Africa RiskView

Climate and Disaster Risk Solutions

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***Africa RiskView* is a software platform that aims to quantify and monitor weather-related food security risk in Africa. To date it focuses on drought, but inclusion of other weather risks is planned.**

Africa RiskView translates satellite-based rainfall information into near real-time impacts of drought on agricultural production and grazing. By overlaying this data with vulnerability information, the software also produces a first order estimation of the drought-affected population and, in turn response cost estimates. Through this process, *Africa RiskView* combines four well-established disciplines: crop monitoring and early warning; vulnerability assessment and mapping; humanitarian operational response; and, financial planning and risk management.

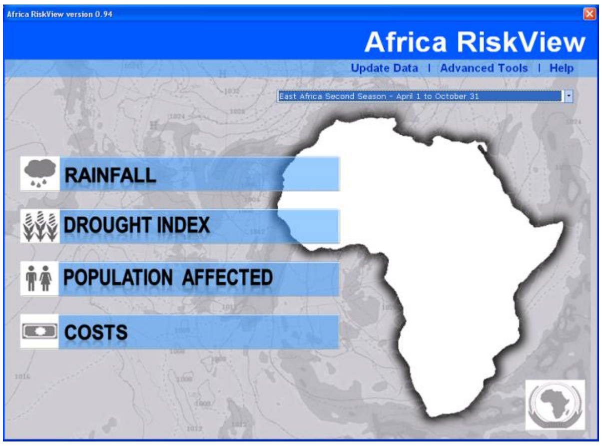


Fig.1: Africa RiskView – Main User Interface

Africa RiskView has the ability to prioritize and interpret different types of weather data and remote sensing products such as rainfall estimates and information about crops, soils and cropping calendars. These data are updated every ten days and fed into the software for each of the 261,135 satellite pixels (or squares of about 10 km^2 near the equator) covering Africa, and can be converted into meaningful indicators for agricultural production and for vulnerable populations dependent on rainfall for crops and rangeland.

Africa RiskView allows users to see how the rainfall season is evolving in the countries or regions of interest, observe weather impacts on agriculture and rangelands and estimate how many people could potentially be affected and in need of food assistance as a result. This information could help to target early food security assessments in specific geographic areas. The tool also allows users to look back in time at past rainfall seasons and observe how they could have impacted today's populations with today's response costs. Studying historical data can help with contingency planning and emergency preparedness for future shocks in the country. *Africa RiskView* might also be helpful in guiding planning and investment decisions aiming to enhance agricultural productivity or market development as outputs contain valuable information as to the spatial distribution of weather risk for crop production and the areas most suited for crop production. *Africa RiskView* incorporates data for drought hazard monitoring and analysis, e.g. rainfall data, WRSI as well as vulnerability data, for 32 countries at present (see fig.2). Users can choose between different regions and seasons (agricultural or pastoral):

East Africa
1st Agricultural Season (1 Feb - 20 Jul)
2nd Agricultural Season (1 Apr – 31 Oct)
3rd Agricultural Season (1 Sep – 30 Apr)
Rangeland

Southern Africa
Main Agricultural Season (1 Oct – 31 May)

Western Africa
Agricultural Season (1 Apr - 31 Oct)
Rangeland

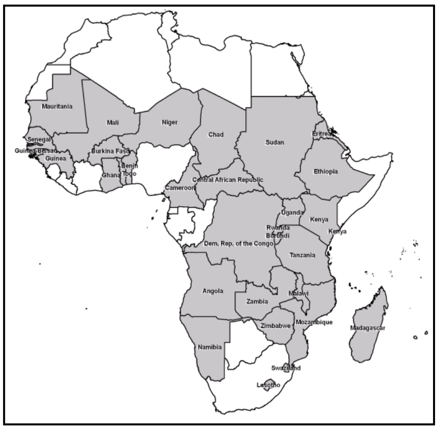
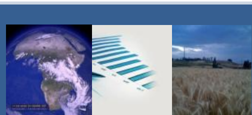


Fig.2: Africa RiskView coverage



Africa RiskView is designed to enable users to quickly access products concerning weather related food security risks for the areas in which they are interested. The software does this by allowing the user to select her or his region/season of interest, then access the products of the successive steps in the analytical process chain (Rainfall > Drought Index > Population Affected > Costs). (A brief overview of selected products follows.)

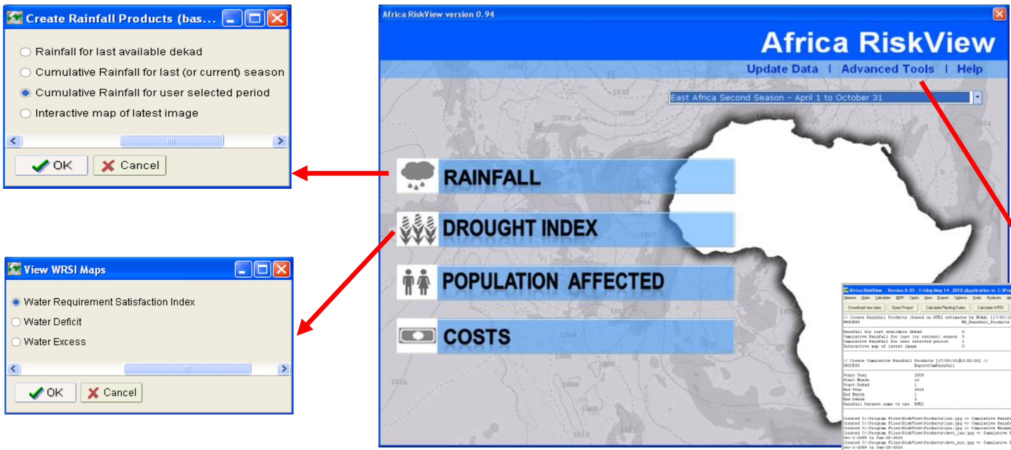


Fig.3: Main user interface and product menu examples of analytical sections

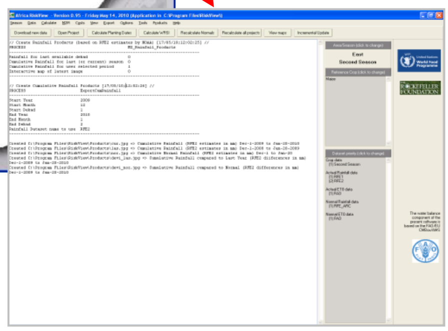


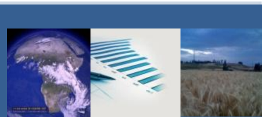
Fig.4: Advanced User Interface

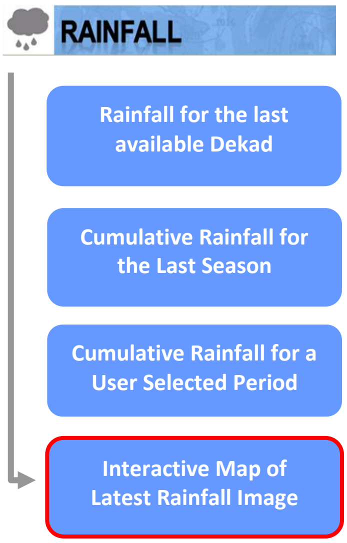
In addition, in order to take into account different levels of technical knowledge and respective needs of various users, a second more comprehensive interface is provided which can be accessed through the "Advanced Tools" button. This second interface allows users to view a broader range of products, change initial settings and input data.

Africa RiskView Products

After understanding how weather will affect food crops and pasture for livestock grazing, the next step is to define how these weather hazards interact with people vulnerable to food insecurity in order to convert information about the magnitude and spatial extent of weather shocks into an estimate of the number of people potentially affected by these shocks.

Africa RiskView does this by considering how peoples' income-generating activities are affected by weather to develop a standardized approach for estimating food insecurity related to weather hazards across the continent -- in particular drought --. WFP houses a repository of data, such as the Comprehensive Food Security and Vulnerability Analysis (CFSVA) surveys, historical operations data, population and vulnerability studies that contain information to inform, cross-check and refine this approach and the data used. Information about national capacities to respond to shocks and current costs of additional resources allow users to estimate response costs in today's dollar terms. *Africa RiskView* aggregates these costs over countries, providing decision-makers with expected and probable maximum costs of weather-related responses before an agricultural season begins and in near real time as the season progresses for every first-level administrative district for all countries in sub-Saharan Africa in which WFP has a presence. The estimated number of people potentially affected by drought in sub-Saharan Africa using the *Africa RiskView* methodology correlates at nearly 90% to the actual number of people assisted by WFP due to drought in emergency operations and protracted relief and recovery operations from 2000-2008.





In the rainfall analysis section, the user can choose between four different products as shown on the left. Rainfall images can be viewed on a dekadal (10-day) basis or as cumulative rainfall for selected periods. The user can view rainfall values for each 10 x 10 km pixel or generate and view rainfall trend graphs (Fig.6). The user can also export the data to Excel using her or his preferred boundary level (national, administrative unit level 1 or 2, CFSVA coverage layer).

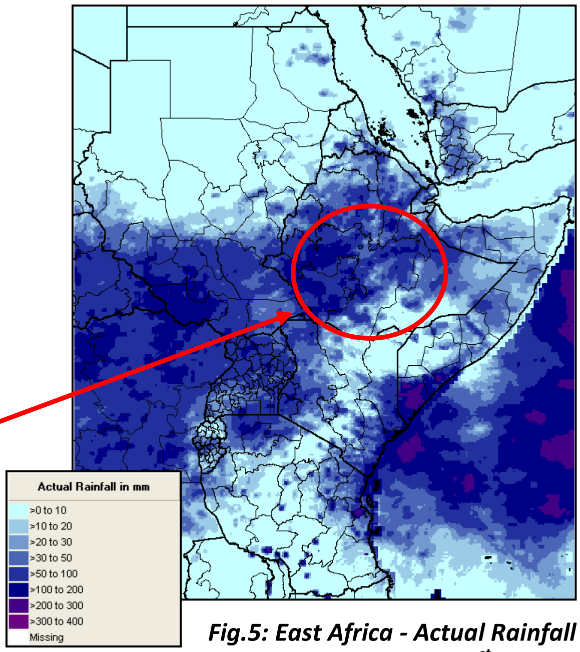


Fig.5: East Africa - Actual Rainfall (mm) image 2010 May 1st dekad

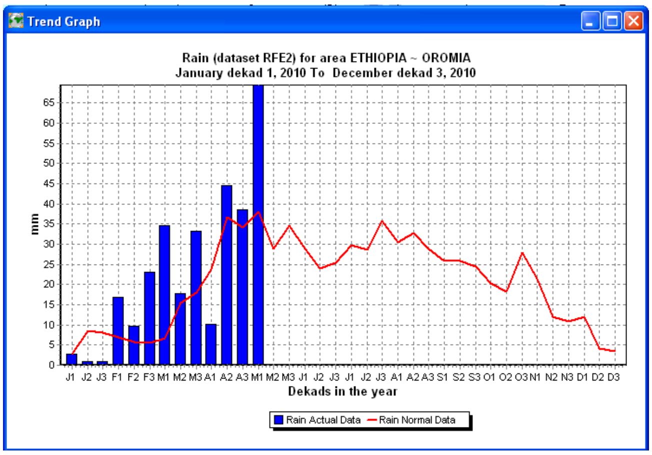


Fig.6: East Africa - Rainfall trend graph Oromia Region, Ethiopia aggregated at the 1st administrative level (2010 May 1st dekad)

Other functions allow the user to quickly compare actual rainfall to average (normal) or move backwards and forward through dekads or years.

Users can compare actual rainfall to the average by checking the “Compare to Normal” box on a rainfall image. This generates an image that enables the user to view, at pixel level, where the selected dekadal rainfall is below or above average as well as the extent of the deviation. Users can right-click on a particular pixel (or a 10 x 10km area near the equator) to access the rainfall trend graph (Figure 6).

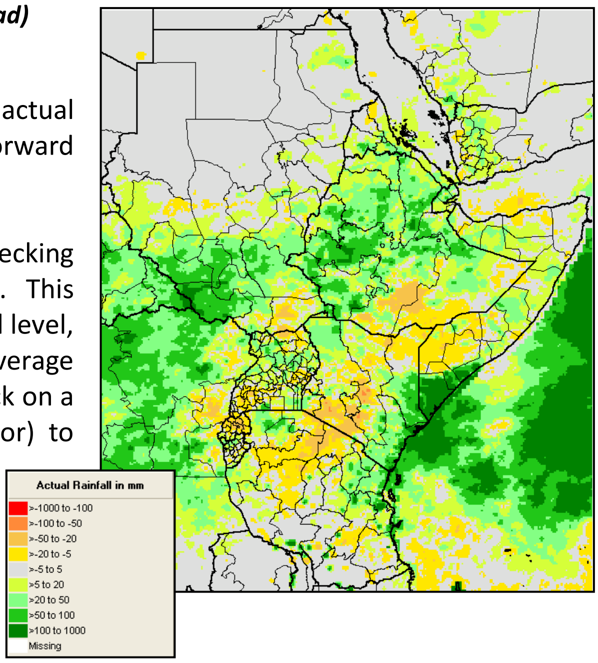
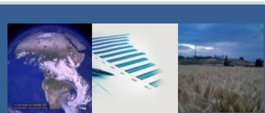
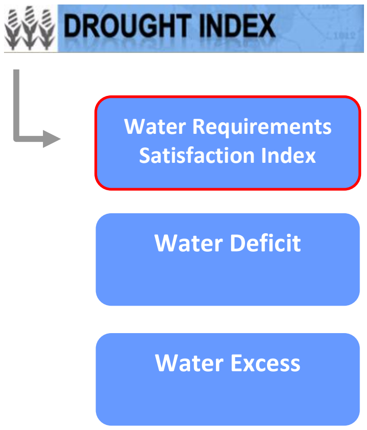


Fig.7: East Africa - Actual Rainfall (mm) 2010 May 1st dekad –“Compare to Normal”





In keeping with the team's philosophy of building on proven technologies, *Africa RiskView* uses the ***Water Requirement Satisfaction Index (WRSI)*** for rain-fed crop and rangeland drought analysis. Measuring total rainfall at the end of a season has proven to be too crude an indicator of potential impact of rainfall deficits on production and therefore on livelihoods.

WRSI is a simple water balance model developed by the Food and Agriculture Organization (FAO), which compares the amount of water available throughout the season to how much a plant needs in its different stages of growth and has been shown to relate better to crop yields. Using this simple and transparent crop model, *Africa RiskView* estimates water available to crops (rainfall minus water lost by soil evaporation and plant transpiration) and compares it to how much the plant needs on a dekad by dekad basis. The output of this water balance calculation is the Water Requirement Satisfaction Index (WRSI) for rain-fed crops and rangeland.

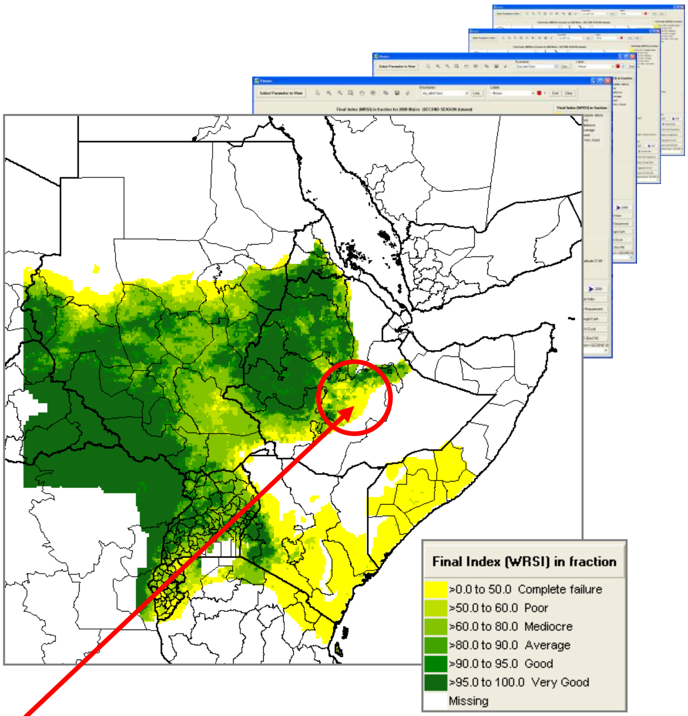
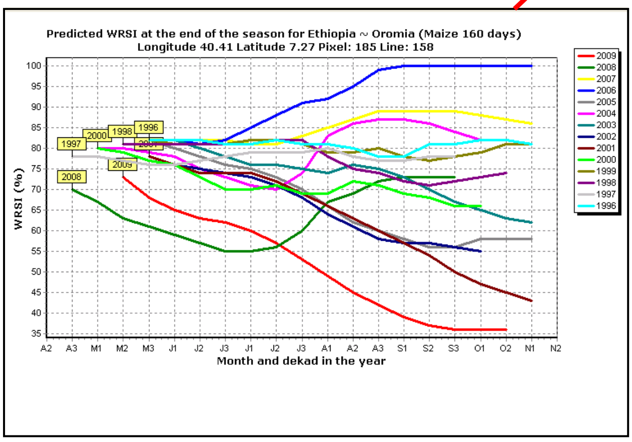


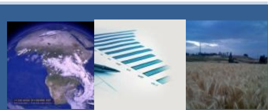
Fig.8: East Africa 2nd Season – Final Index WRSI 2009 for Maize

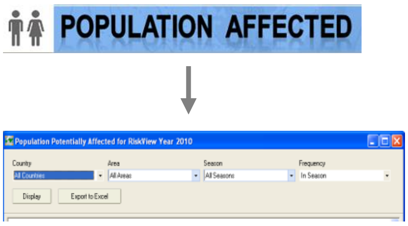


More specifically, WRSI is defined as the ratio of seasonal actual evapotranspiration experienced by a crop to the crop's seasonal water requirement. FEWSNET, the Joint Research Centre of the European Commission (JRC), and FAO all use the same methodology for calculating WRSI and consider the index a meaningful indicator of how a shortage of rainfall may impact crop yields and the availability of pasture by monitoring water deficits throughout the growing season, capturing the impact of timing, amount and distribution of rainfall. *Africa RiskView* uses FAO's algorithm and FEWSNET's model parameters to calculate WRSI.

Fig.9: Predicted End of Season WRSI Value – Pixel based analysis output for Oromia, Ethiopia

As in the rainfall analysis section "Compare to Normal" images can be generated in *Africa RiskView* in order to compare the WRSI index of the current season with the average of all years from 1995 onwards. A function called "In Season Analysis" can be used to predict End of Season WRSI values on a pixel basis allowing the user to interpret WRSI index values by comparing them to index values of the previous years (see above). This function is meant to allow users to quickly determine, at a disaggregated level and by comparing results to previous years, whether a certain area could experience an exceptionally good, average, or bad season.





To convert information generated by the drought index into number of people affected requires an understanding of how drought interacts with people's income-generating activities. The methodology to do so is simple, in line with the current information available and can be applied systematically across sub-Saharan Africa to include all countries where basic economic and household data exists. *Africa RiskView* divides the population within each administrative unit into various drought risk categories determined according to considerations on two dimensions: exposure and resiliency. Exposure to drought risk is defined by the weight of agricultural activities (in terms of production, casual labour and livestock) in the household's total annual income.

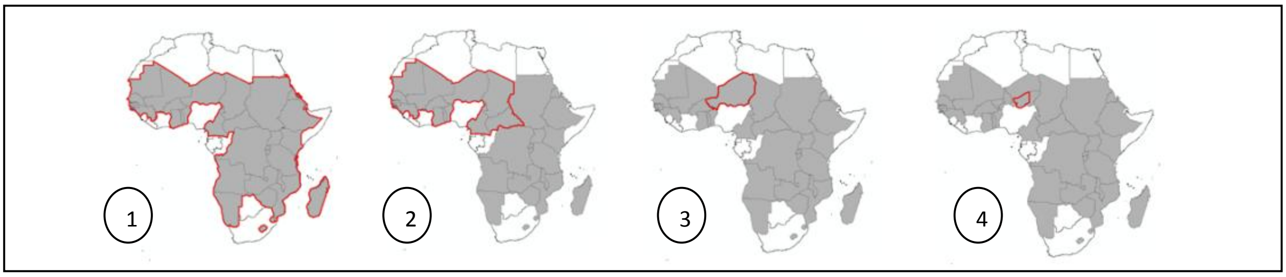


Fig.10: Options for geographical data aggregation: All Countries (1)/Regional (2)/Country (3)/Sub-National Area (4)

Resiliency is measured in terms of a household's distance from the poverty line. Given a drought event of a given magnitude in a particular area (defined through deviations in the drought index in that area) high-level estimates of the people potentially *directly* affected by drought can be generated not only at the end of the rainfall season, but also as the season evolves (as rainfall is reported). Estimates can be generated for each administrative level unit, country, region, season and across all countries using this standardized approach.

WFP has a vast operational response dataset against which triggers and assumptions have been tested to ensure the methodology accurately reflects drought events in the past and with the correct order of magnitude, taking into account changes in the underlying factors that impact populations and their vulnerability since those events. At the moment, the correlation between the estimated number of people potentially affected by drought and the historical operational response data is approximately 90% for all drought-related WFP operations from 2000-2008 in sub-Saharan Africa.

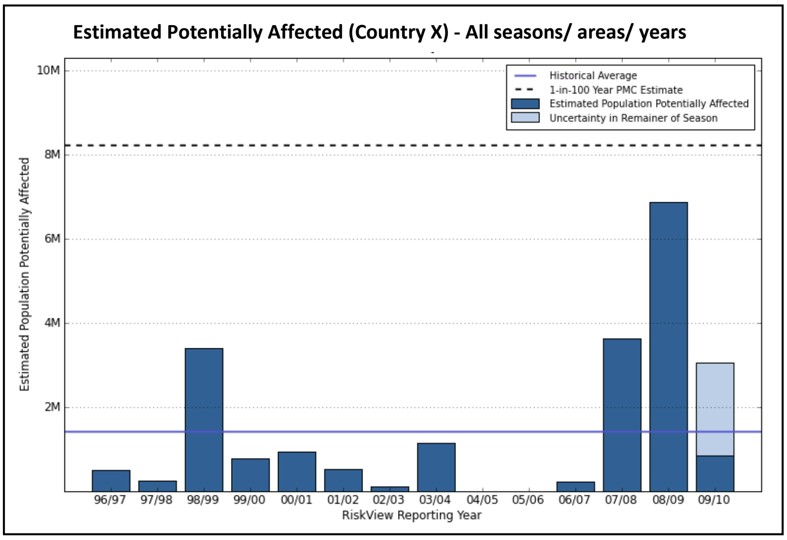
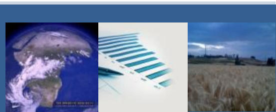


Fig.11: Estimated potentially affected population for Country X for all years and seasons

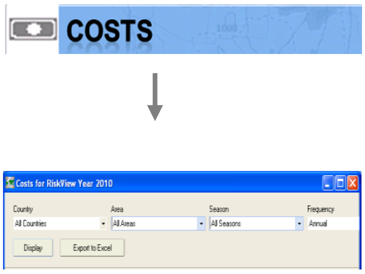
However the model does not correspond well to WFP data in all countries, particularly those that have not had drought-related Emergency Operations in the most recent 10 years or countries with complex emergencies although the recent drought events in the Sahel are captured well. Nevertheless, the model can be refined for those areas and shows promise in many of the countries where WFP is often called upon to assist with a drought response, e.g. Ethiopia, Kenya, Malawi. Using this starting point, the model is fully flexible and can be adapted, refined and strengthened for countries that may wish to use it so that it is customized to suit their needs.



Africa RiskView

Costs Analysis Layer - Product Example:

Estimated Response Cost by Country



Based on Population Affected data, *Africa RiskView* estimates the expected and potential (variable) response costs at the continental (sub-Saharan Africa only), regional, country and first administrative levels, given a selected cost per beneficiary input. This can be adjusted by the user to reflect the *current* cost of the appropriate food assistance response (e.g. food aid, cash vouchers). So, in addition to estimating people potentially affected, the model can estimate the potential operational costs for a given situation and a given type of response.

Estimated response cost forecasts during the current season can be visualized as shown in the example on the right (see fig. 12). The red line indicates the current expected cost estimated for the selected country. This line is calculated by taking the actual rainfall data up to the current date and then finishing the remainder of the season using rainfall data from all the historical years that are available. The last red point represents the average of all these possible future rainfall scenarios.

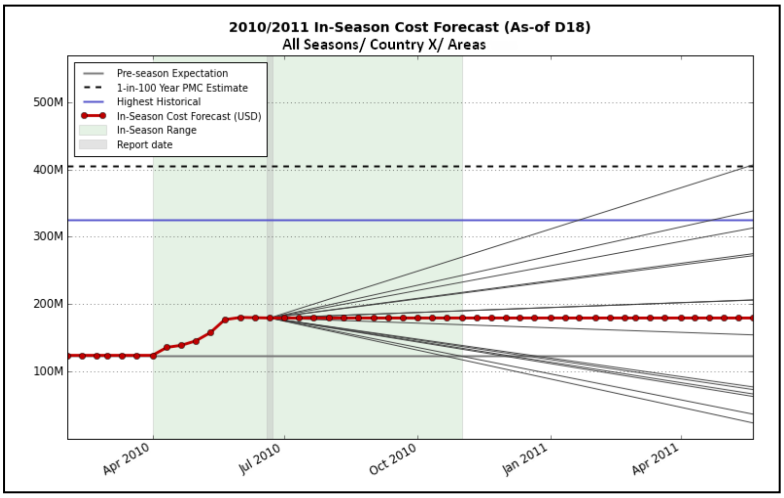


Fig.12: In season cost forecast for Country X, all seasons -2010/2011

Based on historical RFE data, various estimates of future costs from the present dekad onward are also shown through the various thin grey lines, which produce a "cone of uncertainty" around the current expected cost estimate. This allows users to see how the remainder of the season or the year could evolve and the uncertainty in the expected cost estimate. Eventually, seasonal forecasts will be incorporated into the software to adjust these cones given the information the forecasts contain. The value represented by the highest grey line, with the largest cost value, is reflected by the light blue bar in the annual charts.

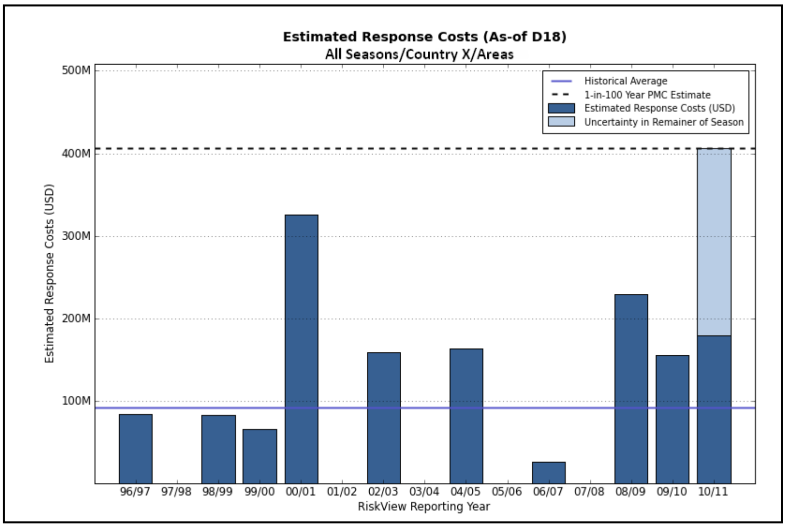


Fig.13: Estimated response costs for Country X for all years and seasons 1996-2011

To put the current year in context, the average (thick grey line) and worst case scenario costs estimate (dashed line) made at the beginning of the year/season (estimated from the historical data) are shown. When the rainfall season is finished there is no more uncertainty as to what happened (and no grey lines emanating from the last red point). Another product example as shown in fig. 13 are annual graphs of estimated response costs per country incorporating data of all seasons and years, not only to illustrate the evolution of the current year's costs, but also to contextualize it in the historical time-series.

Climate and Disaster Risk Solutions Team
Please feel free to contact us with any comments or questions.

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