

## **WWCH 2017 PROBLEM DESCRIPTION**

| <b>Problem Title</b>   |  |
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| RasGharib Floods   |  |
| <b>Contact Information</b>   |  |
| Name   | Mohamed Ahmed Elghorab – Rana Mohamed Hesham Fahmy |
| Country  | Egypt  |
| <b>Basic information</b>   |  |
| <p>Floods are extreme natural events that may have disastrous effect on human societies. The flood events are random hydrological phenomena which occur when heavy rain falls in mountainous areas that are punctuated by a group of valleys. Rain water moves through these valleys that form a watershed (i.e., a catchment) and accumulates at a single outlet at the narrowest part of the watershed or drainage basin. Accumulated water then moves out of the watershed at a very high velocity and a high depth that may cause loss of crop lands, lives and properties and may also cause infrastructure damage. Due to the random nature of floods, similar to many natural phenomena, it is difficult to predict the timing or severity of flood or continuity. Many places in Egypt are prone to severe flooding. One of those places is the Red Sea Governorate.</p> <p>The Red Sea governorate in Egypt is located along the shores of the Red Sea starting from the Suez Gulf in front of Sinai Peninsula and going southward. The governorate has an area of about 204,000 km<sup>2</sup> and two major cities; Hurghada and RasGharib. The city of RasGharib has recently been hit by a severe flood that caused significant damages and loss of lives. RasGharib is located 150 Km to the north of Hurghada on the Red Sea coast with coordinates zone 36R , 507814.57 m easting, 3136134.42 m northing (WGS84) With an area of 10,465 km<sup>2</sup>, population reaching 35379 (General Agency for Public Mobilization and statistics), and oil economy that contributes nearly 70% of the country's oil production it is considered to be the second largest and most important city in the region.</p> <p>Egypt has its own intriguing history with flash floods. For instance, in January 2010 a flash flood hit the city of Al Arish cutting the main road of the city and splitting it into two halves. In February 2013, Nuweiba was hit by a flash flood, and in March 2014 the flash floods hit several parts in Egypt including El Tur, Dahab, and Assiut. In October 2015 two flash floods occurred with one destroying Taba-Nuweiba road and the other causing many casualties in Alexandria. Last but not least the particular case of this water problem is related to the City of RasGharib that was hit by a flash flood few months ago. According to the Egyptian meteorological authority the city has an arid or semi-arid climate - recorded by four weather stations surrounding the city- as shown in the table below.</p> |  |

| Station     | Min. – Max. Temperature in degree | Average temperature in degree night/day | Rain average annually mm | Rain max. in one day mm / day | Evaporation mm / day | Relative Humidity % |
|-------------|-----------------------------------|---|--------------------------|-------------------------------|----------------------|---------------------|
| Suez        | 4.1 – 46.1                        | 14.7 – 28.9                             | 0.3 – 6.2                | 49.6 (1965)                   | 6.7 – 15.4           | 42 – 56             |
| Hurghada    | 3.4 – 43                          | 15.7 – 30                               | 0.2 – 1.5                | 24.7 (1954)                   | 9.8 – 18.8           | 43- 55              |
| Sant Antinu | (-1.3) – 42.5                     | 13.2 – 29.6                             | 0.2 – 3.1                | 18.3 (1954)                   | 13.9 – 31.1          | 31.3 – 51.7         |
| Bair Oweida | (-1.7) – 44.7                     | 10.9 - 28                               | 0.2 – 1.5                | 3 (1978)                      | 6.2 – 20.2           | 26 – 64             |

### Problem description

The purpose of this paper is to demonstrate the effect of flash floods on areas where no mitigation measures are available and to provide a clear idea regarding an actual case of flash flood damages that have recently occurred in Egypt. The purpose also extends to developing a vision or a specific idea to tackle the case at hand. In fact, flash floods have recently become renowned on global scale, due to its hazardous and devastating effects that cause loss of resources, infrastructure and lives.

Although RasGharib has its own share of urbanization and economic importance, on October 26, 2016 a storm event occurred over the region and continued for two days with rainfall depth exceeding 32 mm and reaching 51 mm (after TRMM data). With this excessive rainfall things started to get more dramatic.

First of all, almost 580 houses in the city were washed away and the infrastructure was hit hard as nearly 90% of the city faced a power failure. This problem was fixed after nearly one week of suffering due to the explosion of the electric cables coming out of the main power station.

Secondly, 29 people died and 73 were injured (Red Crescent Organization). Moreover, the highway between Hurghada and RasGharib was cut off and some parts of the road were washed away by the flood and this dramatically affected tourism in Hurghada and MarsaAlam. In addition, the potable water mainline was damaged leaving the city without water. Thus, the people in the city remained without water and electricity and were trapped in flood waters for couple of days. Even when the mainline was fixed and water was pumped, it was with a very poor quality as the water treatment plant was not prepared to deal with the highly turbid flood water that reached the plant intake. As mentioned before, RasGharib is one of the major Egyptian cities in oil production, and the flood caused more than 30 international oil companies to stall their operations. According to the Ministry of Irrigation and Land Reclamation, the unexpected runoff volume reached 120 million cubic metres which was extremely devastating.

According to the official weather forecasting expectation, This flood was expected and the Ministry of Water Resources and Irrigation was informed but that did not decrease the level of the disaster. The minister of water resources and irrigation reported that the soil in RasGharib is saturated with oil and this played an important role in reducing the infiltration rate and so leaving no space for the water except to runoff. The absence of any storm water drainage network in the city and means of protection for roads, culverts, made the situation even worse. The lack of planning or maintenance plans caused Egypt to lose, beside all of the above mentioned losses, about 120 million cubic meters of water that would have been sufficient to fulfill the needs of 120,000 citizens instead of damaging their homes and taking their lives (The Egyptian Center for Public Opinion Research Baseera).

The problem starts with the lack of supervision and lack of awareness and emergency plans

to deal with natural disasters. This led to RasGharib citizens to illegally build houses and other buildings on the main streams (dry paths that turn into high velocity water streams during a heavy rainfall event) with lack of basic services and infrastructure. This unexpected volume of water did not come alone, but carried with it reptiles, snakes and scorpions from the desert area behind the mountains.

In the previous century, this kind of disaster used to take place frequently but since the early 2000s, Egypt has been facing this catastrophe almost yearly. Instead of prevention and mitigation measures, there are usually the attempts to solve the aftermath of the problem. This option should be no more available as crisis remedy is much more expensive than crisis prevention and Egypt is suffering from both an economic problem as well as a water scarcity problem.