Enabling Climate Information Services for Europe

Report

DELIVERABLE 4.5
Report on past heavy precipitation events for the eastern part of Sicily

Activity:	*WP4 – Cities*
Activity number:	*Task 4.4 - Flood risk assessment in cities of Eastern Sicily*
Deliverable:	*Report on past heavy precipitation events for the eastern part of Sicily*
Deliverable number:	*4.5*
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Summary

Daily precipitation series have been rescued and quality checked for Sicily region, in southern Italy, with the aim of analysing spatial distribution of extreme events. Return levels of some defined precipitation threshold were spatialized onto a regular high resolution grid.

The activity developed in the frame of this deliverable went far beyond the planned goal of the project, which consists in the analysis of extreme events for the eastern part of Sicily: data rescue and analysis were in fact extended to the whole Sicily region, with the aim of providing a useful comparison of the return levels of intense precipitation in eastern Sicily with those of the other parts of the region.

1. Introduction

Sicily is a large Mediterranean island (the surface is 25.711 km^2) located in the area 12.4-15.7 East - 36.5-38.5 North. The population density is rather large (196 inhabitants/km^2) and the number of inhabitants exceeds 5 millions. The population is mainly concentrated on the coastal belt, especially around Palermo and Catania, which are among the ten most populated cities of Italy.

Sicily has a typical Mediterranean climate with hot and dry summers and wet and mild winters. Yearly total precipitation ranges between 500 and 1300 mm, with highest values on the eastern and northern coastal mountains. Heavy precipitation events, which led to economic and human losses, are rather frequent, especially in the eastern part of the region; some of them have mesoscale extension, whereas other ones have a very local character.

The last event causing a high number of fatalities occurred on October 1st, 2009 (Figs 1 and 2).

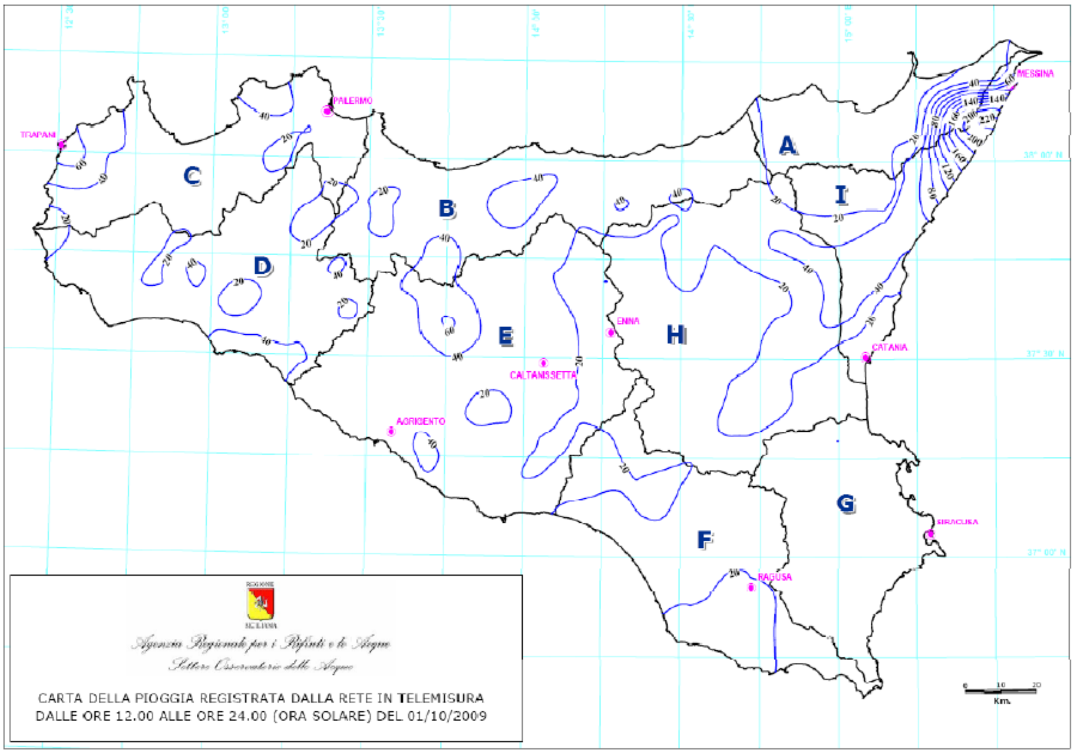

Figure 1: October 1st, 2009: precipitation between 12:00 and 24:00

The high frequency of heavy precipitation, the elevated population density, the complex geography and the lack, especially in the past, of an adequate urbanisation policy, make the region highly vulnerable to risks connected with heavy precipitation events.

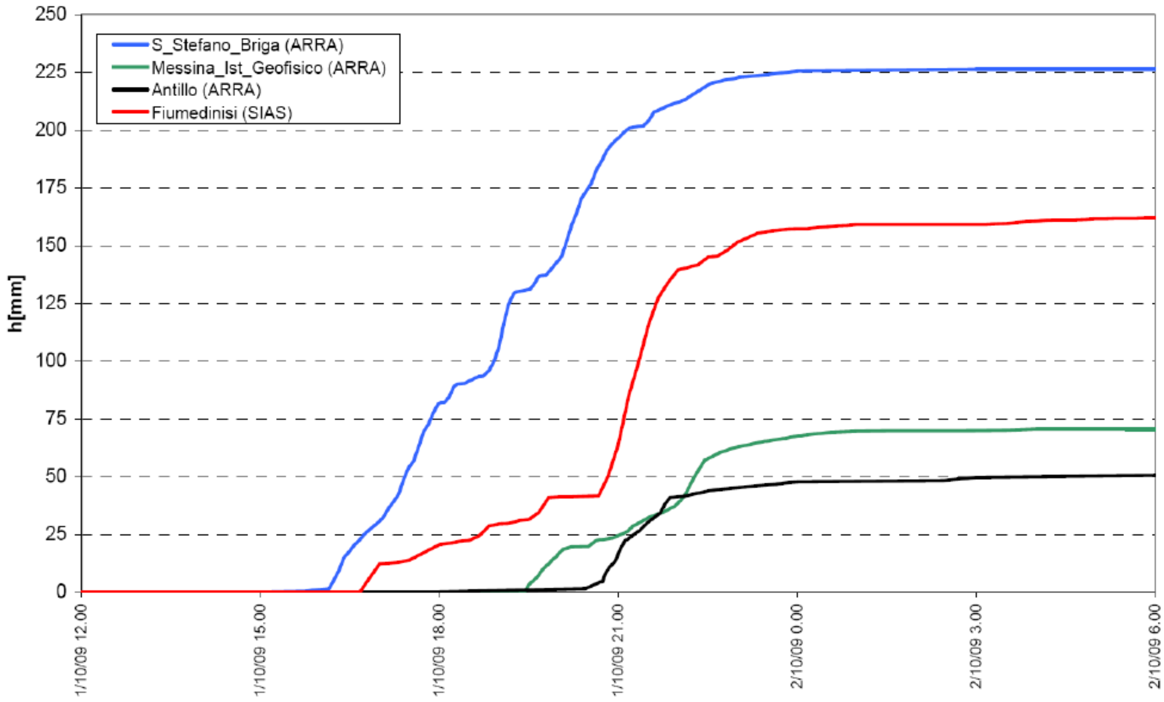

Figure 2: October 1st, 2009: cumulative precipitation from 12:00 at four observation stations

Within this context it is very important to get a better knowledge of the spatial distribution of the probabilities of occurrence of these events and to assess whether climate change may affect such probabilities. Both these issues will be considered by ISAC/CNR within the ECLISE project. This report focuses on the first issue.

2. The dataset

The network of daily precipitation records used for the analyses presented in this report was set up merging data from different institutions. The main data source was the “Osservatorio delle Acque”, an office of the water and waste management department of the Sicily regional administration. At present time this office manages the station network that was set up in 1917 by the Hydrographic Service. Other data sources were the National Air Force, the Agricultural Research Council and one Observatory with a records starting in the 18th century.

The first step of our analyses consisted in a cross comparison among the records and in checking the stations which were available from more than one source: in this case only the most reliable version was included in the final dataset (i.e. usually the one with the smaller amount of missing values). Then all records were subjected to a quality check procedure which consisted in checking all sites for their position (the consistency among declared location and position was the main constraint) and in correcting the coordinates, when possible, or deleting the series any time the correct position could not be identified with a reasonable confidence. The final consistence of the station network after this quality checks was 325 stations (see Fig. 3).

Given the high sensitivity of extreme data analysis to the presence of erroneous values in the daily records, we also performed a strict quality control on the full data-set, by separately inspecting anomalous large precipitation amounts (outliers) and spurious long dry spells. In both cases, identification of potentially erroneous data was based on a comparison between records from neighbouring stations.

Specifically, for detection of outliers, a reference daily series was set up for each station to be examined, by averaging synchronous data from the 10 closest stations (within 30 km) to the target one, and sufficiently complete (no more than 15 missing values per year). Each precipitation event in the target station was compared to the reference values within a 3-day window (i.e. those values in the reference series pertaining to the day before and the day after in addition to the event day itself), to account for possible one-day lags in the event occurrence in nearby measuring sites. Large precipitation amounts were marked as suspect whenever the following quantities simultaneously exceeded sensible bounds:

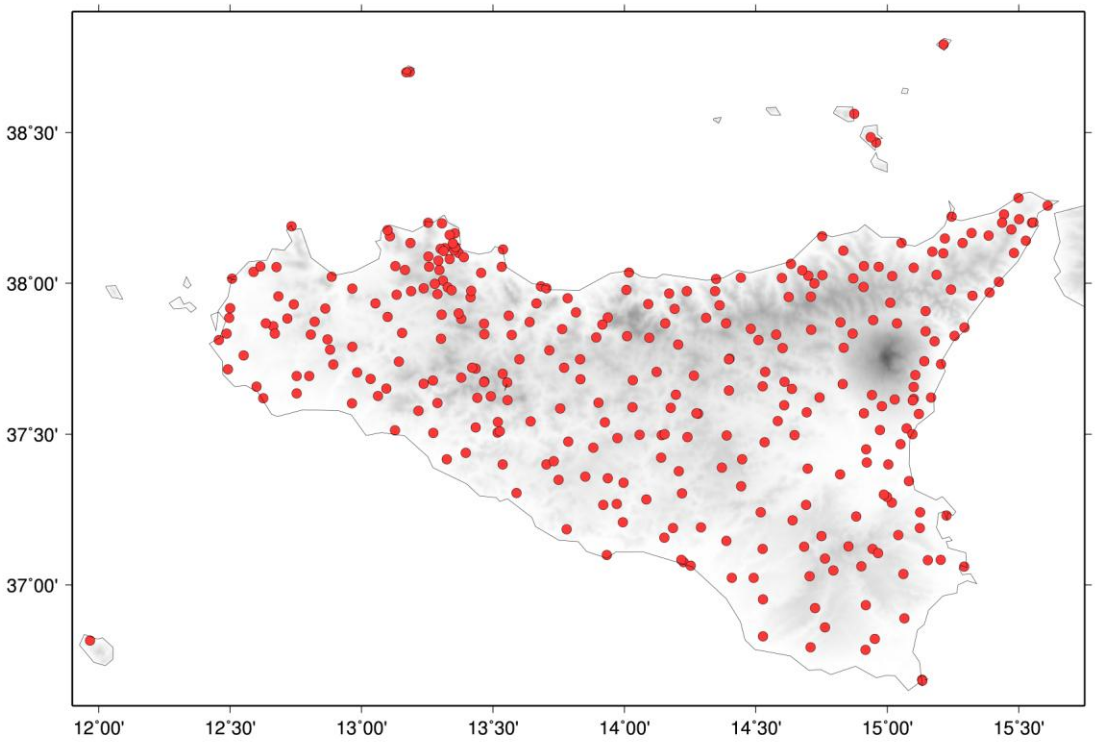

Figure 3: Sicily stations with daily precipitation data

i) absolute difference from each of the reference values in the 3-day window;

ii) ratio to each of the reference values in the 3-day window;

iii) ratio to the absolute maximum across all values in the 3-day window from the individual 10 closest stations (i.e., not averaged).

Limiting values for the above quantities, though inherently arbitrary, were set here to i) 60 mm, ii) 6, iii) 3, which should be conceived as a trade-off between the risk of retaining unreliable data and that of selecting an excessive number of potential outliers. As a result, a total of about 300 precipitation values across the entire data-set turned out to be out-of-bounds. These data were subsequently examined individually, with the help of the Year Books of the Hydrographic Service, and graphical tools that visualize the spatial pattern of precipitation in a broad region on the event day and nearby days. In some cases we also checked the reasonability of the data by means of weather maps and old local newspapers.

The bulk of the events previously classified as suspect was ultimately validated (true extremes), whereas only a minor part (less than 10%) remained unconfirmed and thus discarded from the data-set. A few of such values, however, were recognized to be monthly amounts, that, in turn, imposed the elimination of entire years (6 years across 3 different stations) affected by the same bias.

Two examples of checked data are shown in figures 4 and 5. The first one concerns Lentini-Bonifica - October 17, 1951, corresponding to the absolute maximum of all the data set (over 700 mm): this data turned out to be highly reasonable both on the basis of the neighbouring stations and on the basis of a lot of other information as the daily weather map, articles in local newspapers, papers and reports on the event, etc. The second one concerns Noto – December 1, 1992. This value was deleted from the data set, as all information was against the possibility of heavy rain in such a date. A better inspection of the Noto record showed then that it had some months in which a cumulative monthly value was assigned to the first day of the month, without indicating that it was actually a monthly total and not a daily value.

Long sequences of dry days in each station records were again verified by comparison with the 10, sufficiently complete, closest stations to the target one. Periods with more than 60 consecutive days without precipitation were flagged as suspect if none of the selected neighbouring stations reported a similar occurrence, that is, at least 90% of dry days in the same time lapse and precipitation amount below 5 mm on each of the remaining days. A considerable number of missing data masked by dry days were identified in this process, and, as a result, one or more consecutive months or years were discarded from 13 stations (a total of 59 months and 12 entire years across the full data-set).

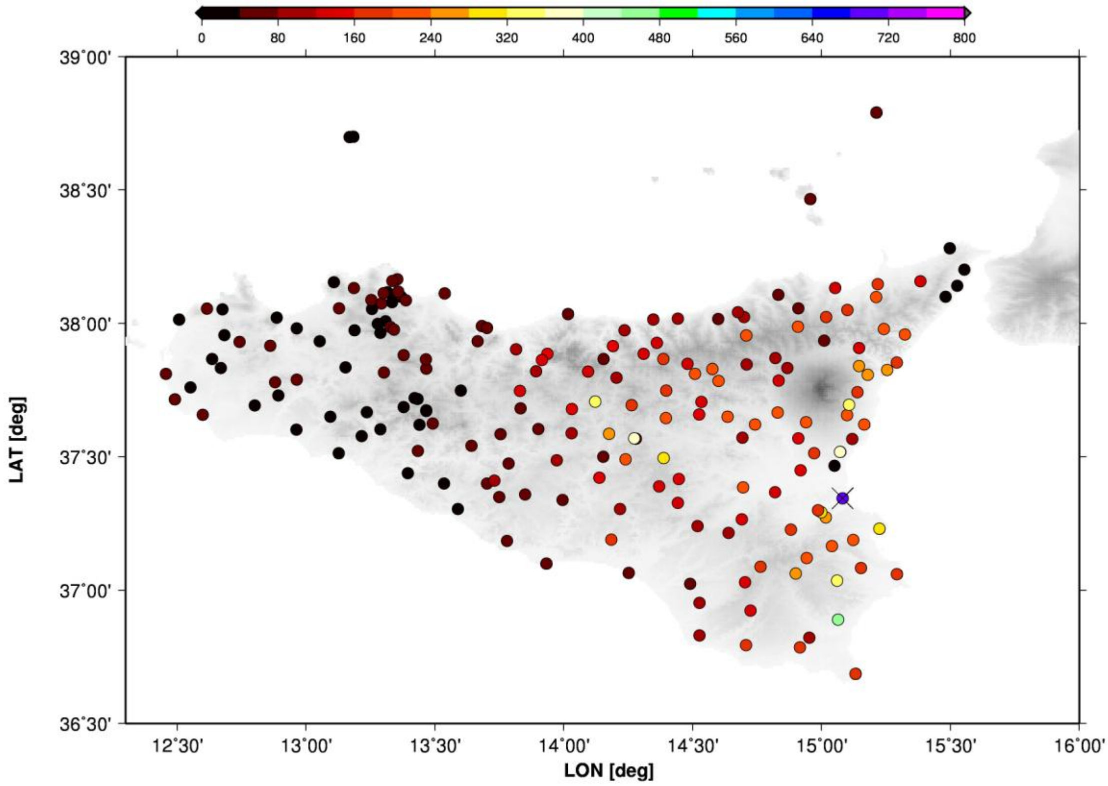

Figure 4: daily precipitation on October 17, 1951.

After the quality control the station records were checked for homogeneity. The first set of stations which was tested for homogeneity was a subset of 61 stations (see Fig. 6), selected with the criteria of the lowest fraction of missing data in the 1951-2005 period, which is the one with the highest data availability. The analyses presented in this report are based on this set of stations. The homogeneity check of the full dataset is in progress and the results presented in this report will be updated when it will be finished.

The records were tested for homogeneity by means of a procedure which rejects the a priori existence of homogeneous reference series. It consists of testing each series against other series, by means of a multiple application of the Craddock test, in sub-groups of 10 series (see Brunetti et al., 2006). The test is based on the hypothesis of the constancy of precipitation ratios. The break signals of one series against all others are then collected in a decision matrix and the breaks are assigned to the single series according to probability. No corrections were applied to the data in order to avoid transporting the uncertainties which are intrinsically present in all homogenisation methods to the estimation of the parameters of the extreme value distributions. So we limited the homogenisation issue to only testing the records and when we detected a record with possible inhomogenities we removed it from the dataset or deleted part of it.

After this tests, the subset of 61 stations which was selected for the analyses presented in this report was reduced to 53 stations. The analyses concern the period of highest data availability (1951-2005).

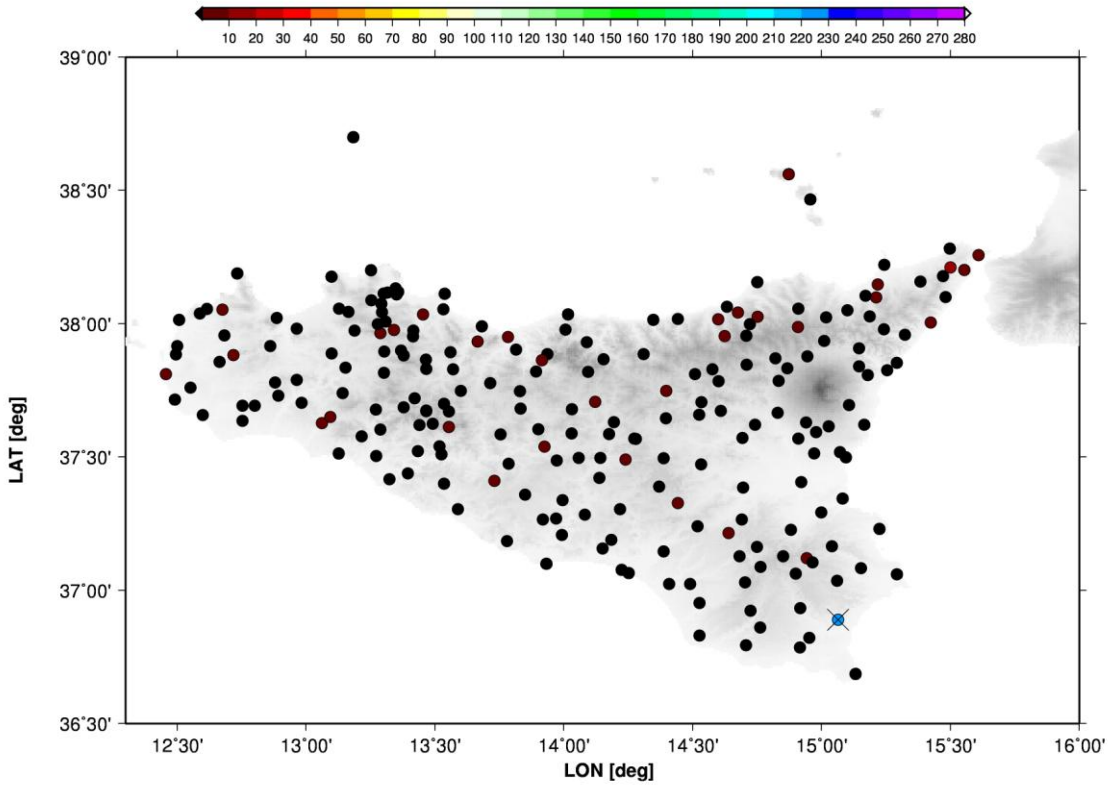

Figure 5: daily precipitation on December 1, 1992

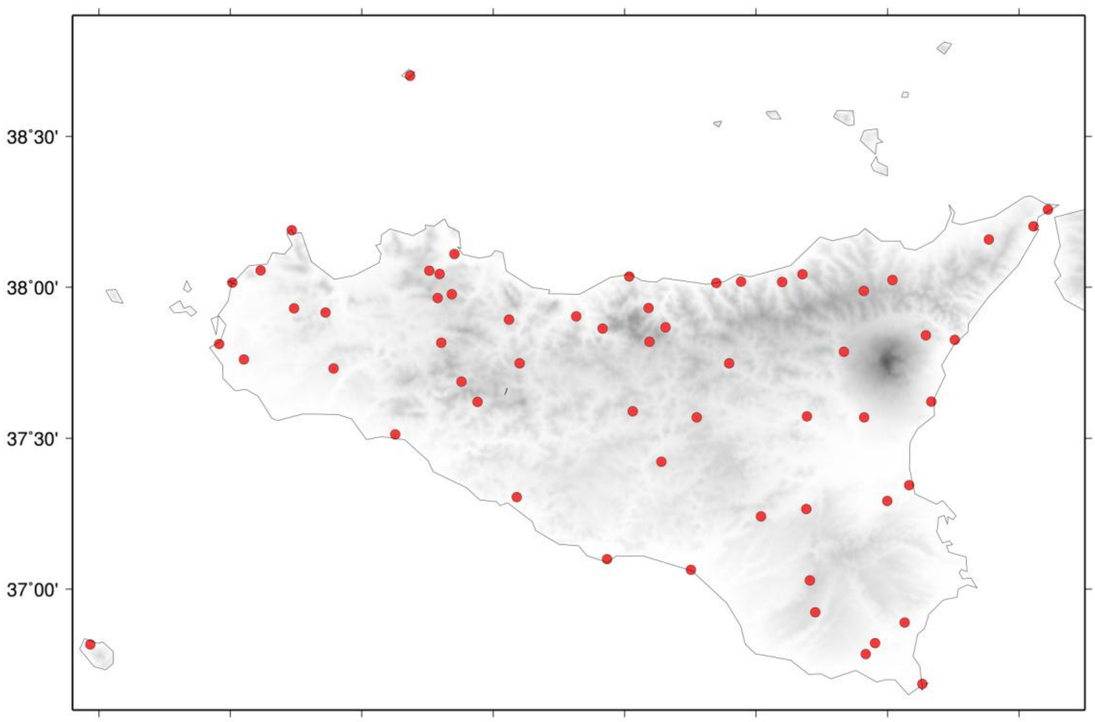

Figure 6: Subset of the 61 stations with better data availability in the 1951-2005 period

3. Analysis of the station records

First of all a quick analysis was performed to check if the records give evidence of significant trends. The results of this analysis, together with the results of a more detailed analysis performed for the neighbouring Calabria region in a previous research (see Brunetti et al., 2012), allowed to highlight that the analysis can be performed with a stationary approach. This issue will be investigated more in detail when the, homogeneity checked, full dataset will be available.

After the presence of significant trends was excluded, the annual maxima of daily precipitation for each station were used to extract the parameters of the corresponding Generalised Extreme Value Distribution (GEV). GEV is a family of probability distributions, developed within extreme value theory, to model the distribution of the maxima of blocks of independent and identically distributed random variables. In our case we considered yearly blocks of daily precipitation data and used the GEV approach to model the distribution of the corresponding maxima.

The GEV parameters – i.e, the position, scale and shape parameters - and the corresponding expected errors (see Coles, 2001) were estimated by means of the open source R software - package evir, function GEV - which carries out the fit using maximum likelihood. They were then used to estimate the return levels corresponding to time intervals of 5, 20, 50 and 100 years, together with the corresponding 95% confidence intervals.

A quick look to the shape parameters and to the corresponding errors immediately allowed to give clear evidence of the great difficulties in using GEV as a tool for practical applications: in fact the expected errors of the shape parameter turned out to be so large that the possible return levels corresponding to the investigated time intervals covered a very large precipitation range.

In order to minimize this problem, we tried to fit the data also by means of the family of Generalized Pareto Distributions (GPD) (see Coles, 2001), which consider all the data over a given threshold. The advantage of GPD with respect to GEV is that using only block maxima can be wasteful as it ignores much of the data. So it is often more useful to look at exceedances over a given threshold instead of simply consider the yearly maxima of the data.

An important topic for GPD is the correct selection of the threshold: it should be high enough that the underlying theoretical development is valid, but low enough that there are sufficient data to make an accurate fit. We investigated the problem by means of the open source R software - packages ismev and extRemes, - analysing the mean excess of the events over threshold and the stability of the scale and shape parameters. On the basis of these analyses, we realised that for our stations a quite reasonable threshold for the GPD corresponds to half of the yearly maxima GEV location parameter. With this threshold we have an average value of near to 300 cases per station, which gives a much better statistics of the about 50 cases of the GEV analysis, allowing to reduce the error of the scale and shape parameter of about a factor 2 and allowing to reduce the uncertainty of the return levels.

So we decided to use the GPD approach. Table 1 shows the selected thresholds, the scale and shape parameters and the corresponding expected statistical errors for the 53 stations used in the analysis.

4. Spatialisation of the GPD results

After analysing the station records, we had to spatialise the GPD results. For this purpose we observed that the ratios between the yearly station precipitation and the GEV position (from which we got the GPD thresholds) and GPD scale parameters have much more spatial coherence than the parameters themselves. So we decided to spatialise these ratios.

The spatialisation was performed by means of Regression Kriging (see Hengl, 2009). First a Multi Linear Regression was performed using latitude, longitude and elevation as independent variables, then the residuals were kriged, with kriging weights obtained by means of an exponential semivariorgam. The spatialisation was performed on the 30-arc-second-resolution GTOPO 30 DEM.

The root mean squared error (RMSE) over all the stations for the ratios of yearly precipitation and position/scale parameters turned out to be, respectively, 1.2 and 9.4, corresponding to about 8 and 17 %, whereas the explained variance of the interpolation model was, respectively, 77% and 57%. All the error estimations were performed with the leave one out approach, consisting in applying the interpolation method several times, excluding one station for each application. This approach allows to compare each station values with interpolated values that are constructed without taking into account the station itself.

Figures 7 and 8 show the spatialisation of the ratios between yearly precipitation and GEV position and GPD scale parameters.

STATION NAME	LAT	LON	ELEV	THRESOLD	SCALE	ERR_SCALE	SHAPE	ERR_SHAPE
AG_AGRIGENTO_20_0168	37.3047	13.5888	175	20.8	11.5	1.0	0.18	0.06
AG_BIVONA_20_0144	37.6204	13.4399	521	24.6	11.8	0.9	0.07	0.06
AG_CATTOLICA_ERACLEA_20_0163	37.4384	13.3958	150	17.3	8.2	0.7	0.24	0.06
AG_SCIACCA_20_0135	37.5130	13.1276	118	21.4	12.1	1.2	0.11	0.08
CL_GELA_20_0196	37.0646	14.2520	30	19.4	11.6	1.2	0.20	0.08
CL_S_CATERINA_VILLARMOSA_20_0153	37.5889	14.0300	606	22.6	11.5	1.2	0.14	0.08
CT_ACIREALE_20_0278	37.6216	15.1659	194	43.7	28.8	3.2	0.13	0.08
CT_BRONTE_20_0241	37.7862	14.8335	780	17.7	7.6	0.7	0.25	0.07
CT_CALTAGIRONE_20_0266	37.2408	14.5186	513	21.3	9.6	0.9	0.27	0.07
CT_LINGUAGLOSSA_20_0273	37.8404	15.1451	530	58.2	38.6	4.6	0.13	0.09
CT_MINEO_20_0267	37.2656	14.6909	524	28.9	13.8	1.7	0.41	0.11
CT_PATERNO_20_0252	37.5687	14.9106	240	22.0	16.2	1.8	0.14	0.09
EN_CATENANUOVA_20_0260	37.5718	14.6931	185	20.8	13.4	1.6	0.22	0.10
EN_ENNA_20_0177	37.5689	14.2732	950	25.7	14.1	1.4	0.19	0.08
EN_NICOSIA_20_0242	37.7479	14.3974	650	28.4	13.4	1.4	0.33	0.09
EN_PIETRAPERZIA_20_0184	37.4216	14.1386	467	18.5	8.9	0.9	0.35	0.08
ME_ALCANTARA_20_0288	37.8252	15.2547	30	33.2	18.8	1.9	0.20	0.08
ME_CARONIA_20_0028	38.0180	14.4425	302	20.9	10.8	0.9	0.12	0.06
ME_FLORESTA_20_0283	37.9875	14.9087	1270	33.5	14.0	1.3	0.36	0.08
ME_GANZIRRI_20_0298	38.2570	15.6089	3	22.0	11.4	0.9	0.12	0.06
ME_MESSINA_01_0017	38.2017	15.5540	54	26.1	11.6	0.9	0.21	0.06
ME_MESSINA_ISTITUTO_GEOFISICO_20_0296	38.2016	15.5548	43	23.4	10.2	1.0	0.25	0.08
ME_MONFORTE_20_0005	38.1583	15.3842	293	33.1	20.6	2.2	0.16	0.08
ME_MONTALBANO_ELICONA_20_0014	38.0237	15.0175	929	31.2	18.6	1.9	0.27	0.08
ME_S_FRATELLO_20_0027	38.0172	14.5990	690	27.0	14.1	1.1	0.05	0.06
ME_S_STEFANO_DI_CAMASTRA_20_0029	38.0141	14.3480	80	19.8	9.4	0.8	0.17	0.06
PA_ALTOFONTE_20_0068	38.0436	13.2954	385	26.2	12.5	1.1	0.15	0.07
PA_CASTELBUONO_20_0038	37.9309	14.0899	380	26.4	14.7	1.3	0.08	0.06
PA_CEFALU_20_0040	38.0350	14.0170	30	22.7	12.7	1.1	0.10	0.06
PA_CIMINNA_20_0056	37.8929	13.5601	525	20.7	11.7	1.0	0.04	0.06
PA_CORLEONE_20_0125	37.8156	13.3020	588	19.0	9.5	0.7	0.03	0.05
PA_DIGA_MAGANOCE_20_0122	37.9644	13.2886	616	23.5	11.8	0.9	0.07	0.06
PA_GERACI_SICULO_20_0036	37.8670	14.1550	1000	27.2	14.0	1.1	0.03	0.06
PA_LERCARA_FRIDDI_20_0145	37.7483	13.6006	658	18.3	9.6	0.8	0.11	0.06
PA_PALAZZO_ADRIANO_20_0139	37.6871	13.3794	679	26.2	16.2	1.3	0.04	0.06
PA_PETRALIA_SOTTANA_20_0172	37.8192	14.0943	932	23.7	11.5	0.9	0.13	0.06
PA_PIOPPO_20_0067	38.0546	13.2564	416	32.5	15.0	1.3	0.12	0.07
PA_SCILLATO_20_0043	37.8633	13.9151	376	25.7	13.4	1.3	0.18	0.08
PA_TURDIEPI_20_0060	37.9767	13.3419	635	25.7	13.5	1.0	-0.03	0.06
RG_CHIARAMONTE_GULFI_20_0202	37.0296	14.7037	672	26.6	16.3	1.7	0.16	0.08
RG_ISPICA_20_0213	36.7858	14.9164	127	20.5	11.7	1.2	0.25	0.08
RG_RAGUSA_20_0210	36.9236	14.7244	515	24.7	13.7	1.2	0.17	0.07
SR_LENTINI_BONIFICA_20_0234	37.3441	15.0816	1	24.9	16.7	1.8	0.39	0.09
SR_LENTINI_CITTA_20_0232	37.2919	14.9989	43	32.2	18.5	2.0	0.31	0.09
SR_NOTO_20_0217	36.8892	15.0645	76	30.7	18.0	1.7	0.22	0.07
TP_CALATAFIMI_20_0090	37.9158	12.8613	345	20.2	9.7	0.8	0.17	0.06
TP_CIAVOLO_20_0105	37.7609	12.5516	128	20.5	9.6	0.9	0.33	0.08
TP_FASTAIA_20_0100	37.9304	12.7424	182	20.1	8.7	0.9	0.13	0.08
TP_MARSALA_20_0107	37.8113	12.4569	4	20.7	10.9	1.2	0.19	0.08
TP_PARTANNA_20_0116	37.7305	12.8923	407	22.0	10.3	1.0	0.22	0.07
TP_S_ANDREA_BONAGIA_20_0095	38.0553	12.6152	55	21.2	9.2	1.0	0.33	0.09
TP_SAN_VITO_LO_CAPO_20_0098	38.1886	12.7331	3	17.3	9.0	1.0	0.12	0.08
TP_TRAPANI_20_0096	38.0147	12.5075	2	17.2	7.8	0.8	0.33	0.08

Table 1: thresholds, parameters and parameter errors for the 53 stations used in the analysis

For the shape parameter it is not correct to consider any normalisation as the shape is independent from the amount of rain. Therefore we spatialised directly the parameter, using the same approach used for the previously described ratios. The RMSE was 0.08 and the explained variance 33 %. Also in this case we used the leave one out approach. The spatialisation of the shape parameter is shown in figure 9.

5. Return levels

The spatialisation described in the previous section, the hypothesis that the GPD threshold can reasonably be expressed by means of half of GEV position parameter and the availability of a spatialisation for yearly total precipitation (this spatialisation, available from another task of the project, will actually be available only at month 18 of the project; so here we used a preliminary result) allowed to have an estimation of the GPD parameters for any point of Sicily. It was then very easy to get the return levels corresponding to fixed time intervals. In particular we considered 5, 20, 50 and 100 years. The best estimations for these return levels are shown in figures 10-13.

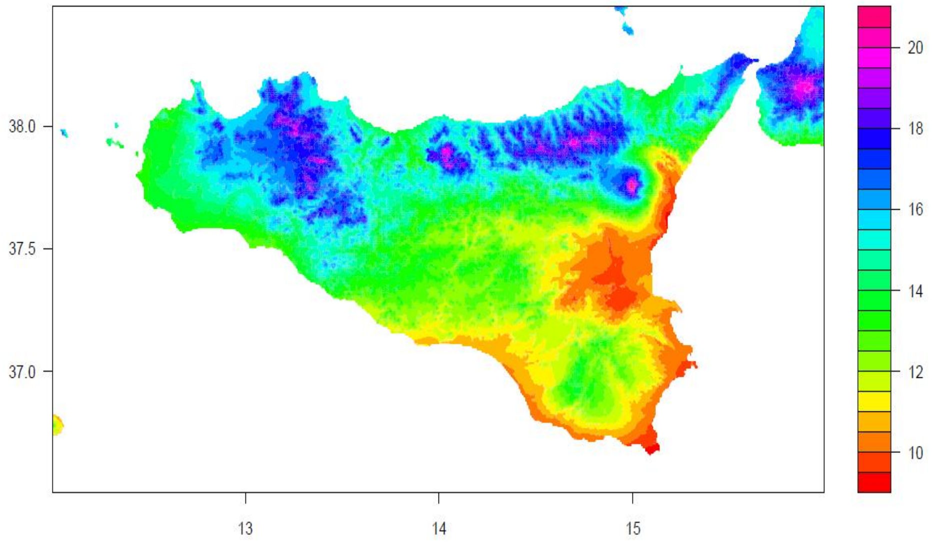

Figure 7: spatialisation of the ratios between yearly precipitation and GEV position parameter

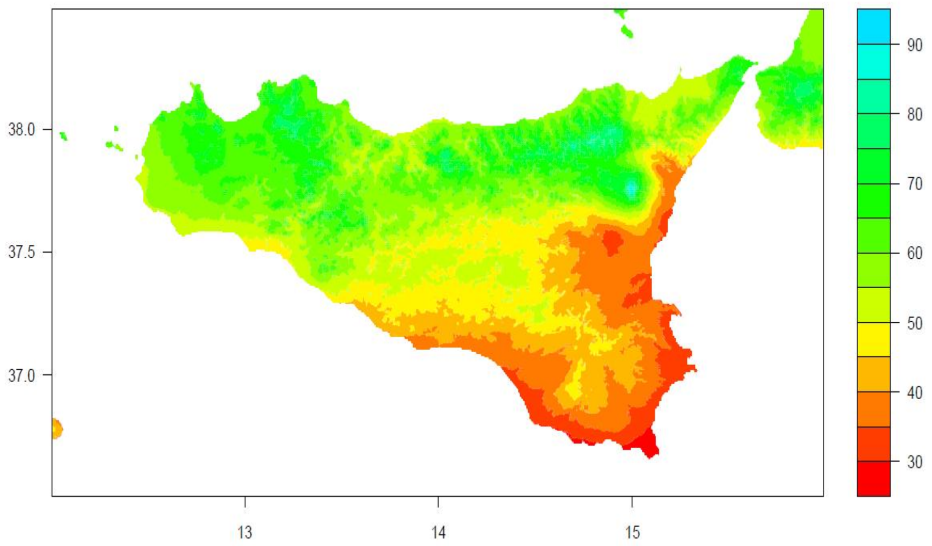

Figure 8: spatialisation of the ratios between yearly precipitation and GPD scale parameter

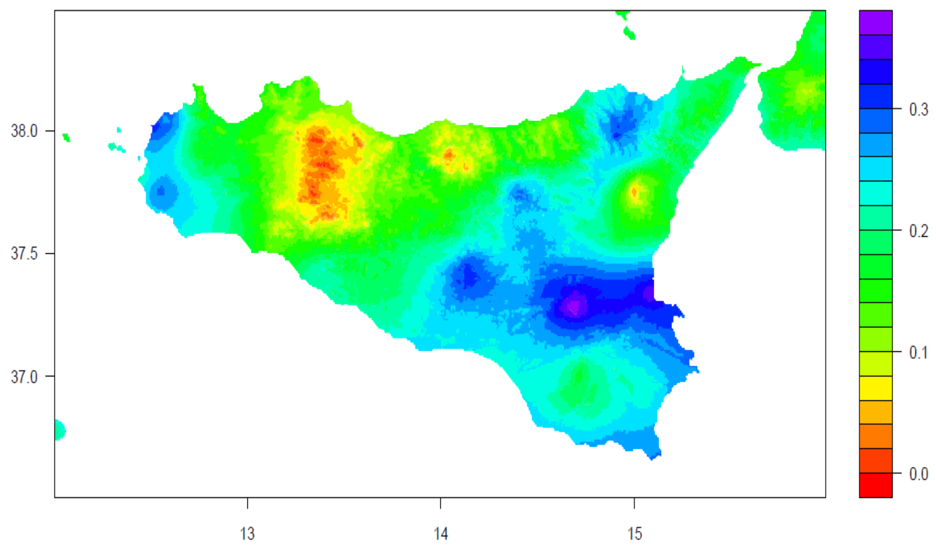

Figure 9: spatialisation of the GPD shape parameter

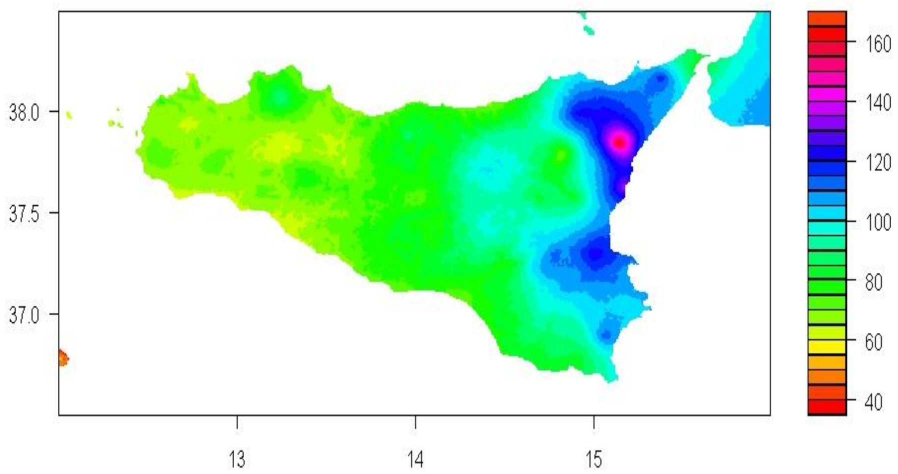

Figure 10: return levels for a 5-year time interval

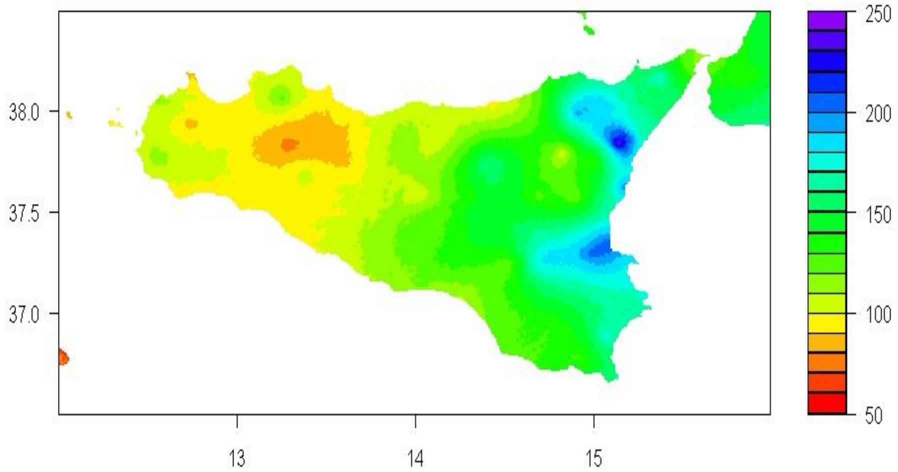

Figure 11: return levels for a 20-year time interval

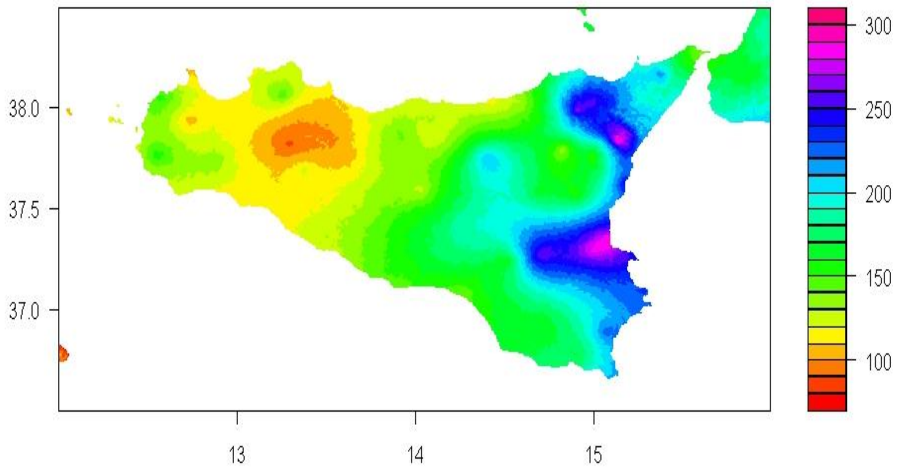

Figure 12: return levels for a 50-year time interval

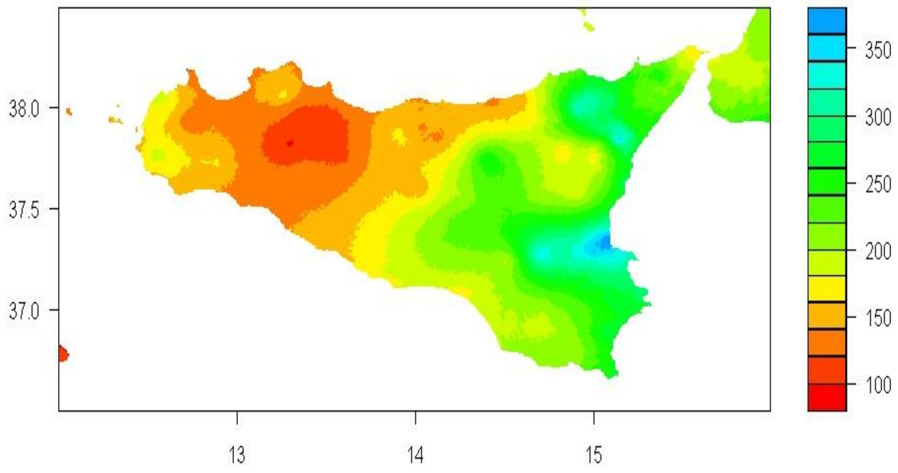

Figure 13: return levels for a 100-year time interval

6. Discussion, conclusions and area for further work

A set of 325 Sicily daily precipitation records was subjected to a detailed quality control procedure in order to check all possible outliers. A subset of stations, selected on the basis of the lowest amount of missing data and on homogeneity tests with neighbouring stations, was studied by means of GEV and GPD analyses.

The analyses allowed to get the return levels corresponding to 5, 20, 50 and 100 years, together with their 95% confidence intervals. Two examples are shown in figures 14 and 15: they concern Lentini-Bonifica, that is the station with the maximum precipitation of all the data set. Another example is shown in figure 16: it concerns the station Antillo which is the closest one of our data set to the area affected by the October 2009 event we discussed in the introduction (actually, in the dataset there is also S. Stefano di Briga. This station was however not yet subjected to the analyses as it was under the data availability threshold we imposed for our station subset).

The results clearly show the high exposure of the Eastern coastal region of Sicily to heavy precipitation events: it is caused both by a rather high number of events with high precipitation (see the low ratios between yearly precipitation and GEV position parameter) and by high shape parameters. In other terms in this region we have, on the one hand, heavy tailed distributions and, on the other hand, we have distributions with high position parameters (or thresholds for GPD). These results underline once more the vulnerability of this area (and of all the Sicily region) to heavy precipitation and the strong need of taking more into account the meteorological risk in spatial planning.

In order to extend the results also to the points which are not covered by stations, we also tried to spatialise the results (parameters and return levels) on a 30-arc-second resolution DEM. The resulting high-resolution fields are also much more easy to communicate than tables listing the results for the single station records. It is however important to underline that further work has to be performed, especially on the spatialisation issue. This work will be performed in the next months; in particular:

- The full station data set will be checked for homogeneity;
- Where possible, the records which are too short for extreme value analysis will be merged with other records in order to get records of sufficient length;
- The GEV and GPD analyses will be performed with a higher number of records and considering a longer period (1921-2005);

- The analyses will be performed also considering the seasonality of precipitation, which is particularly strong in Sicily;
- The spatialisation of the return levels will be performed using the final version of the spatialisation of precipitation that will be available within month 18 of the ECLISE project;
- Confidence intervals have to be estimated and provided for the spatialisation of the return levels.

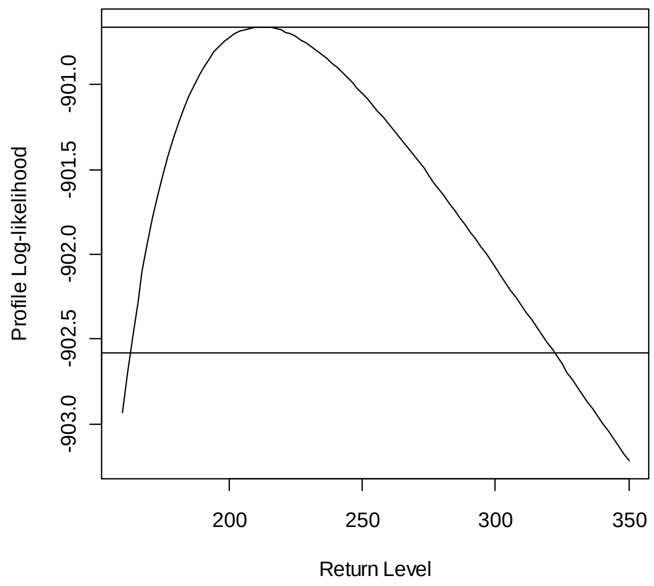

Figure 14: profile log-likelihood for the 20 year return level (mm) at Lentini-Bonifica. The intersections between the lower horizontal line and the curve give the lower and upper limits of the 95% confidence interval.

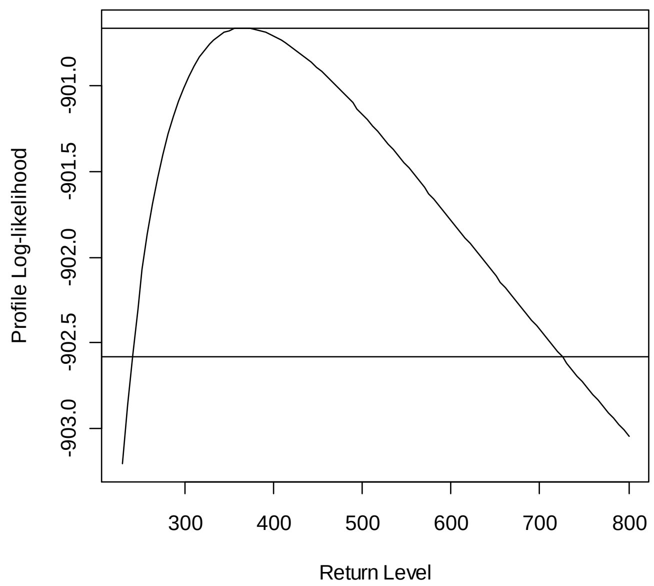

Figure 15: as in figure 14 but for the 100 year return level. It is interesting to observe that also the very high absolute maximum (702 mm - October 17, 1951) turns out to be within the 95% confidence level interval.

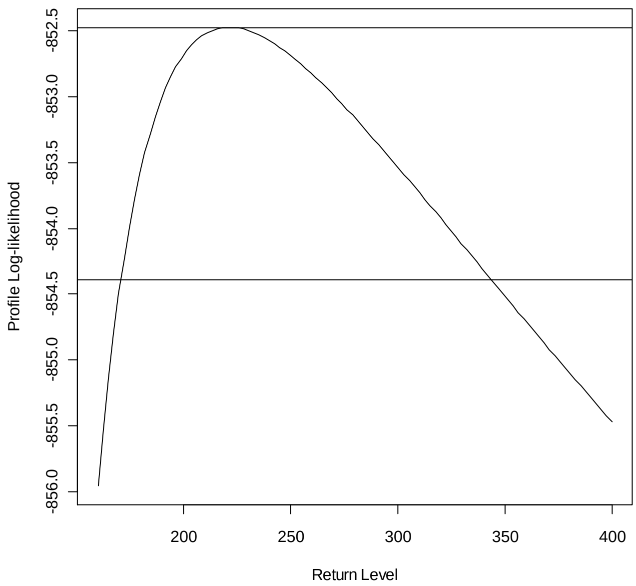

Figure 16: as in figure 14, but for the 50 year return level at Antillo. Even though Antillo is not the best station to investigate the 1st October, 2009 event (it is at about 30 km from the area with maximum precipitation), it is interesting to observe that the maximum of this curve is very close to the maximum daily precipitation estimated for this event (about 220 mm, see figure 1). When the homogenised version of the full data set will be available, it will be interesting to perform the same analysis also for S. Stefano di Briga. At present time we only performed a first quick GEV analysis of the yearly maxima of this station: it seems to confirm that 50 year is quit a reasonable return period for 24 hour amounts of about 220 mm. So, even though some more analyses have to be performed in the future on the October 2009 event, the information that is already available clearly shows that it highlights once more that an effective management of the risk connect with heavy precipitation events is an absolute priority for the Sicily region.

References

Brunetti, M., Maugeri, M., Monti, F., Nanni T., 2006: Temperature and precipitation variability in Italy in the last two centuries from homogenised instrumental time series. Int. J. Climatol., 26, 345-381.

Brunetti M., T. Caloiero, R. Coscarelli, G. Gullà, T. Nanni, C. Simolo; 2012. Precipitation variability and change in the Calabria region (Italy) from a high resolution daily dataset. International Journal of Climatology, 32, 57-73, DOI: 10.1002/joc.2233.

Coles, S. (2001), An Introduction to Statistical Modeling of Extreme Values, Springer, London.

Hengl, T., 2009: A Practical Guide to Geostatistical Mapping, ISBN 978-90-9024981-0. Licensed under a Creative Commons Attribution-Noncommercial-No Derivative Works 3.0 license. Available at: http://spatial-analyst.net/book/.

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