-dig (Constanța-dam) (Fig. 1). These data were also used to calculate the total precipitation over the entire analyzed period.

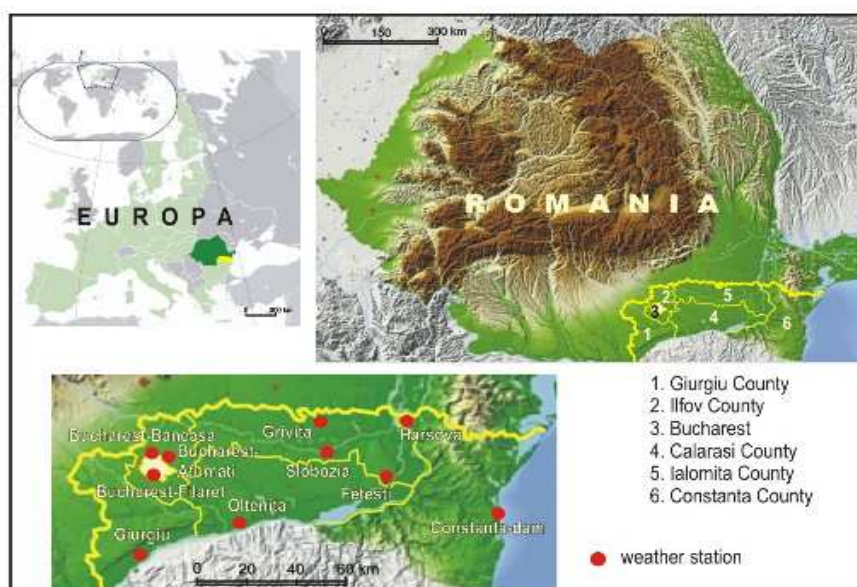


Fig. 1. The location of the study area and of the analyzed weather stations
(Source: open source processing GIS, 2026)

Moreover, on 7th October 2025, NMA issued a red code weather warning for heavy rain, especially for the southeastern regions of Romania, including the following counties: Giurgiu (GR), Ilfov (IF), Ialomița (IL), Călărași (CL), Constanța (CT) and the city of Bucharest (B). In addition, other counties in the southern and eastern part of Romania were included in an orange code weather warning (Fig. 2).

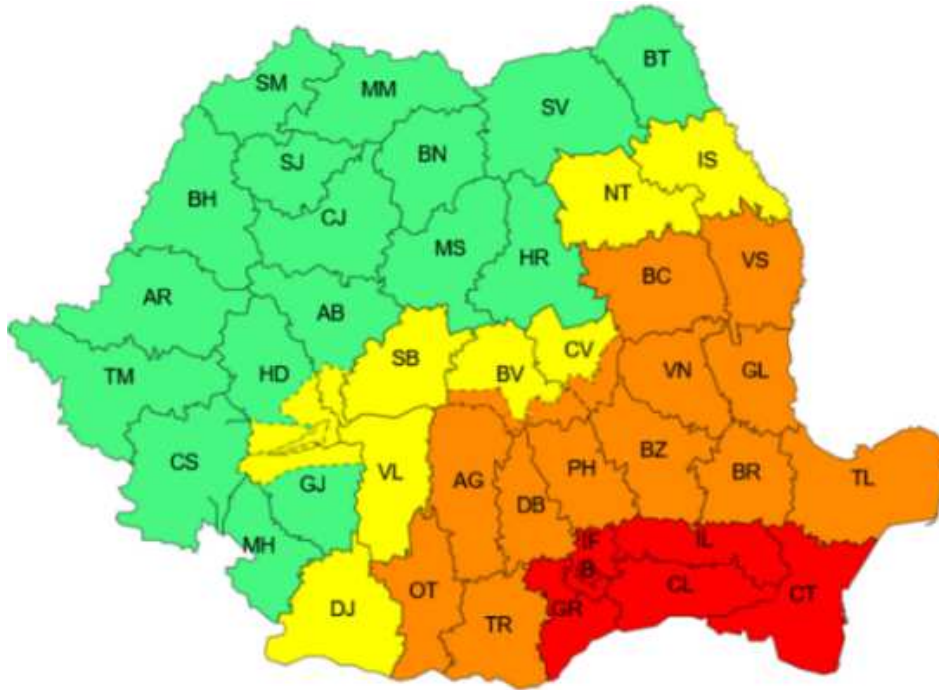
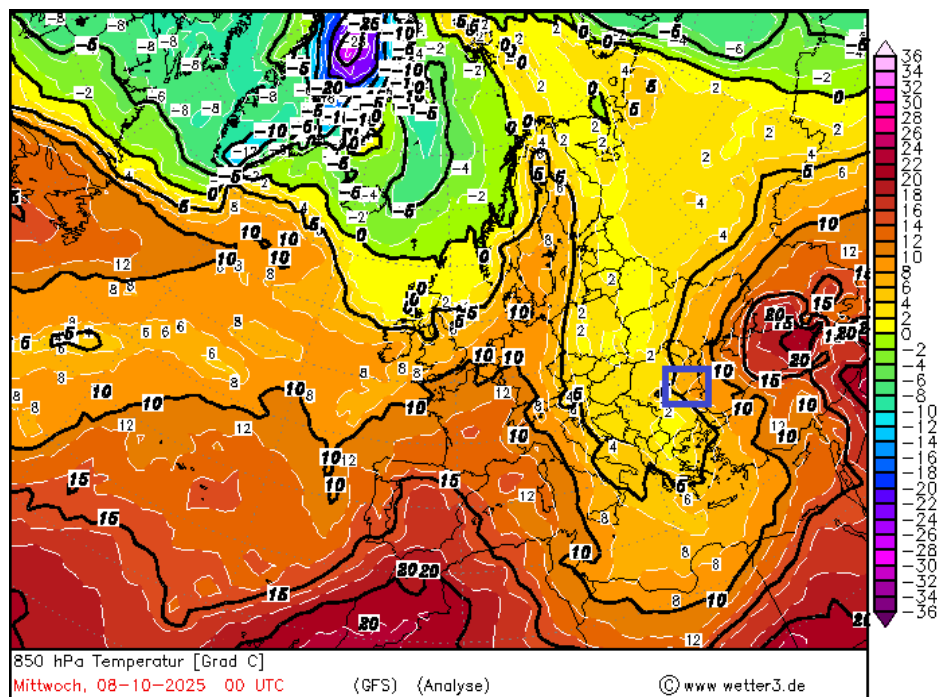
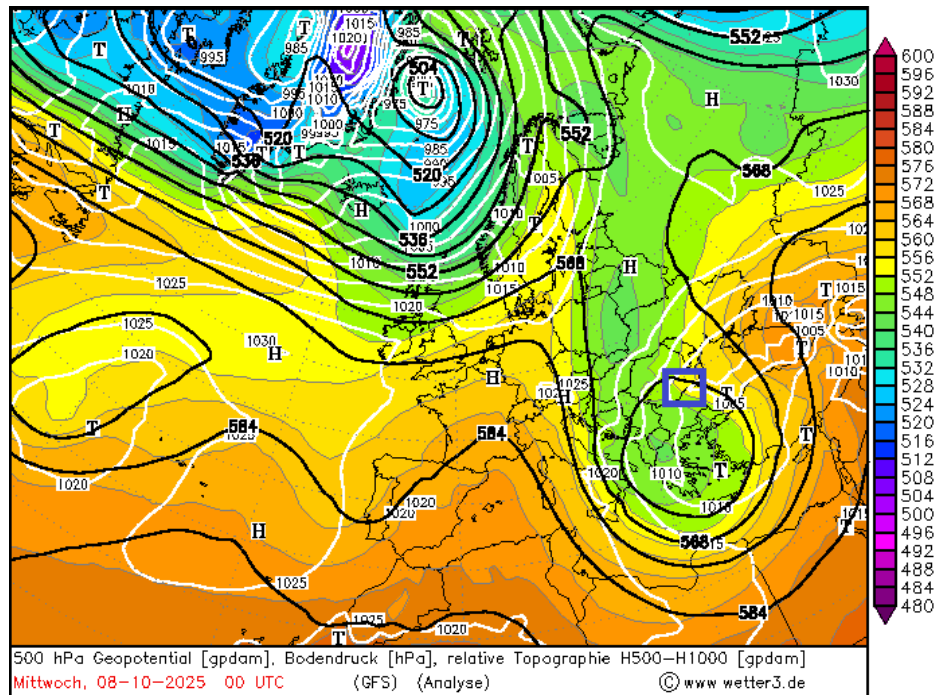


Fig. 2. The weather warning map issued by NMA on 7th October 2025. Note: green – not risk, yellow – potentially dangerous, orange – dangerous and red – very dangerous
(Source: NMA, 2025)

Results and discussion

On 7th October 2025, the occluded front associated with the Mediterranean cyclone „Barbara” became dominant, affecting the south and southeast of Romania, where significant amounts of precipitation and strong wind gusts were recorded. The synoptic circulation favored the additional supply of moisture from the Black Sea, maintaining high convective activity in Dobrogea and the southeastern Romanian Plain.

Between 8 and 9 October 2025, the depression system moved towards the northern Black Sea, simultaneously with the weakening of the baric field (1010 hPa) and the frontal activity over southeastern part of Romania (Fig. 3).



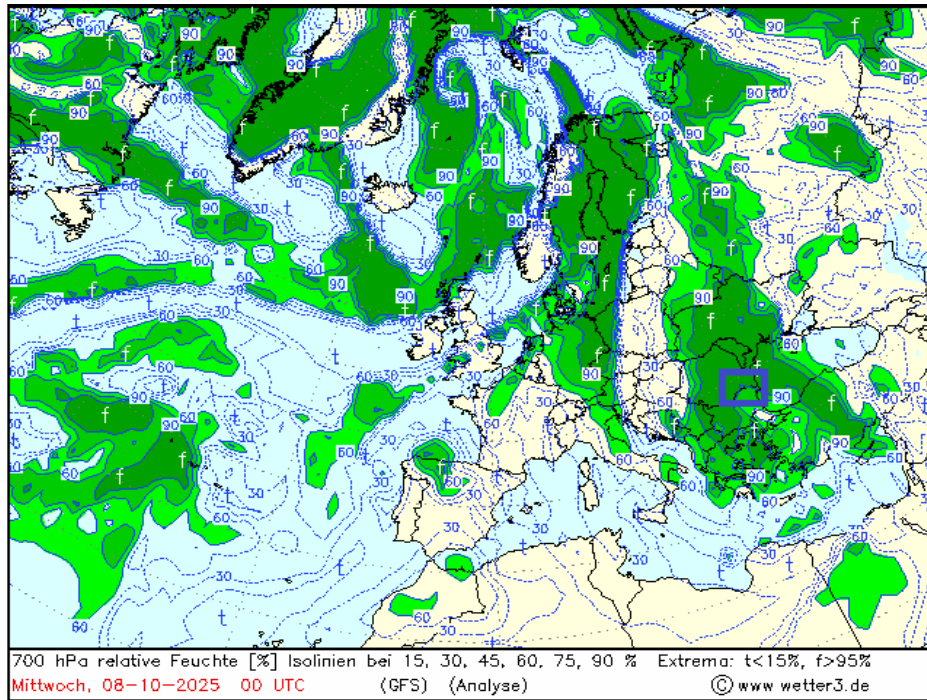


Fig. 3. The 500 hPa geopotential (black lines), the surface atmospheric pressure (white lines) and the thickness of the 500-1000 hPa layer (gpdam) (above); the 850 hPa temperature (middle); the 700 hPa relative humidity (below); GFS model, 08.10.2025, 00 UTC.

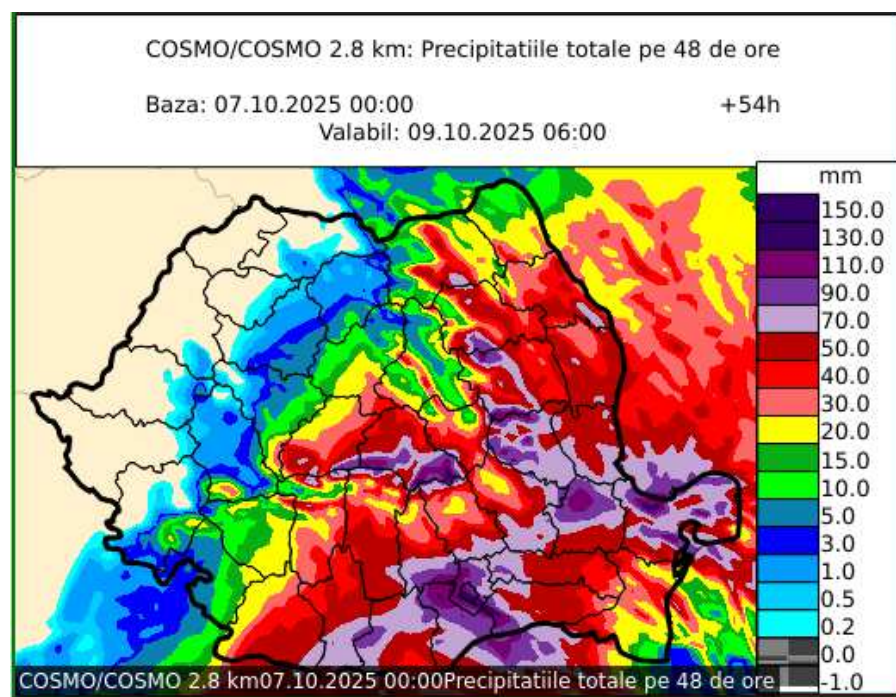
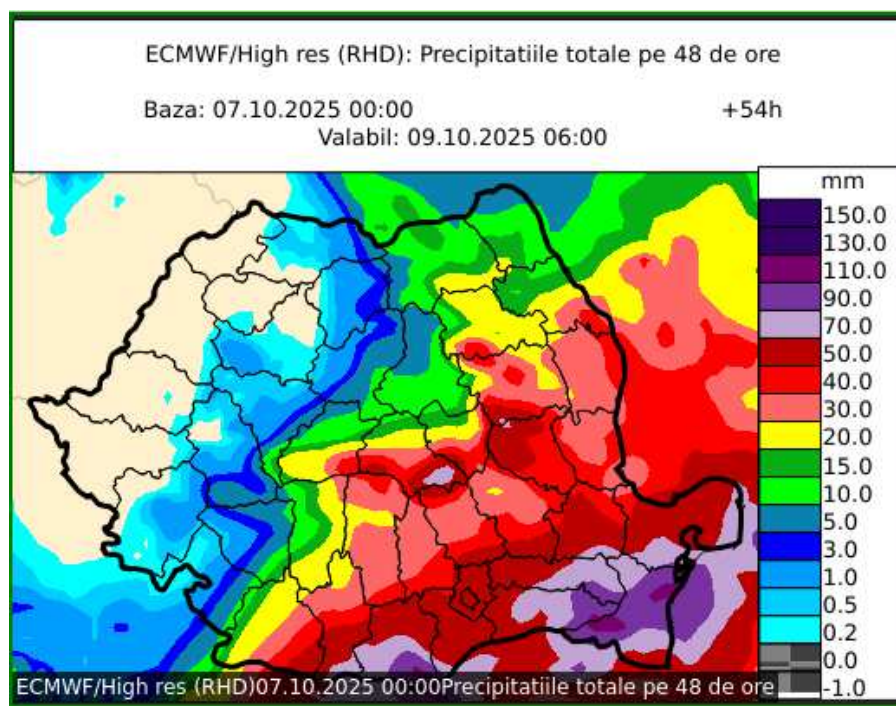
Note: study area is highlighted by a blue border

(Source: https://www.wetter3.de/archiv_gfs_dt.html, accessed on 28th January 2026)

In the middle troposphere (500 hPa) a cold core can be identified over the southern part of Romania, with a geopotential height of 560 gpdam. Moreover, the temperature at 850 hPa was around only 3°C and the relative humidity at 700 hPa exceeded 90%.

The synoptic evolution of the cyclone indicated a classic pattern of Mediterranean cyclogenesis with trans-Balkan trajectory, characterized by well-structured atmospheric fronts, consistent moisture supply and a significant pluviometric impact on the countries of southeastern Europe.

All forecast models predicted high amounts of precipitation (over 90 mm within 48 hours) but the area with the highest quantities was different in the case of the ECMWF model, which indicated these amounts in Constanța, eastern Călărași and Ialomița counties. On the other hand, COSMO and ICON models indicated substantial cumulative precipitation in Giurgiu, Ilfov and western Călărași counties, but also in the city of Bucharest (Fig. 4).



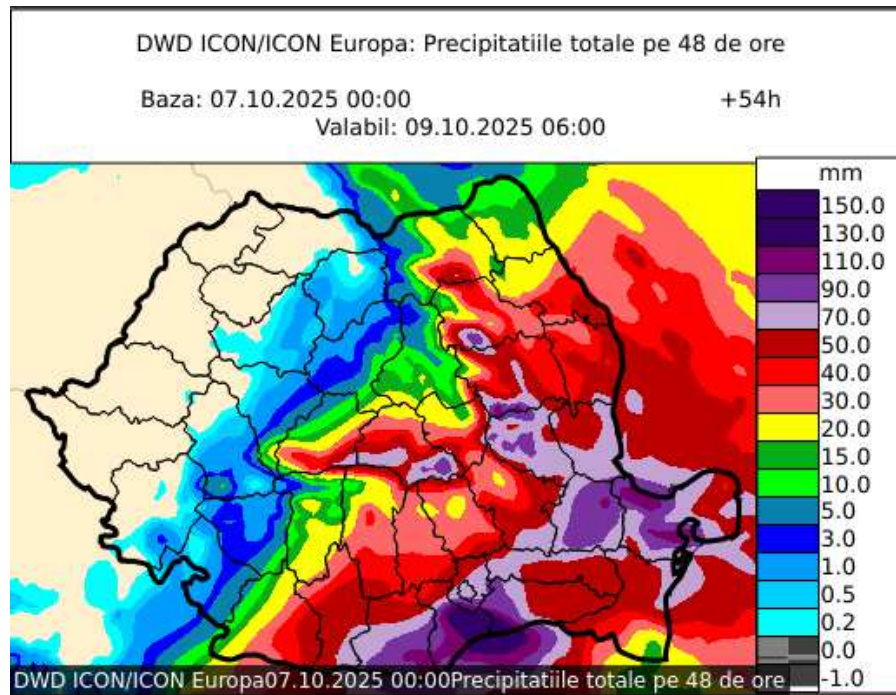


Fig. 4. The amount of precipitation forecasted in Romania between 7-9 October 2025, by the models ECMWF (above) COSMO (middle) and ICON (below) on 07.10.2025, 00 UTC
(Source: NMA, 2025)

The recorded precipitation amounts ranged between 77.7 mm at București-Băneasa and 210.5 mm at Giurgiu weather stations (WS). Due to the slow movement of cyclone „Barbara”, the southeastern part of Romania received the largest rainfall totals during the analyzed period. Other notable precipitation quantities were recorded at Hârșova (125.4 mm), Constanța-dig (120.2 mm), Fetești (118.6 mm), Oltenița (115.5 mm) and Slobozia (100.2 mm) (Table 1), justifying the previously issued red code weather warning. In Bucharest city there were registered 84 mm at București-Filaret WS, 77.8 mm at București-Afumați WS, and 77.7 mm at București-Băneasa WS.

It should be noted that the multi-year average precipitation (1961-2024) in October for the study region is only 31-50 mm.

Table 1

Daily and total precipitation amounts (mm) recorded between 6-9 October 2025 at the weather stations analyzed in the study area

WS / Day	06-07.10	07-08.10	08-09.10	06-09.10
Giurgiu	14.3	117.3	78.9	210.5
București-Băneasa	3.2	49.8	24.7	77.7
București-Filaret	4.7	52.5	26.8	84.0
București-Afumați	6.3	49.1	22.4	77.8
Oltenița	12.4	70.9	32.2	115.5
Slobozia	6.1	58.6	35.6	100.2
Grivița	7.6	57.6	31.9	97.1
Fetești	10.3	75.1	33.1	118.6
Hârșova	9.6	78	37.8	125.4
Constanța-dig	4.4	100.2	15.6	120.2

Source: National Meteorological Administration (NMA), 2025.

Conclusions

One of the most severe hydro-meteorological events recorded in southern and southeastern Romania occurred between 6-9 October 2025. Thus, large amounts of precipitation that should have normally been recorded in more than six months were registered in a relatively short period of time. However, the hydrological effects were not significant, as the recorded values were distributed over several days instead of a single episode.

The Mediterranean cyclone, named by the Italian Meteorological Service "Barbara" formed on 5th October 2025, over the Ionian Sea, as a result of the interaction between warm and humid air above the Mediterranean Sea and an extensive area of cold air in the middle troposphere (500 hPa), located over central and eastern Europe.

The run of the ECMWF, COSMO and ICON models (from 7th October 2025, 00 UTC) showed significant differences regarding the location of the highest possible amounts of precipitation, but all of them highlighted that the most susceptible area would be the southeastern part of Romania, lying exactly within the counties included in the red code weather warning issued by Romania's National Meteorological Administration (NMA) on the morning of the respective day.

The largest quantities were registered in Giurgiu, Constanța, Ialomița and Călărași counties, being the most affected by the heavy precipitation event in the period between 6-9 October 2025.

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