



EN/ACTS

ENHANCED NATIONAL CLIMATE SERVICES

Weighted Anomaly Standardized Precipitation (WASP)

**Training Module
Tanzania
July 19, 2016
Version 1.0**



International Research Institute for Climate and Society (IRI), (2016). Weighted Anomaly Standardized Precipitation (WASP)- Tanzania. March 22, Version 1.0. Palisades: IRI.

This work is licensed under a Creative Commons Attribution-Non Commercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>) and may be adapted or reproduced with attribution to the IRI and for any non-commercial purpose.

Acknowledgements

The ENACTS team, wishes to thank all the individuals and institutions that contributed in the many ways to the preparation of this manual. The shared technical knowledge, experiences, and perspectives have produced a training module that will have a significant positive impact on the capability of strengthening the ENACTS tools in various East African countries.

Special thanks are extended to the IRI staff members who collaborated in the preparation of the different manuals: Dr. Pietro Ceccato, Luz Cervantes, John delCorral, Dr. Tufa Dinku, Igor Khomyakov, Aisha Owusu, Yohana Tesfamariam Tekeste and Dr. Madeleine Thomson.

The preparation of this manual would not have been possible without the support provided by our donors WHO - Global Framework for Climate Services and UK DfID WISER ENACTS and we extend sincere appreciation to our donors.

CONTENTS

1	Weighted Anomaly Standardized Precipitation (WASP) Training - Tanzania	1
1.1	Overview	1
1.2	Definition	1
1.3	Interpretation	1
1.4	Access	2
1.5	Case Study - Tanzania	2
1.6	Exercise 1 using Figure 1.2 - Tanzania	4
1.7	Exercise 2 - Tanzania and Baseline Years	4
1.8	Quiz	6
1.9	Summary	7
1.10	Reference(s)	7

WEIGHTED ANOMALY STANDARDIZED PRECIPITATION (WASP) TRAINING - TANZANIA

1.1 Overview

Why was it developed?

The Weighted Anomaly Standardized Precipitation (WASP) Tool was initially created by Climate Scientist, Brad Lyon, to monitor the spatial extent of tropical drought. It has since been modified for use in malaria impact assessments.

What can the WASP tool be used for?

1. Assessing drought at national, regional and local scale
2. Assessing changes in climate risk in baseline and intervention periods within climate sensitive sectors
3. Assessing changes in climate risk in baseline and malaria intervention periods
4. Visualizing extreme climate anomalies relative to baseline periods

What can the WASP tool NOT be used for?

1. Predicting epidemics
2. Obtaining estimates or predicting actual rainfall (e.g. in mm)

1.2 Definition

To compute the WASP index, monthly rainfall departures from the long-term average (here, 1981-2010) are obtained from the ENACTS rainfall database and then standardized by dividing by the standard deviation of monthly precipitation. The standardized monthly anomalies are then weighted by multiplying by the fraction of the average annual rainfall for the given month. Area averages are created according to the shape files available. In this example, shape files are created by administrative boundaries at the district, regional and country level. Thus the WASP tool does not give you the actual rainfall (e.g. in mm), but rather how rainfall varies from the baseline average over time.

1.3 Interpretation

For the WASP plot, green shades indicate conditions that are wetter than the average for the baseline period brown shades indicate conditions that are drier than the average. Anomalies that are greater than 1.5 standard deviations may be considered extreme relative to the baseline period. Note some extreme anomalies may persist over multiple years. (Please refer to Figure 1.1 in the following section.)

1.4 Access

The WASP Tool in Tanzania can be accessed via the Health Maproom at <http://maproom.meteo.go.tz/maproom/Health/WASP/index.html>. Here you can also find brief text and instructions on how to generate graphs for particular regions, provinces, and districts.

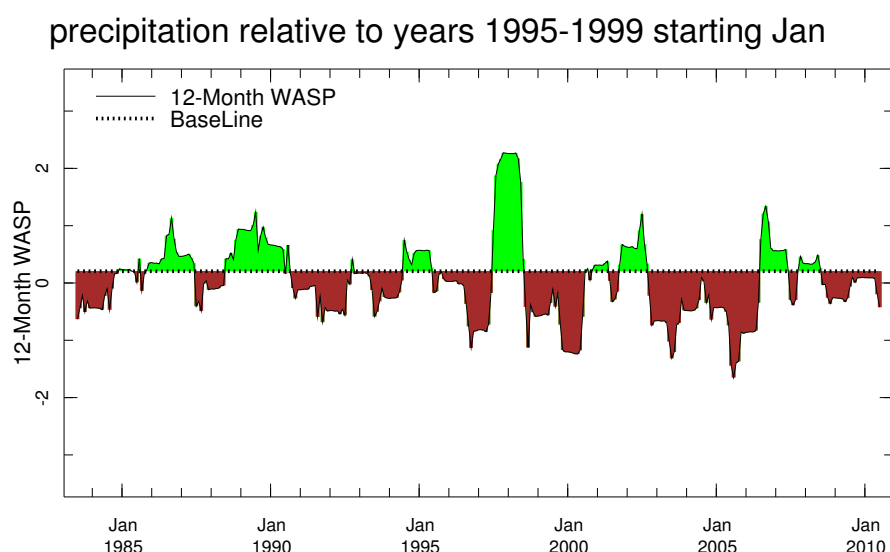


Fig. 1.1: Time series of 12-month Weighted Anomaly Standardization Precipitation (WASP) index relative to a baseline period for Tanzania

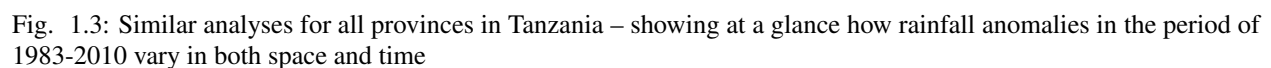
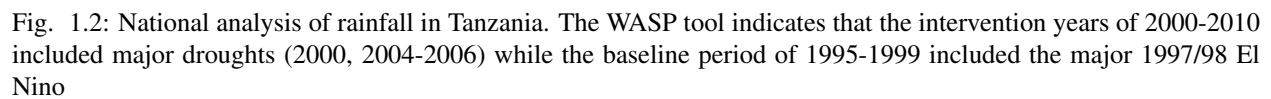
1.5 Case Study - Tanzania

Tanzania is located in Eastern Africa. It has a very varied geography – extending from the Indian Ocean coastline in the East - to the humid Lake Victoria region in the West. Most of the country has a tropical climate with cooler regions, limited to the highland areas associated with Tanzania’s volcanic mountain range (including Kilimanjaro) in the northwest and the highland plateau in the south central region.

In Tanzania, the relationship between malaria and climate is significant and varies across the country. Climatically, temperature is extremely important in highland areas in the northwest and south central regions, whereas rainfall can be significant across the entire country, but especially in the central semi-arid regions.

Central to malaria interventions and impact assessments is the concept of a baseline year or baseline period against which changes in outcomes can be measured. For example, if the climate risk for malaria in the baseline period was unusually severe then achieving change relative to that baseline is relatively easy. Using the WASP tool, it is possible to explore changes in rainfall integrated over time and over a specified region for both a baseline and intervention period. Where temperature is not a constraint to malaria transmission, this tool may provide a good estimate of climate risk for malaria. Figure 1.2 shows a WASP calculation for Tanzania using the baseline period of 1995-1999, and an intervention period of 2000-2010. Figure 1.3 expands the analysis to the whole country.

As mentioned before Fig 1.2 depicts the major interventions that occurred in Tanzania from 2000-2010. From the graph we can also observe the impact of the first medium - term strategic plan for 2002-2007 that was implemented by NMCP, as well as the second medium - term strategic pan for 2008-2013 which pushed for an even higher malaria intervention coverage for the national population (Smithson et al, 2015).



1.5.1 Case Study Conclusions

The WASP tool, using regularly updated ENACTS rainfall products for Tanzania, provides high quality climate information for pre- and post-intervention efforts at different spatial scales (e.g. district, province, country).

From the results, it is clear that the baseline period included the 1997/98 El Niño, when epidemics of malaria were widespread in Tanzania.

In contrast, drought persisted in Tanzania through much of the intervention period of 2000-2010. However, major scale-up of interventions occurred post 2005 – after the most severe droughts had occurred (2000, 2003, 2005). If 1995-1999 is used as a baseline, there is a high risk that impact assessments for the period of 2000-2010 will overestimate the impact of interventions if climate is not taken into account.

1.5.2 Case Study Summary

In Tanzania the relationship between malaria and rainfall is significant and varies across the country with (1) temperature important in highland areas in the northwest and south central regions and (2) rainfall playing a significant role across the country especially in the semi-arid regions. In these regions, analysis of malaria and climate must be undertaken at multiple scales to account for local complexity.

1.6 Exercise 1 using Figure 1.2 - Tanzania

Q1. Which choice of baseline has the highest risk of overestimating the impact of interventions during the 2000-2010 period?

Q2. Was 2000 an unusually dry or wet year compared to the entire time series?

Q3. Which was the wettest year in the time series (BONUS: What teleconnection was it associated?)

1.6.1 Exercise 1 - Answers

A1: 1995-1999

A2: Dry

A3: 1997, El Niño

1.7 Exercise 2 - Tanzania and Baseline Years

As year-to-year variability in rainfall is high and can have a considerable impact on short-term changes in malaria transmission in some regions, the choice of baseline year(s) for malaria impact assessment may significantly affect the assessment. See Figure 1.4.

Figure 1.4 shows that if the baseline year (or period) was unusually favourable or unfavourable (e.g. wet or dry; warm or cool) for the particular malaria outcome, then achieving change relative to that baseline year (or period) may be confounded. For example, if interventions follow an unusually high (e.g. wet and/or warm) baseline year and malaria incidence declines, it may be tempting to attribute all of the decline in malaria outcomes to the interventions – thereby and inadvertently, overestimating their effectiveness.

However, as the climate varies over time, it is likely that malaria incidence will at some point reverse, and cases may increase as a result of a more favourable climate. If climate is not factored into the equation, then the increase in case numbers may be inappropriately attributed to programme failure or other factors.

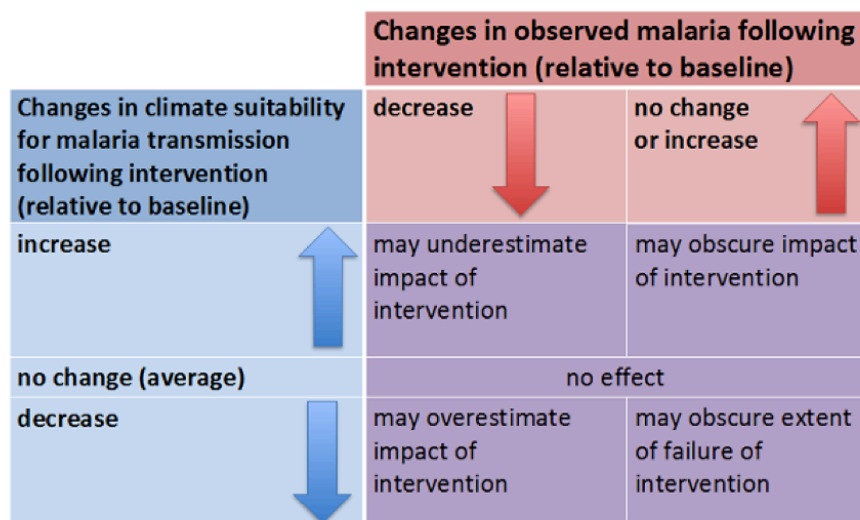


Fig. 1.4: Possible impacts of climate suitability for malaria transmission on efforts to reduce malaria incidences.

Please perform the following exercises:

E1. Generate the WASP figure for the Kisarawe district in Tanzania using 1995-1999 as a baseline period, starting in Jan (see Figure 1.5).

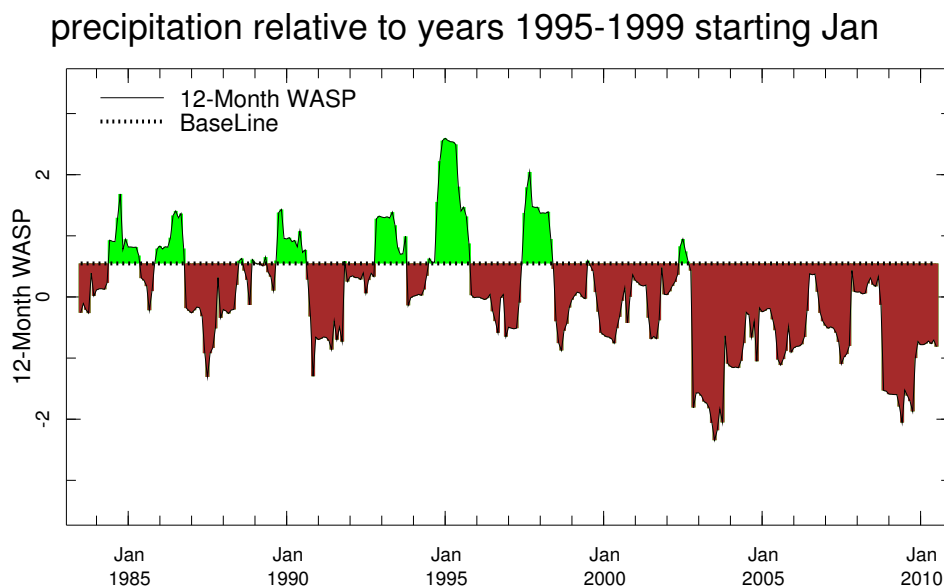


Fig. 1.5: WASP precipitation relative to years 1995-1999 starting Jan (baseline period) for the Kisarawe district in Tanzania

E2. Generate the WASP figure for the Kisarawe district in Tanzania using 2000 as the baseline period, starting in Jan (see Figure 1.6).

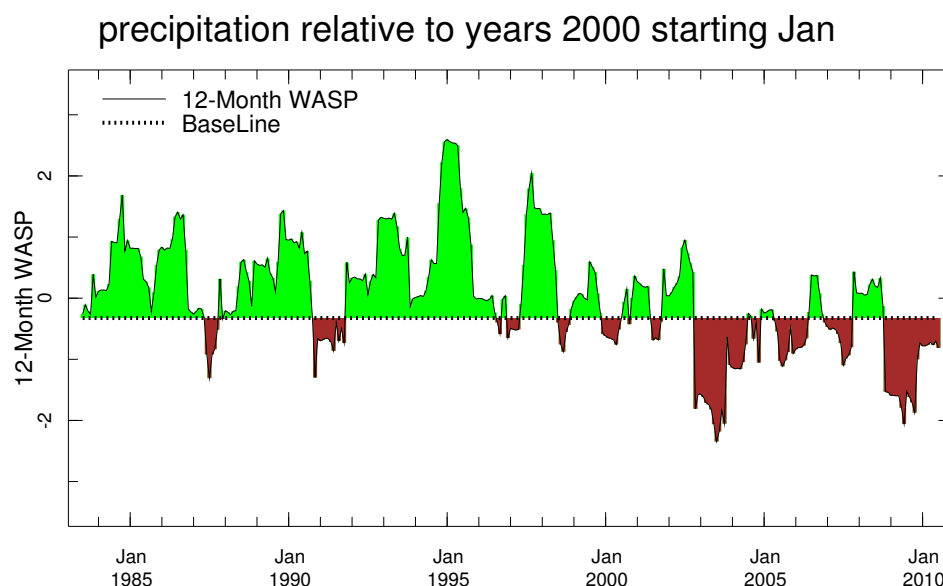


Fig. 1.6: WASP precipitation relative to year 2000 starting Jan (baseline period) for the Kisarawe district in Tanzania

1.8 Quiz

Please answer the following questions:

- Q1. WASP stands for Weighted Average Standardized Precipitation. (T/F)
- Q2. Rainfall variability is MOST likely to confound malaria impact assessments in: a) semi-arid regions b) highland regions c) humid regions
- Q3. If climate suitability for malaria is higher in the baseline year(s) than in the intervention period, malaria impact assessments may overestimate the impact of interventions. (Y/N)
- Q4. The WASP tool can be used to predict rainfall related to epidemics. (T/F)
- Q5. The WASP tool can be used for impact assessments for climate sensitive outcomes other than malaria. (T/F)
- Q6. The WASP tool can be used to describe anomalies in rainfall amount in mm. (T/F)

1.8.1 Quiz - Answers

- A1: True, WASP stands for Weighted Average Standardized Precipitation.
- A2: a) rainfall variability plays a significant role across the entire country, but especially in the semi-arid regions.
- A3: True, per Figure 1.4, if climate suitability for malaria is higher in the baseline year(s) than in the intervention period, malaria impact assessment may overestimate the impact of interventions.
- A4: False, as mentioned previously, the WASP tool CANNOT be used to predict rainfall nor can it be used to predict epidemics.
- A5: True, the WASP tool can be used for impact assessments for climate sensitive outcomes and sectors related to agriculture, energy, biodiversity, etc.
- A6: False, the WASP tool describes anomalies in rainfall as in index and not as a metric units.

1.9 Summary

WASP is a simple tool for use in malaria impact assessment and possible outcomes. It enables the user to assess whether rainfall during a baseline and intervention period is likely to have (1) overestimated or underestimated the impact of the intervention or (2) obscured the extent of the success or failure of the intervention.

1.10 Reference(s)

- Aregawi, M., M. Lynch, R. Cibulskis, W. Bekele, H. Kebede, D. Jima, H. Solomon, t. Meseret, A. Yenchun, A. Lilay, R. Williams, M. Thomson, F. Nafo-Traore, K. Admasu, T. A. Gebreyesus and C. M. (2014). “Measure of trends in malaria cases and deaths at hospitals, and the effect of antimalarial interventions, 2001–2011, Ethiopia.” PLoS One.
- Dinku, T., A. Kanemba, B. Platzer and M. C. Thomson (2014). “Leveraging the Climate for Improved Malaria Control in Tanzania”. IEEE. <http://www.earthzine.org/2014/02/15/leveraging-the-climate-for-improved-malaria-control-in-tanzania/>
- Florey, L., S. R. Salgado, C. L. Hershey, H. Masanja, A. Bhattarai, A. Mwita, P. D. McElroy and TMIERG. (2015). “Impact of Malaria Control on Mortality and Anemia among Tanzanian Children Less than Five Years of Age, 1999–2010.” PLoS One 10.1371/journal.pone.0141112. 10.1371/journal.pone.0141112
- Lyon, B. (2004). “The strength of El Niño and the spatial extent of tropical drought.” Geophysical Research Letters 31(L21204).
- Smithson, P., L. Florey, S. R. Salgado, C. L. Hershey, H. Masanja, A. Bhattarai, A. Mwita, P. D. McElroy and TMIERG. (2015). “Impact of Malaria Control on Mortality and Anemia among Tanzanian Children Less than Five Years of Age, 1999–2010.” PLoS One 10.1371/journal.pone.0141112. 10.1371/journal.pone.0141112
- Thomson, M. C., F. Zdravetz, B. Lyon, G. Mantilla, D. Willis, P. Ceccato and T. Dinku (2012). “President’s Malaria Initiative-USAID Report: Development of Climate Analysis Section for the President’s Malaria Initiative Impact Evaluation: Reports for Ethiopia and Tanzania”. IRI. 62pp. Palisades, New York.
- TMIERG (2012). “Evaluation of the Impact of Malaria Interventions on Mortality in Children in Mainland Tanzania”. 114.