

DRIHM

DISTRIBUTED RESEARCH INFRASTRUCTURE
FOR HYDRO-METEOROLOGY

the uncertainty

DRIHM e-infrastructure for Civil Protection and Disaster Risk Reduction

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e-infrastructure

*DRIHM is co-funded by the EC
under the 7th Framework Programme*



POLITÉCNICA

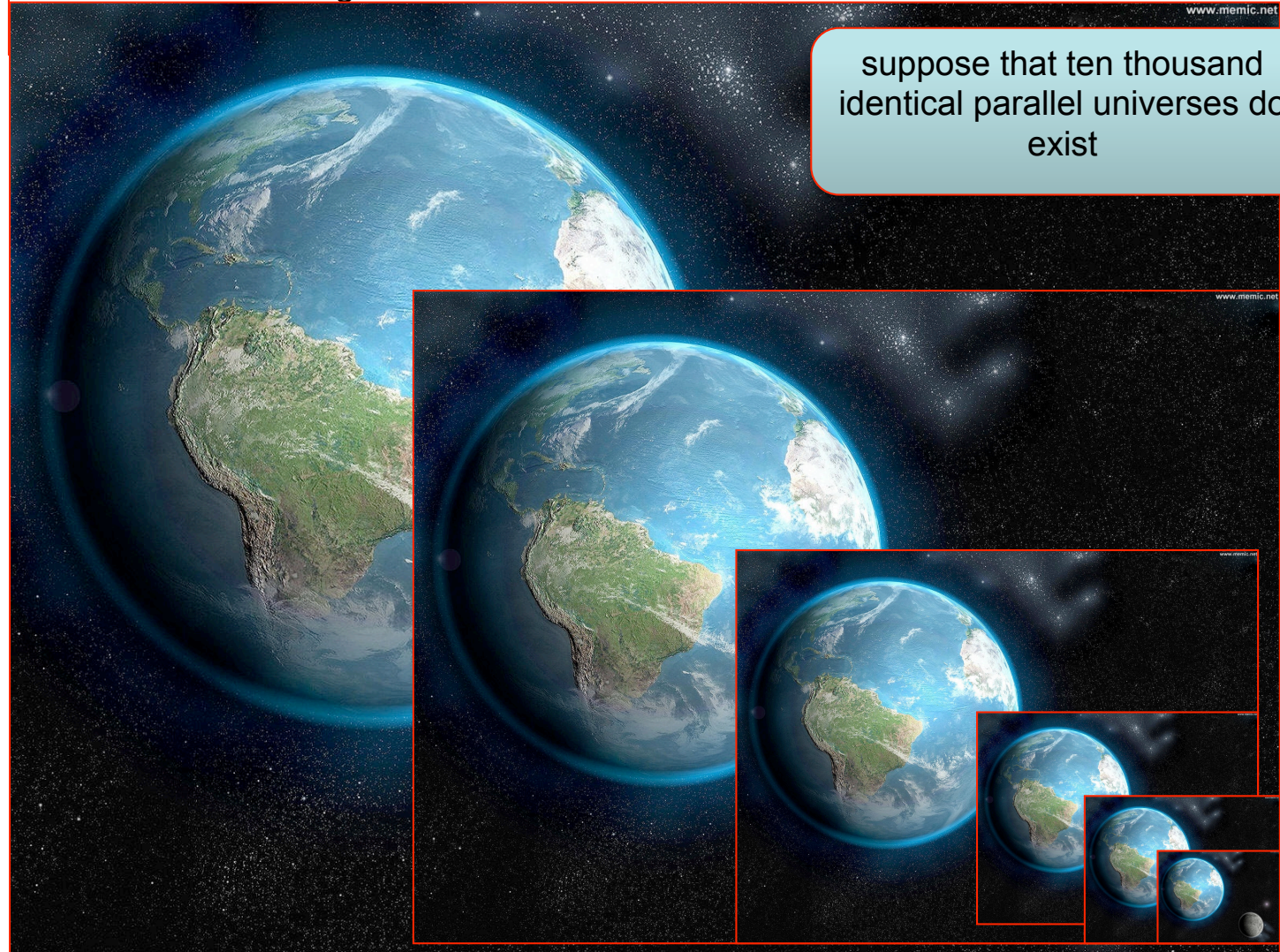


advancing the frontiers





The tale I'm telling you was presented in october 2011 in Rome to an audience of lawyers, journalists and Civil Protection people in order to clarify the social relevance of the uncertainty in the hydrometeorological predictions. I avoided there to use the word "probability", and I did substitute the concept with "ten thousand identical parallel universes". Obviously we don't know before the event what's the universe we are living in.







the stream

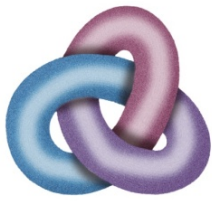
the soccer stadium

the stream covered

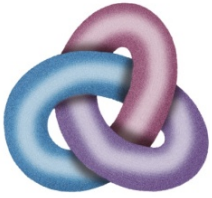
the stream mouth

with ten thousand identical cities of
Genoa with the same urban planning
developed in the same way



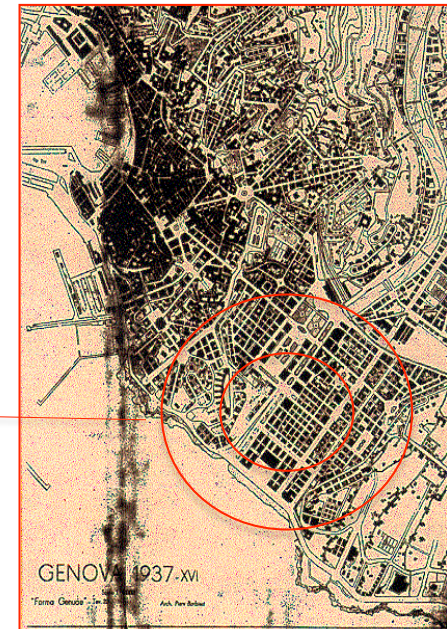
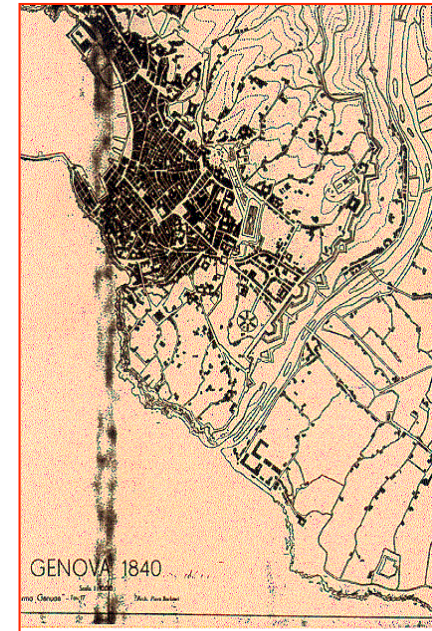
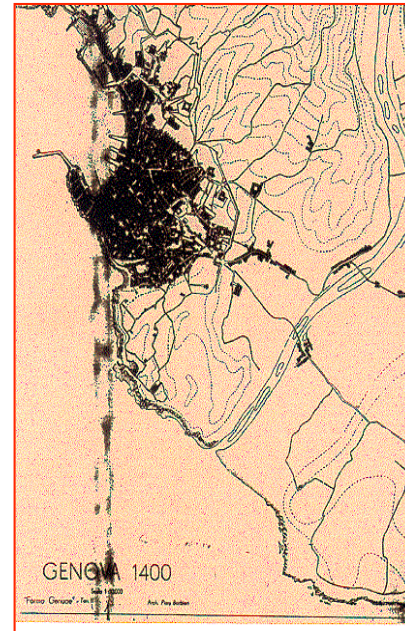


with ten thousand identical streams covered by an entire monumental district designed by the archistar of the fascist period



the urban development from
1400 to 1937, five years
after the stream was
covered

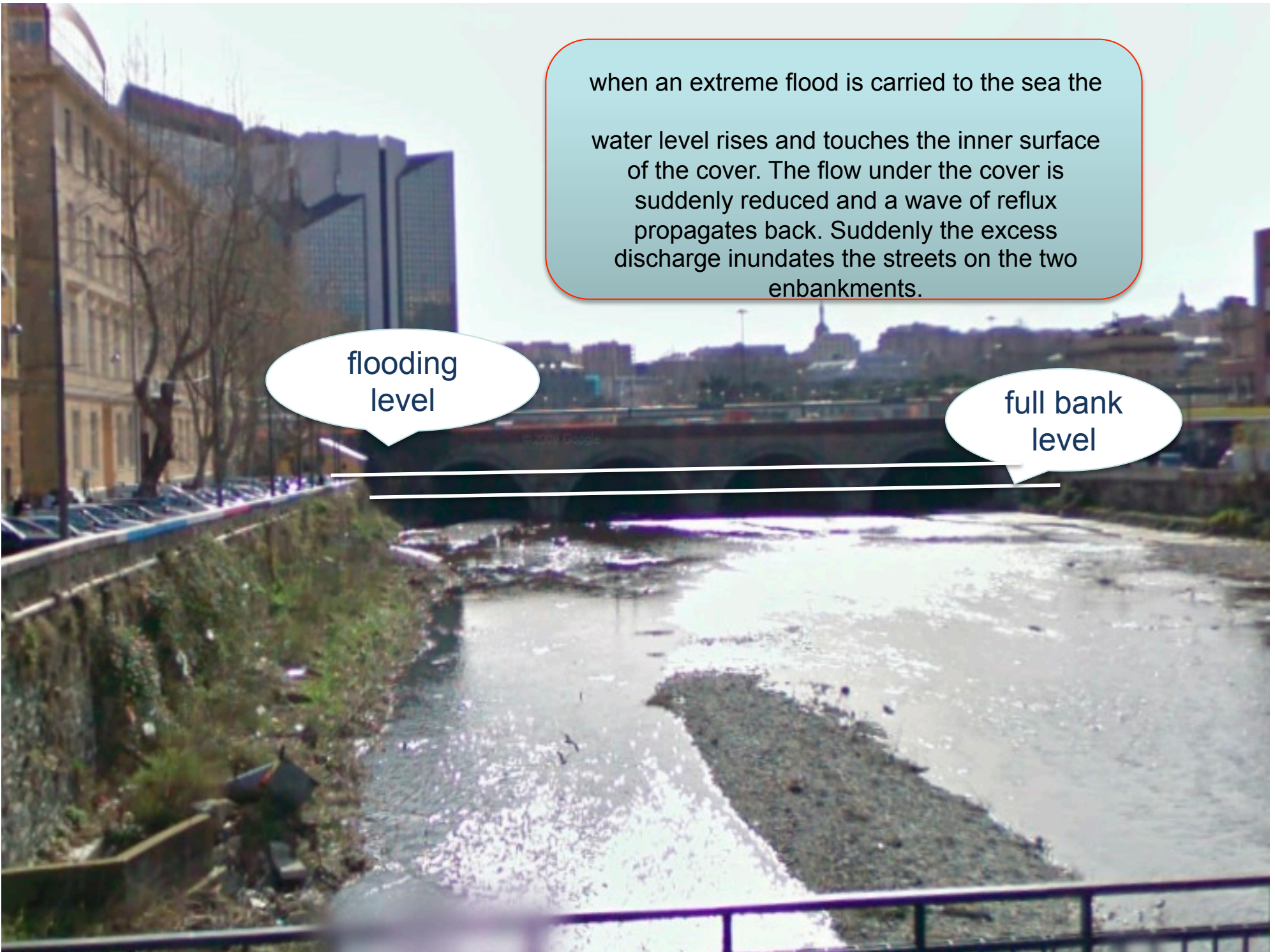
the event theater



when an extreme flood is carried to the sea the water level rises and touches the inner surface of the cover. The flow under the cover is suddenly reduced and a wave of reflux propagates back. Suddenly the excess discharge inundates the streets on the two embankments.

flooding level

full bank level

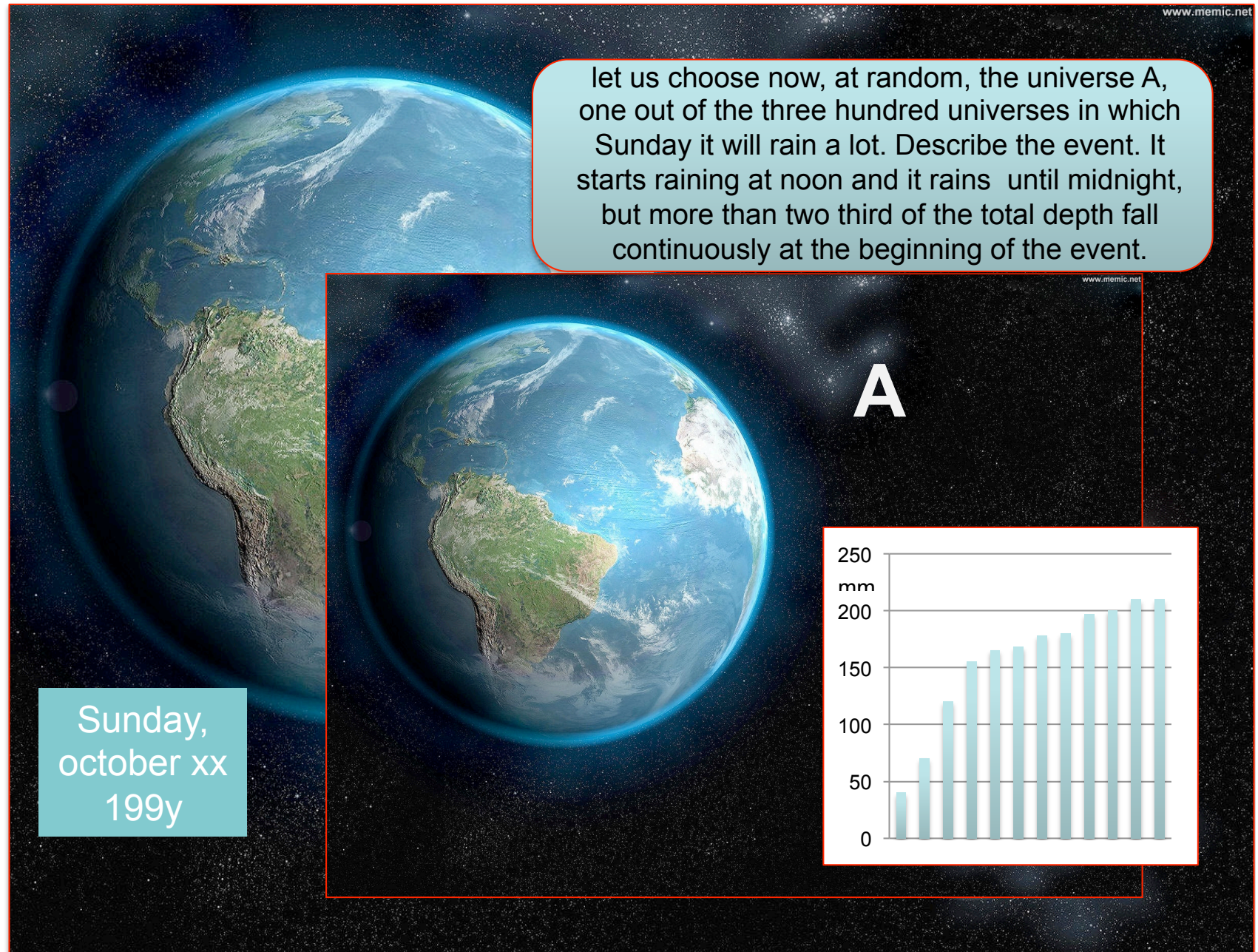
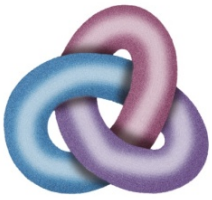


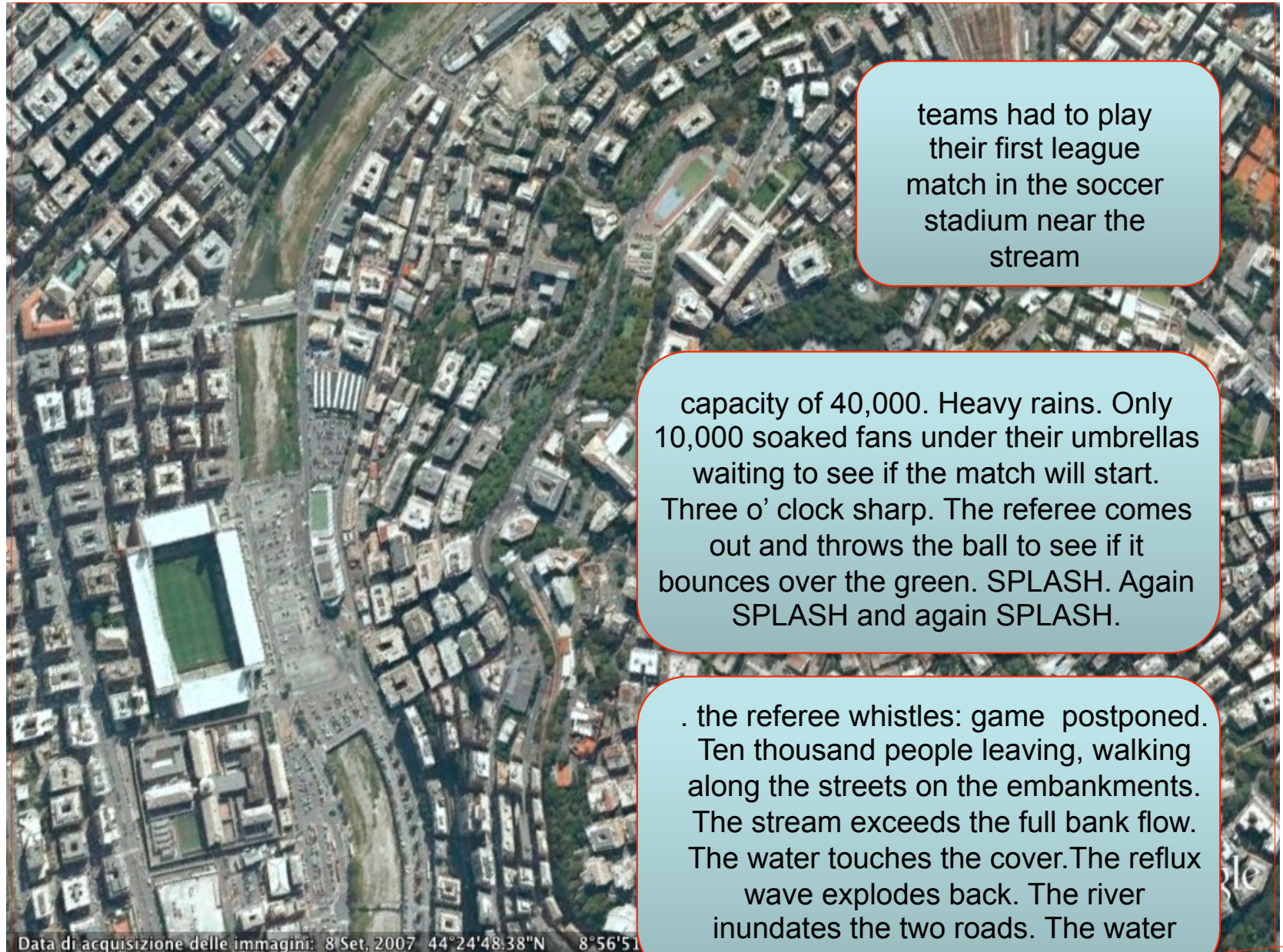
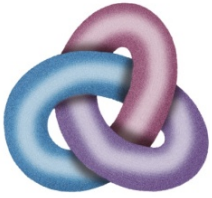


Sunday it will rain for at least twelve hours, and the rain depth will possibly be equal or exceeding 200 mm

now let us suppose that out of the ten thousand universes a fall extreme storm is announced in, say, three hundred of them







teams had to play their first league match in the soccer stadium near the stream

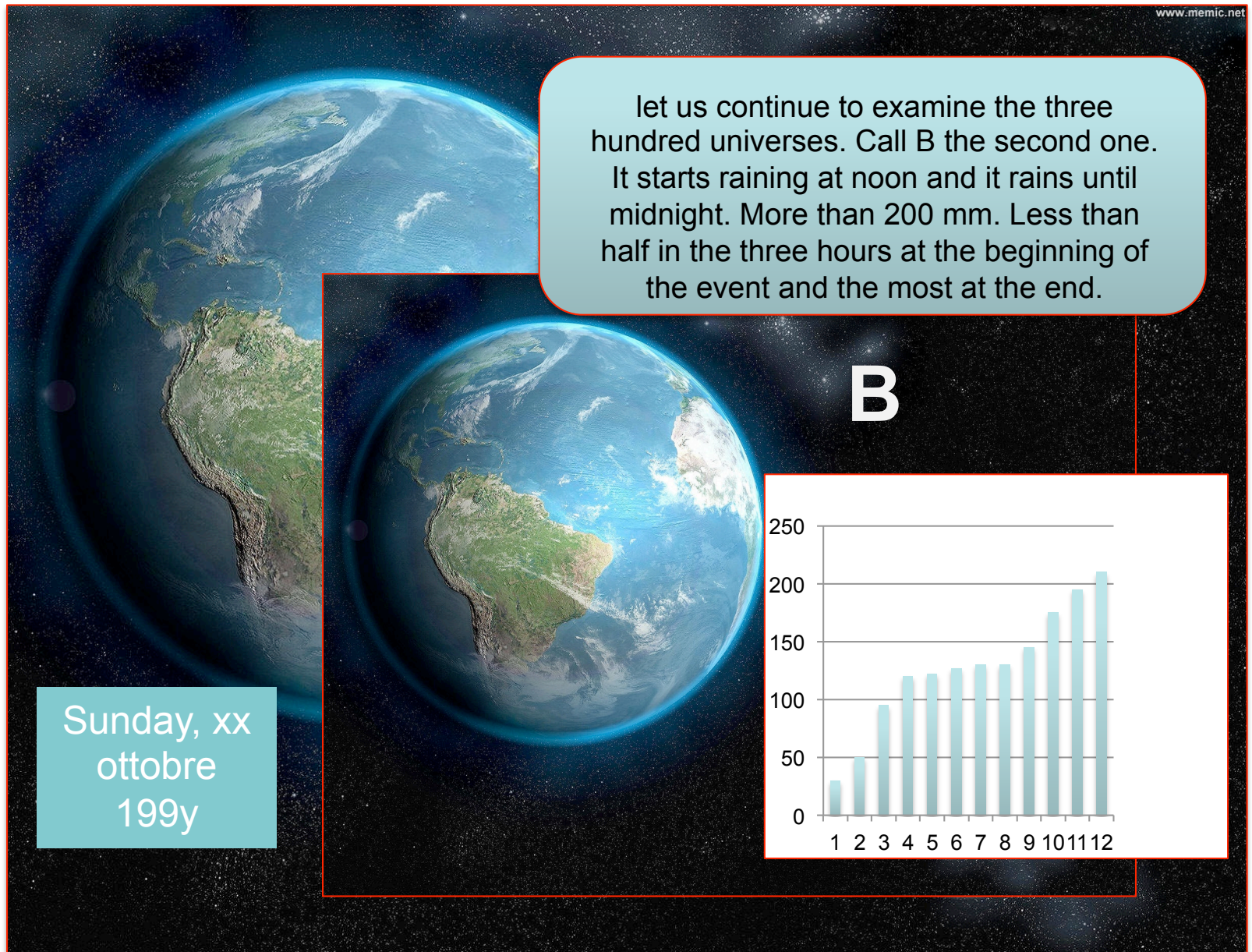
capacity of 40,000. Heavy rains. Only 10,000 soaked fans under their umbrellas waiting to see if the match will start. Three o' clock sharp. The referee comes out and throws the ball to see if it bounces over the green. SPLASH. Again SPLASH and again SPLASH.

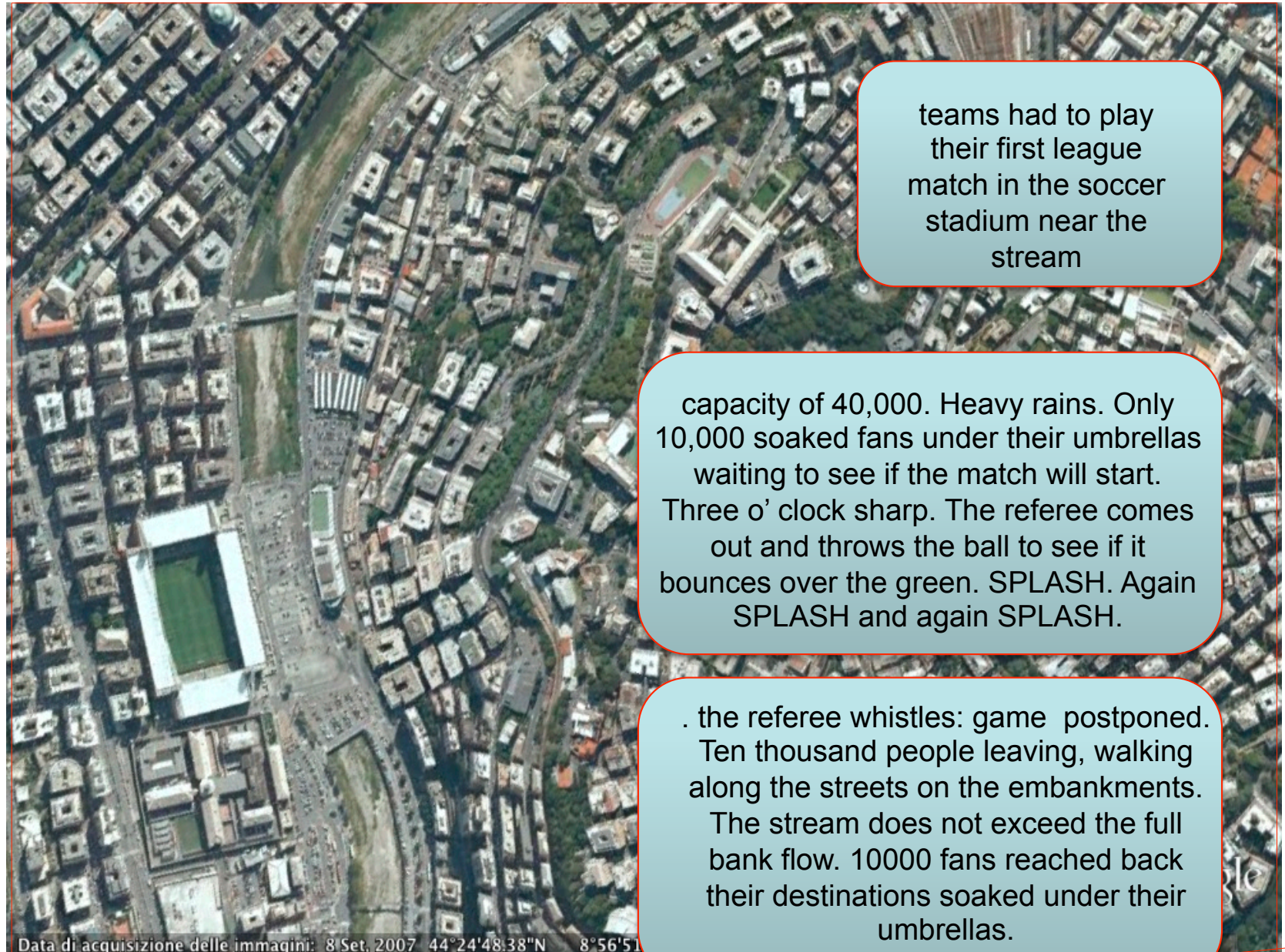
. the referee whistles: game postponed. Ten thousand people leaving, walking along the streets on the embankments. The stream exceeds the full bank flow. The water touches the cover. The reflux wave explodes back. The river inundates the two roads. The water drags pedestrians and cars



at five o'clock it's all over. A catastrophe. More than one thousand victims. In hospitals there is no more place. Firefighters from other provinces and regions are still coming.







teams had to play their first league match in the soccer stadium near the stream

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. the referee whistles: game postponed. Ten thousand people leaving, walking along the streets on the embankments. The stream does not exceed the full bank flow. 10000 fans reached back their destinations soaked under their umbrellas.

Data di acquisizione delle immagini: 8 Set, 2007 44°24'48.38"N 8°56'51"E



about nine o'clock in the evening it starts again to rain hard. It rains for three hours continuously. The stream exceeds the level of full bank flow. Same scenario that we've seen in the universe A. The difference is that in the universe B it happens shortly after midnight. Subways are closed. No one in the streets. Only parked cars. The buses are in the night garages. Many damages. No victims.





The event in the universe B, that did happen late in the night, when the Genoese were all home, is almost as unlikely-or likely- as that of the Universe A.

And so, among others, two professors of Civil Engineering are still teaching at the University of Genoa.

They went to watch the match between Sampdoria and Milan, and survived.

Why? Because they were in the universe B, so we discovered after the event.

Do you perceive how thin is the physical role of the uncertainty and how large is the social one?



A few weeks after the presentation of such an example in Rome an extreme event hit the area I just described. Very similar flooding, around one o' clock in the afternoon, with pupils leaving the schools. Six casualties. Warnings were issued the day before.

I had to explain to newspaper and tv people that's impossible to predict weeks before the event. That my tale at the conference was not a forecast.

Because to predict where and how it's easy, but to forecast when and how much is quite another matter.

That's the reason why the 2011 event in Genoa was chosen as a study case for DRIHM e-infrastructure.



Why DRIHM e-infrastructure for Civil Protection?

Thirty years ago I began, with a few friends, the construction of the system of Italian Civil Protection. We put every effort in so-called non-structural measures, those useful measures to alert the authorities and citizens when a paroxysm of meteorology could bring water to their homes, and kill and destroy properties and means of production.

So they could be ready to accept restrictions on the use of the land and properties, but also so that they could take simple temporary protective measures.

Because we can - it always has been - live in flood prone areas. The paroxysmal events are rare and do not strike in the same place.



Dealing with uncertainty. By the use of ensemble prediction in meteorology and by the use of disaggregation of predicted rainfall fields from meteo to hydro scales.

The Italian system for predictions is now distributed into a number of technical groups of meteo and hydro experts at the local scale and a coordinating group at the national scale. More than one hundred skilled people.

The procedures are extending to the whole Europe as a best practice for the European Civil Protection, presently under transformation and strengthening.

That's the reason why I think that DRIHM e-infrastructure is a very promising hot spot in hydrometeorological research.



Still research needs? Oh, yes.

Nassim N. Taleb, published in 2007 "The black swan: the impact of the highly improbable". The book created intense controversy in mathematical circles.

It deeply revises the paradigms of the forecast of future states of a system, based on the observation of past states.

The Taleb thesis, in essence, is that the human condition, which learns from experience, forces into a mental tunnel the predictions of what might happen.

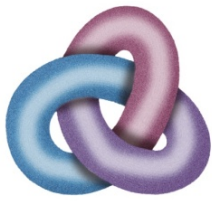
The prediction tunnel is formed by the experience of past events, among which the highly unlikely event almost never appears because it is very rare and therefore almost never belonged to the experience.



I did try to offer the example in a way that I hope is readable. I did it in order to avoid that DRIHM e-infrastructure is perceived as the saving solution to all the problems of dealing with uncertainty.

DRIHM e-infrastructure allows the operators to operate repeated simulations of reality much faster than before and so gives the operators time to think.

The basic problems, why we have to think the members of the ensembles, true ensembles or poor man ensembles, equiprobable, or why we have to think members of the rainfall field disaggregation independent on the terrain orography, are still there as food for the minds of young researchers.



Why DRIHM e-infrastructure for DRR?

For climate change applications the Taleb's effect stays upstream of the future meteorological possible states. The uncertainty is absorbed into the construction of future climatic systems. Their effects are highly unlikely events per se.

Contrary DHIHM e-infrastructure plays the essential role of a specific tool, a quite powerful tool, to investigate the effects at small scale, i.e. the scale of the impacts, conditional on possible meteorological states.

It's the tool for evaluating the effects of disaster scenarios through repeated simulation experiments that the e-infrastructure of DRIHM easily allows.



Why DRIHM, in essence?

There is no doubt that the e-infrastructure is the most appropriate tool to facilitate the work of forecasters in the field of civil protection and simplify the role of risk managers or planners in the field of disaster risk reduction.

However, as I hinted, here and there, there is still a lot of food for the mind of young researchers.
I wish them a long career of reflections and successes.

Like I had.

Thanks for your attention.