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Seasonal Analysis Using Tourism Climate Index of Major Tourist Places of Ethiopia

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Abstract: Ethiopia is the cradle of mankind and civilization endowed with unique historical and archaeological sites, national parks with many endemic animal and plant species; encyclopedia magnificent natural landscapes; obelisks and castles, more than 200 rock hewn and rock cave churches; intangible cultural and spiritual heritages. However, the tourism industry in the country is still in its infancy stage. Climate is the most important factor for the development of tourism industry. The objective of this study is to investigate the climate suitability for tourism in Ethiopia using Mieczkowski's Tourism Climate Index. The data of maximum daily temperature; minimum daily relative humidity; mean daily temperature; mean daily relative humidity; total precipitation; total hours of sunshine; and average wind speed for 30 years (1971-2000) sourced from CLIMAT-2.0 for CROPWAT collected by Food and Agricultural Organization(FAO) from metrological stations were used. The tourism climate index was calculated using ArcGIS 10.2 from 16 major tourist destination areas. As per the Mieczkowski`s classification, it was found that tourist destinations in the country range from Marginal (40-49) to Ideal (90-100). For tourist destinations in and around: Addis Ababa Oct, Nov, Dec, Jan (excellent); Arba-Minch Jun and Aug (excellent), Asaita Jun and Dec (Very good); Awash Jan, Nov and Dec(Very good); Axum Oct, Nov, Dec and Jan (ideal); Bahir-Dar Jan, Feb, Mar, Oct, Nov and Dec (excellent); Dallol Jan, Feb, Oct, Nov and Dec(excellent); Debre-Berhan Jan, Feb, Mar, Apr, May, Jun, Oct, Nov and Dec(excellent); Debre-Zeyt Jan, Feb, Mar, Oct, Nov (Excellent) and Dec (ideal); Robe Jan, Feb and Dec (excellent); Gondar Jan, Mar, Apr (excellent), Feb, Oct, Nov and Dec (ideal); Harar Feb, Mar, Apr, May, Jun, Oct (excellent), Jan, Nov and Dec (ideal); Jinka Dec (excellent); Konso Apr, May, Jul, Aug, Sep, Oct, Nov, Dec (excellent) and Jun (ideal); Lalibela Mar and Apr (excellent), Jan, Feb, Oct, Nov and Dec (ideal); Wukro Mar, May and Jun (excellent), Jan, Feb, Apr, Sep, Oct, Nov and Dec (ideal) are favorable seasons to visit. Except some of the areas with some months indicated in the study, the climatic condition of the country is very favorable for tourists coming from every corner of the world.

Keywords: Tourism Climate Index, Tourism, climate, Climatic Suitability for Tourism

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I. INTRODUCTION

Tourism has become one of the largest global economic sectors in the world and contributes significantly to national and local economies (Berrittella, Bigano, Roson, and Tol, 2006; United Nations World Tourism Organization, 2009). As one of the largest industries in the world, tourism is directly responsible for an estimated 5% of the world's gross domestic product, 6% of total exports, and more than 8% people employed worldwide (UNWTO, 2012a), and accrues huge economic benefit to almost all countries of the world (World Tourism Organization, 2008).

Geographical location, topography, weather and climate are major factors that influence decisions regarding areas to be visited (Matzarakis, 2006). With its close connections to the environment and climate, tourism is considered to be a highly climate-sensitive economic sector similar to agriculture. Indeed, climate change is influencing decision-making in the tourism sector (United Nations Environmental Program, 2008; UNWTO, 2008; WMO, 2009).

Various studies reveal that there is a close relationship between climate and tourism in which climate has an influence on tourist motivation and destination choice particularly for climate-dependent destinations (Mintel, 1991; Ryan and Glendon, 1998; Wilton and Wirjanto, 1998; Maddison, 2001; Elsasser and Burki, 2002; Lise and Tol, 2002; Fukushima, Kureha, Ozaki, Fujimori, and Harasawa, 2002; Burki, Elsasser, Abegg and Koenig, 2005; Hamilton, 2005).

It is a fact that weather and climate are interconnected with tourism/recreation in various ways, and, as such, tourists, tour organizers, travel agencies, tourism planners and stakeholders need to be reliably informed about the role of weather and climate (Zaninovic and Matzarakis, 2009).

Climate and weather are factors that may increase or decrease the attractiveness of a specific tourism destination. They may also constitute risk factors, through air pollution, extreme temperatures, storms, etc. (Shih, Nicholls and Holecek, 2009). Many climatic variables namely air and water temperature, sunshine duration and intensity, long wave radiation, rainfall and wind speed affect tourist activities. For the tourism sector, the impact of climate change was claimed to pose a greater risk than the threat of terrorism (Rashid and Robinson, 2010).

An index approach is useful for measurement and evaluation of the impacts of climatic variables on tourism because of the multifaceted nature of weather and the complex ways that weather variables come together to give meaning to climate for tourism (Farajzadeh and Matzarakis, 2009).

Tourism climate index (TCI) evaluates the climatic feature in relation to the quality of tourism. In general, this index shows whether the combination of different climatic features at a specific time can be suitable for tourists and travelers (Mieczkowski, 1985).

Ethiopia is a land of plentiful remarkable and magnificent tourism attractions found in different parts of the country. The exceptional combination of historical, cultural, and natural attractions marks the country as a unique tourist destination in East Africa (Ministry of Culture and Tourism, 2009). The country attracts especially those informed about its affluent history, astounding historical monuments and shrines, and its religious and cultural diversity. The country is the cradle of mankind and civilization endowed with unique historical and archaeological sites, national parks with many endemic animal and plant species; encyclopedia magnificent natural landscapes; obelisks and castles, more than 200 rock hewn and rock cave churches; intangible cultural and spiritual heritages. Till date the country has registered nine tangible (in 1978 St Lalibela Rock Hewn Churches and Semien Mountain National Park; Fasil-Gibi (the castles of Gondar) in 1979, in 1980 Axum, Tiya, Lower Awash Valley and Lower OmoValley; in 2006 The Walled City of Harar; in 2011 Konso Cultural Landscape) and three intangible cultural heritages (in 2013 MeskelDemera; in 2015 Fichee-Chambalaalla, New Year festival of the Sidama people; and in 2016 Gedda System) in United Nations Educational Scientific and Cultural Organizations (UNESCO).

Having many tourist attraction sites, the tourism industry in the country is still in its infancy stage. Many factors are responsible for the under development of tourism sector in the country. Tourists are very sensitive to climate and weather conditions. Before their departure from the place of residence, the first thing come to their mind is weather condition of the area to be visited. Being found in tropics, people think that Ethiopia is having a very harsh climatic condition which is not conducive for tourists. Hence, this study gives attention to investigate whether the climatic condition of the country is suitable for tourism or not. Therefore the objective of this study is to investigate the climate suitability for tourism in Ethiopia using Mieczkowski's (1985) Tourism Climate Index.

II. MATERIALS AND METHODS

Data source and types used

Data used for computing tourism climatic index are maximum daily temperature; minimum daily relative humidity; mean daily temperature; mean daily relative humidity; total precipitation; total hours of sunshine; and average wind speed.

This study used CLIMWAT -2.0 database for monthly climatic data of 170 weather stations from the whole Ethiopia but 16 towns were selected based on the proximity and availability of many tourist sites in and around. These places are Addis Ababa, Arba Minch, Asaita,Awash, Axum, Bahir Dar, Dallol, Debre Birhan, Debre Zeyt, Robe, Gondar, Harar, Jinka, Konso, Lalibela, and Wukro. The database was created by FAO team covering the time period of 30 years (1971-2000). The data in excel format was transformed to raster format with interpolation using Inverse Distance Weight (IDW) model.

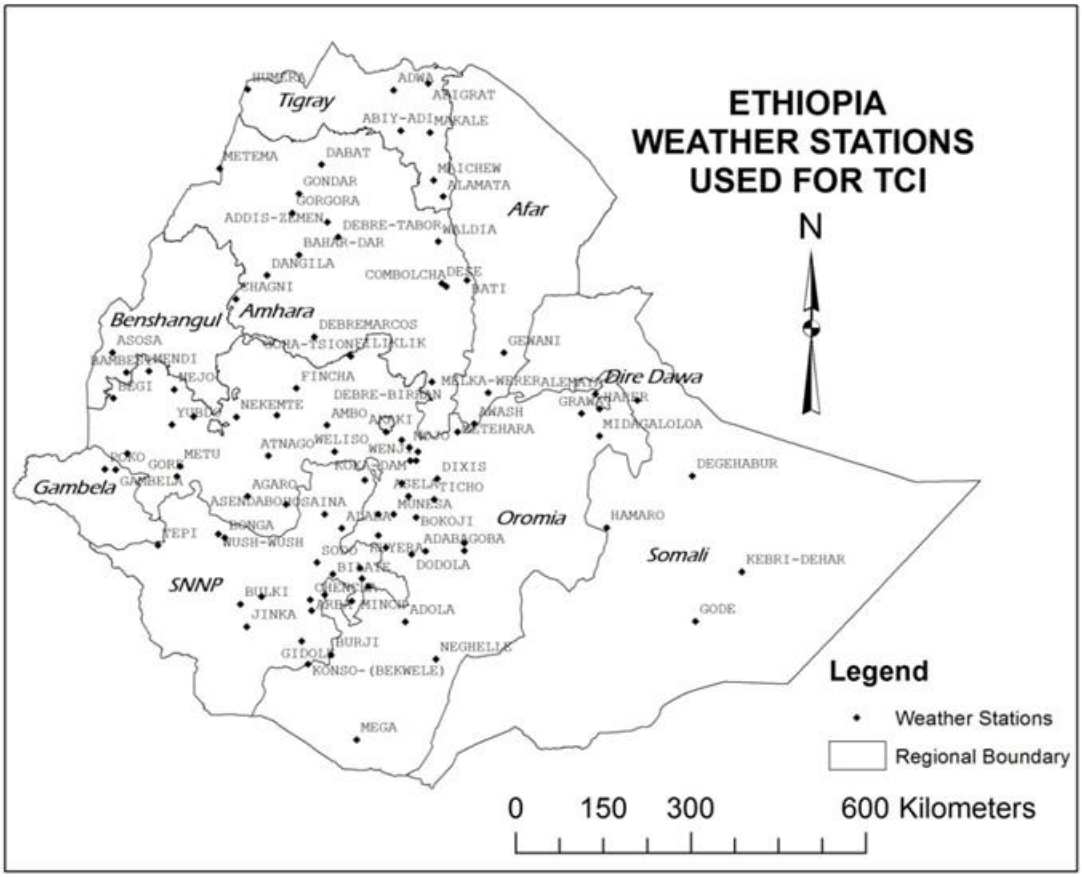

Figure 1: Weather stations used for climate data analysis (Source: *CLIMAT-2.0, 1971-2000)*

Method of Data Analysis

In this study tourism climate index was calculated using tourism climate index (TCI) developed by Mieczkowski. This index systematically assesses climatic conditions for tourism using different climatic factors. Having all the required data, computations done based on Mieczkowski method.

In this method all considered index compute the specific value to display the climate suitability and then all computed indices combined in a final equation 1.

TCI = 2*(4CID + CIA + 2P + 2S + W)…….Eq.1

Tourism Climate Index (TCI) is calculated using The Daytime Comfort Index (CID), which is a combination of maximum daily temperature and minimum daily relative humidity to assess the level of daytime climate conditions when maximum tourists' activities occur (40%); The Daily Comfort Index (CIA), a combination of mean daily temperature and mean daily relative humidity to assess the thermal comfort over the 24 hours including sleeping hours (10%); variables like Precipitation (P) and Sunshine (S) given20% each.Whereas Wind Speed was given 10%.

Table 1: Rating Categories of Tourism Climate Index (TCI)

TCI score	**Descriptive category**
90 -100	Ideal
80 - 89	Excellent
70 - 79	Very good
60 - 69	Good
50 - 59	Acceptable
40 - 49	Marginal
30 - 39	Unfavorable
20 - 29	Very unfavorable
10 - 19	Extremely unfavorable
9 to -9	Impossible
-10 to -30	Impossible

Source: Mieczkowski (1985)

Table 2: Tourism Climate Index rating scheme

Rating	Effective temperature (°C)	Mean monthly precipitation (mm)	Mean monthly sunshine (h)	Wind speed (km/h)
5.0 ≥	20-26	0.0-14.9	10	<2.88
4.5	19;27	15.0-29.9	9-10	2.88-5.75
4.0	18;28	30.0-44.9	8-9	5.76-9.03
3.5	17;29	45.0-59.9	7-8	9.04-12.23
3.0	16;30	60.0-74.9	6-7	12.24- 19.79
2.5	10-15;31	75.0-89.9	5-6	19;8-24.29
2.0	5-9; 32	90.0-104.9	4-5	24.30-28.79
1.5	0-4;33	105.0-119.9	3-4	28.80-38.52
1.0	-5-(-1);34	120.0-134.9	2-3	-
0.5	35	135.0-149.9	1-2	-
0	>36;-10- (-6)	>150.0	0-1	>38.52

Source: Mieczkowski (1985)

III. RESULTS AND DISCUSSION

As per the Mieczkowski`s classification, the results of this study shows that tourist destinations in the country range from Marginal (40-49) to Ideal (90-100).

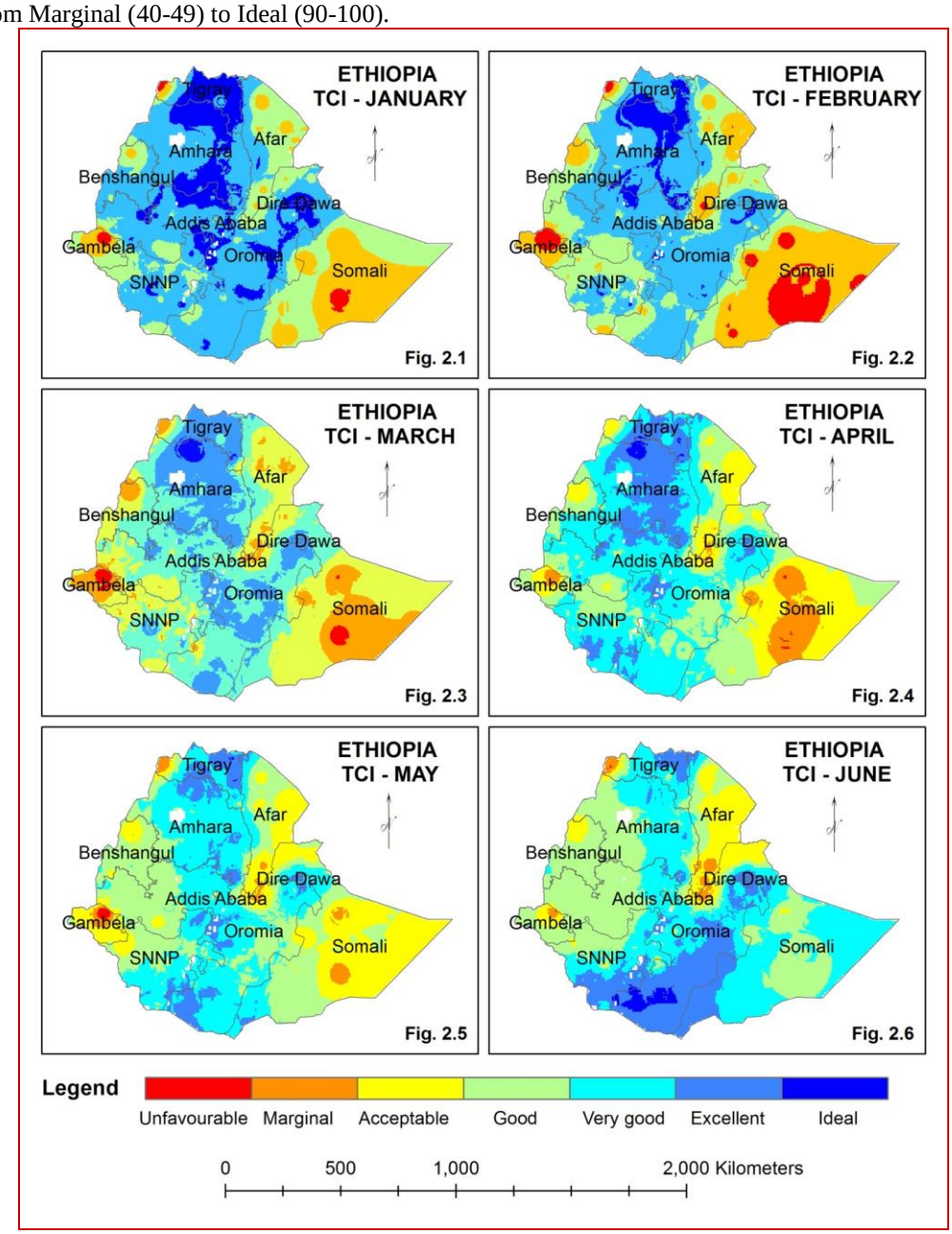

Figure 2: TCI values in Ethiopia (January-June) Own (source: Computed from *CLIMAT-2.0, 1971-2000)*

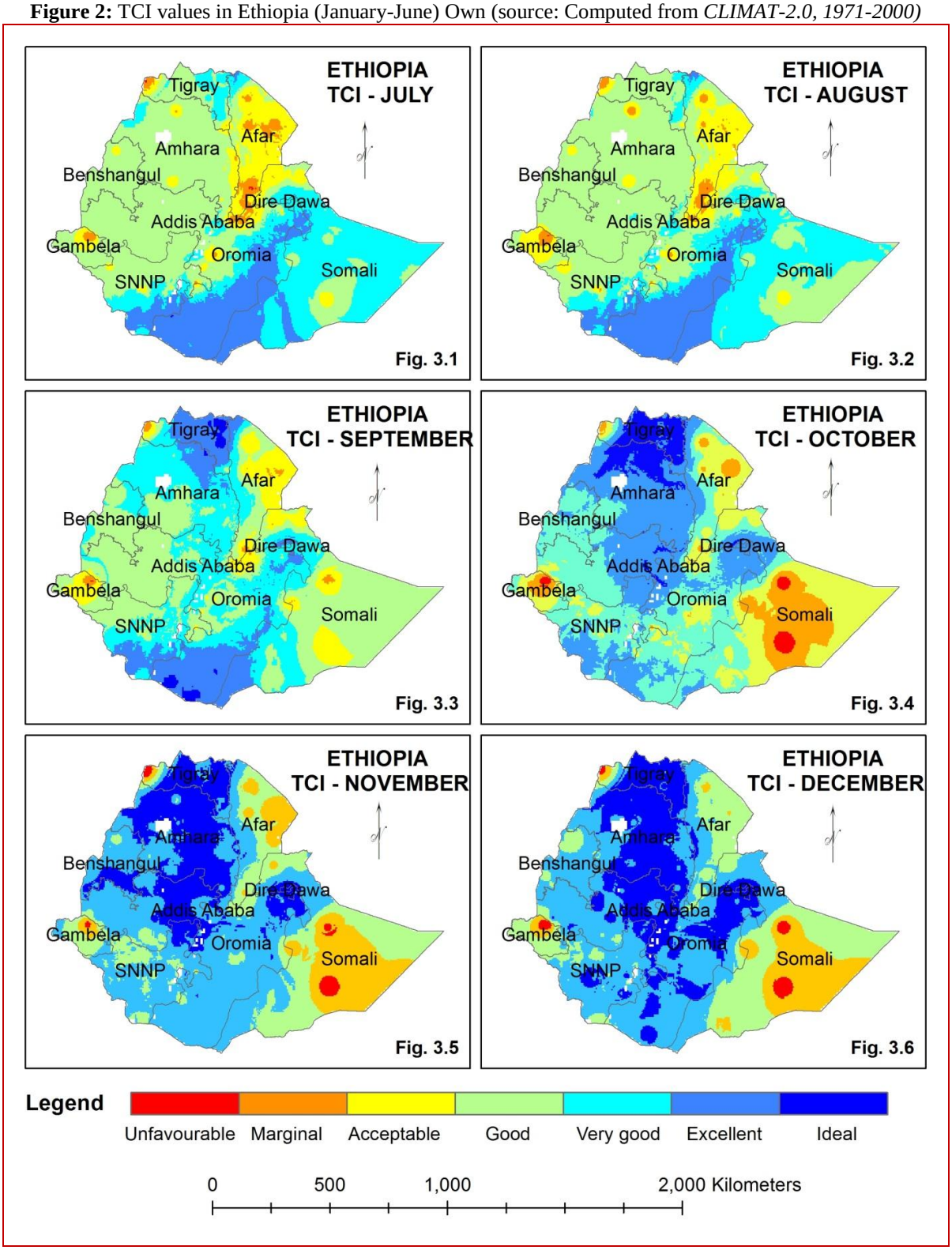

Figure3: TCI values in Ethiopia (July-December) Own (source: Computed from *CLIMAT-2.0, 1971-2000)*

For tourist destinations in and around: Addis Ababa Oct, Nov, Dec, Jan (excellent); Arba-Minch Jun and Aug (excellent), Asaita Jun and Dec (Very good); Awash Jan, Nov and Dec (Very good); Axum Oct, Nov, Dec and Jan (ideal); Bahir-Dar Jan, Feb, Mar, Oct, Nov and Dec (excellent); Dallol Jan, Feb, Oct, Nov and Dec(excellent); Debre-Berhan Jan, Feb, Mar, Apr, May, Jun, Oct, Nov and Dec(excellent); Debre-Zeyt Jan, Feb, Mar, Oct, Nov (Excellent) and Dec (ideal); Robe Jan, Feb and Dec (excellent); Gondar Jan, Mar, Apr (excellent), Feb, Oct, Nov and Dec (ideal); Harar Feb, Mar, Apr, May, Jun, Oct (excellent), Jan, Nov and Dec

(ideal); Jinka Dec (excellent); Konso Apr, May, Jul, Aug, Sep, Oct, Nov, Dec (excellent) and Jun (ideal); Lalibela Mar and Apr (excellent), Jan, Feb, Oct, Nov and Dec (ideal); Wukro Mar, May and Jun (excellent), Jan, Feb, Apr, Sep, Oct, Nov and Dec (ideal) are most favorable seasons for tourists to visit tourist sites.
The graphical representations of the sites are depicted below.

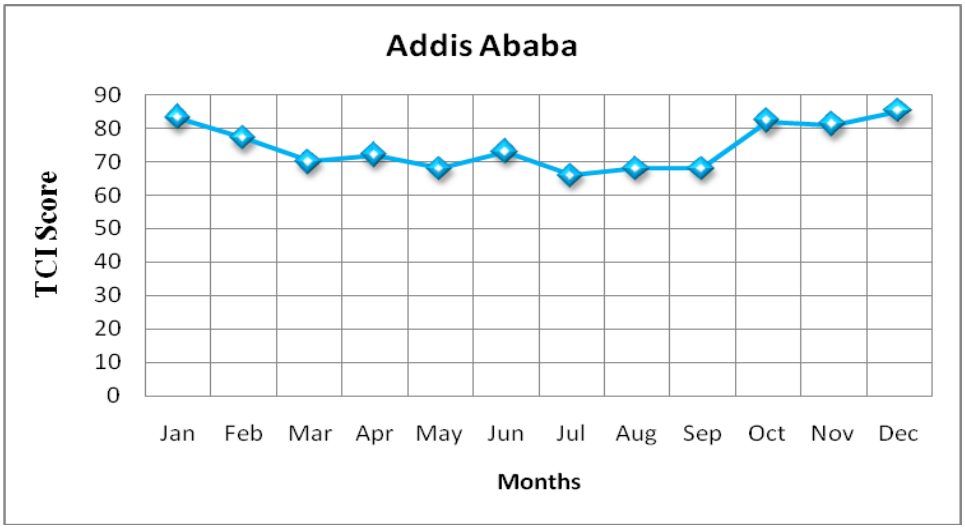

Figure 4: TCI of Addis Ababa (Computed by Authors, 2017)

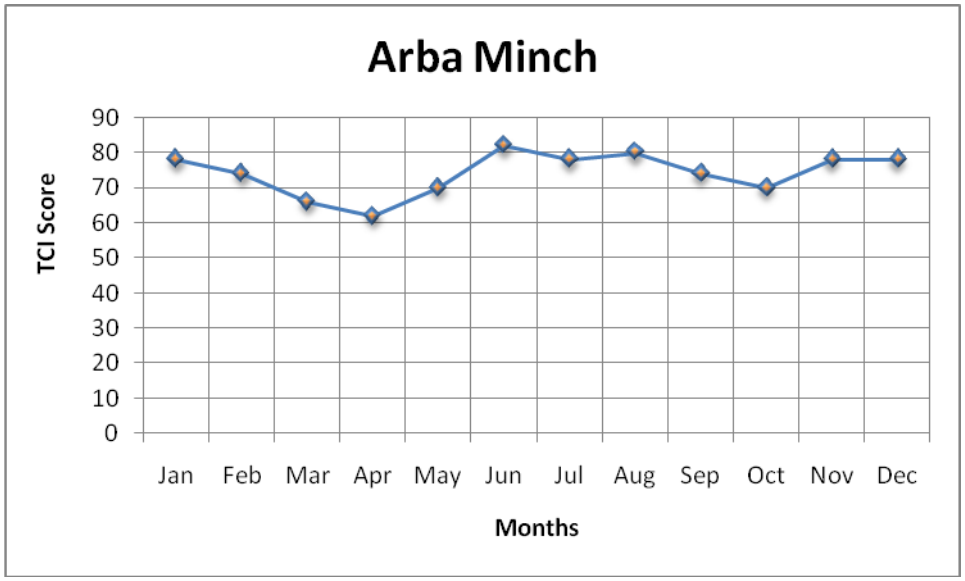

Figure 5: TCI of Arba-Minch (Computed by Authors, 2017)

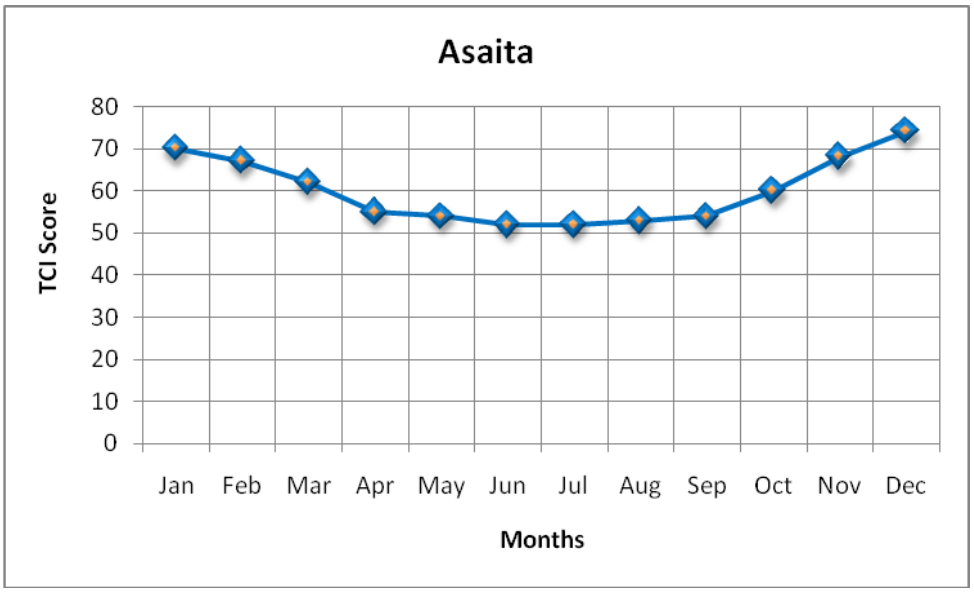

Figure 6: TCI of Asaita(Computed by Authors, 2017)

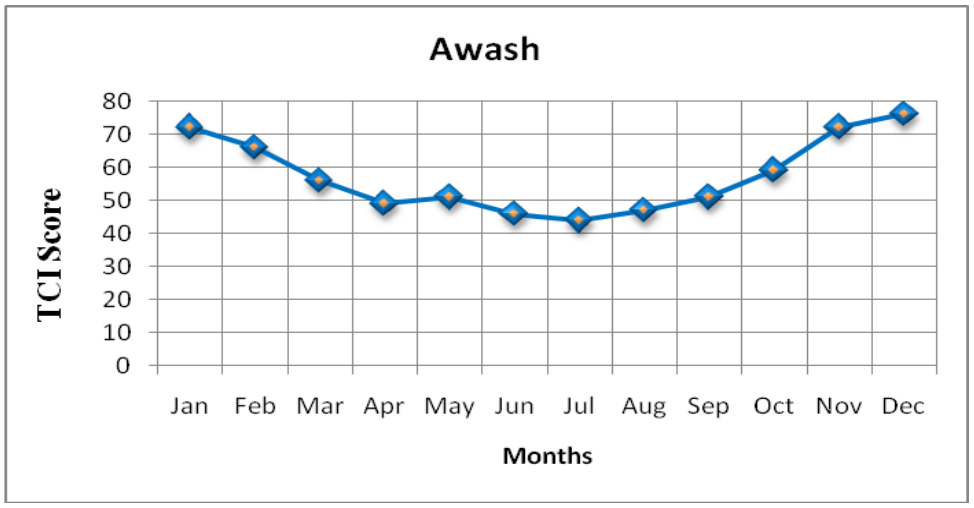

Figure 7: TCI of Awash(Computed by Authors, 2017)

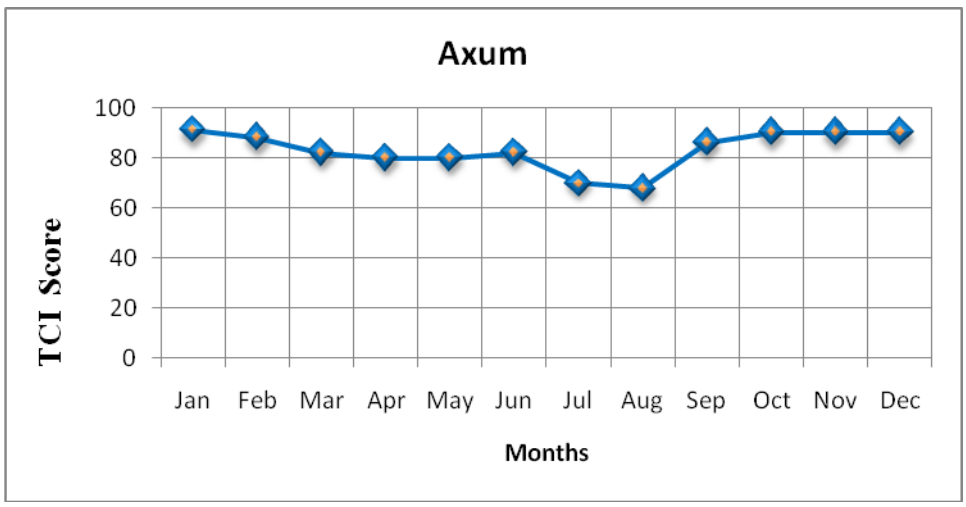

Figure 8: TCI of Axum(Computed by Authors, 2017)

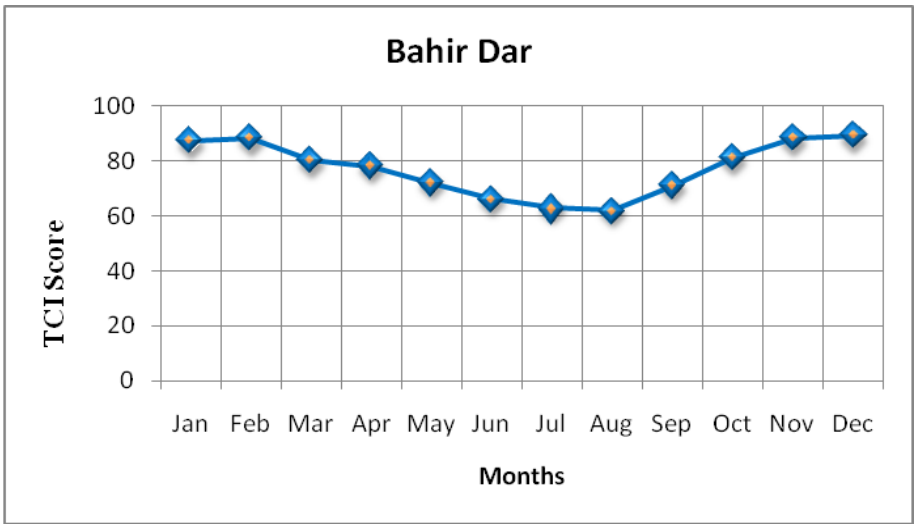

Figure 9: TCI of BahirDar(Computed by Authors, 2017)

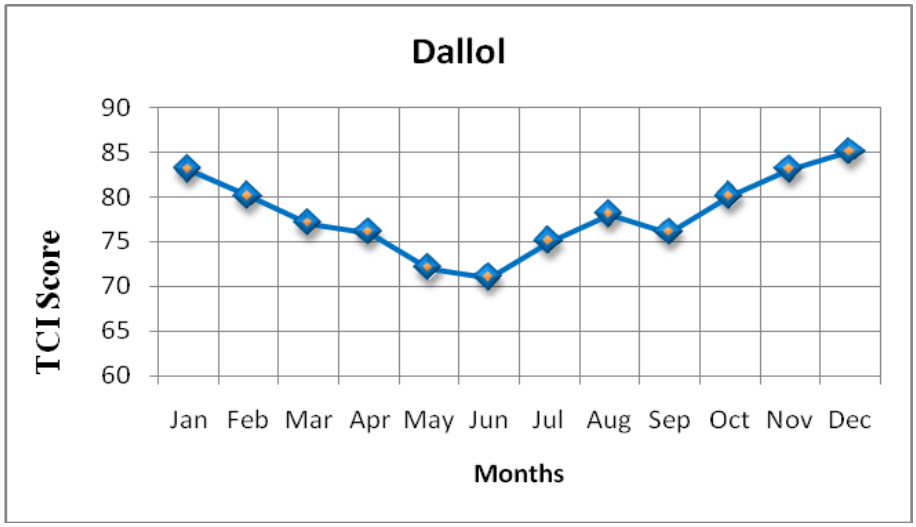

Figure 10: TCI of Dallol(Computed by Authors, 2017)

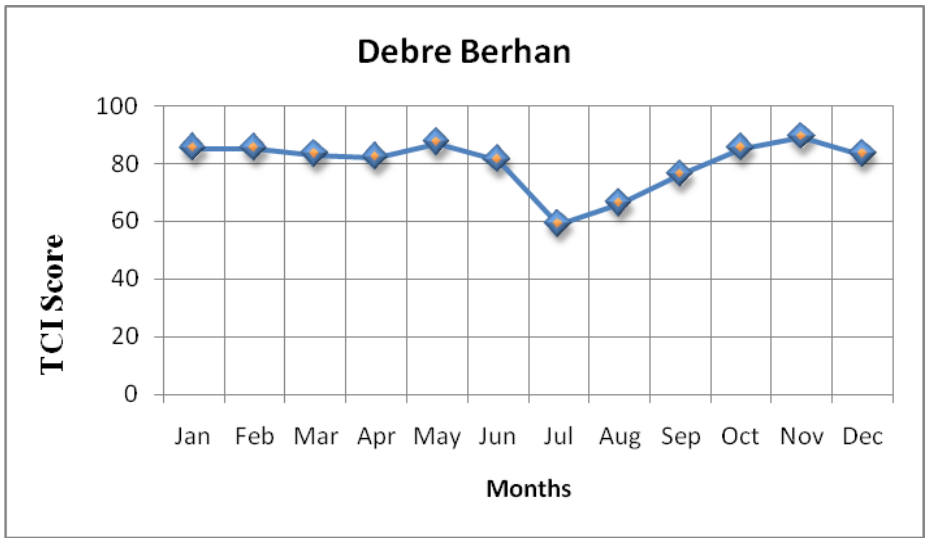

Figure 11: TCI of Debre Berhan(Computed by Authors, 2017)

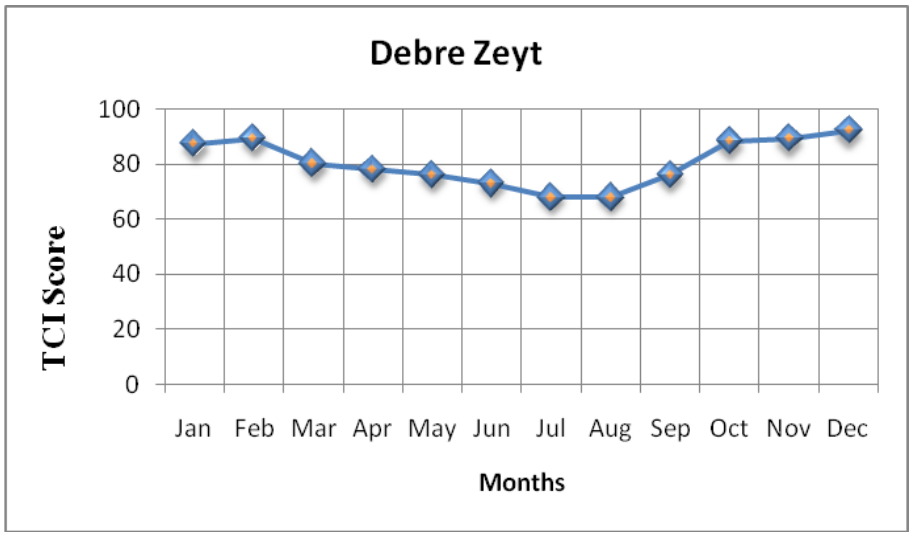

Figure 12: TCI of Debre Zeyt(Computed by Authors, 2017)

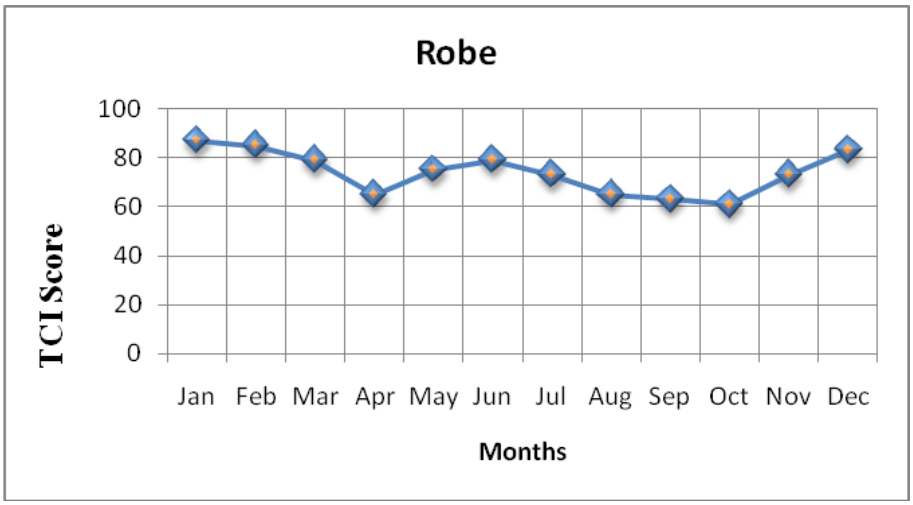

Figure 13: TCI of Robe(Computed by Authors, 2017)

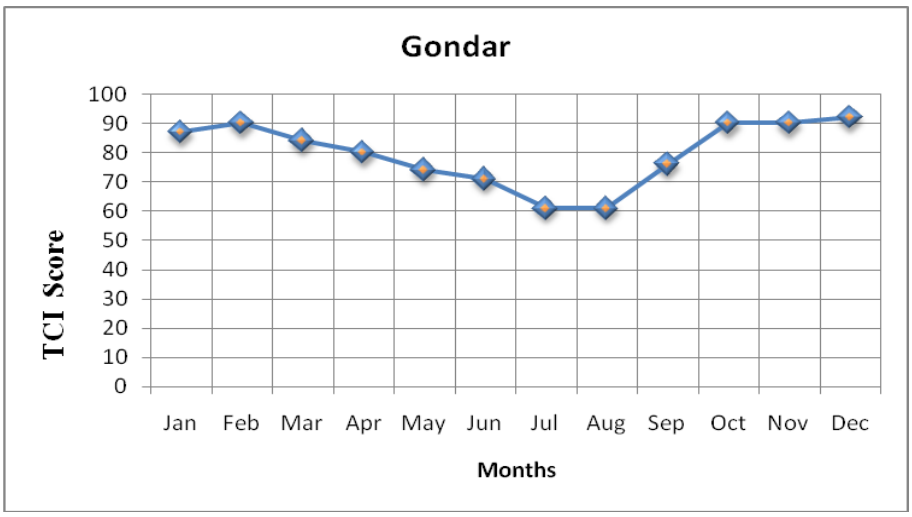

Figure 14: TCI of Gondar(Computed by Authors, 2017)

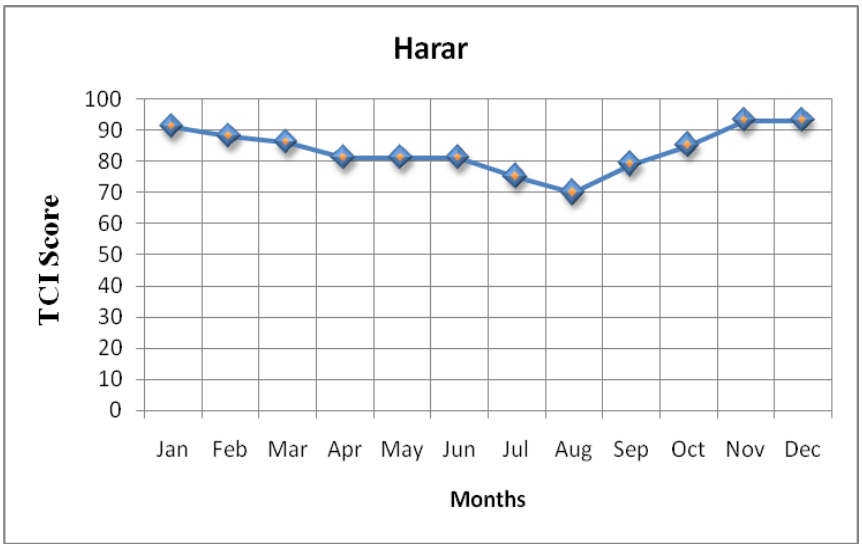

Figure 15: TCI of Harar(Computed by Authors, 2017)

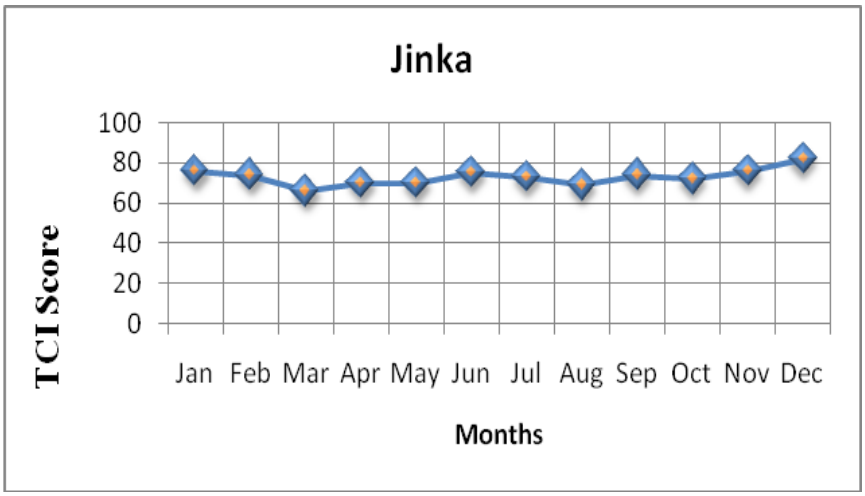

Figure 16: TCI of Jinka(Computed by Authors, 2017)

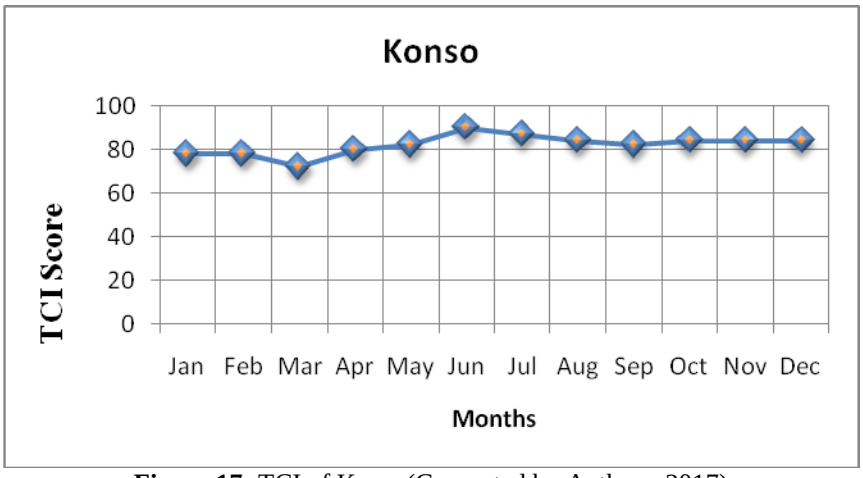

Figure 17: TCI of Konso(Computed by Authors, 2017)

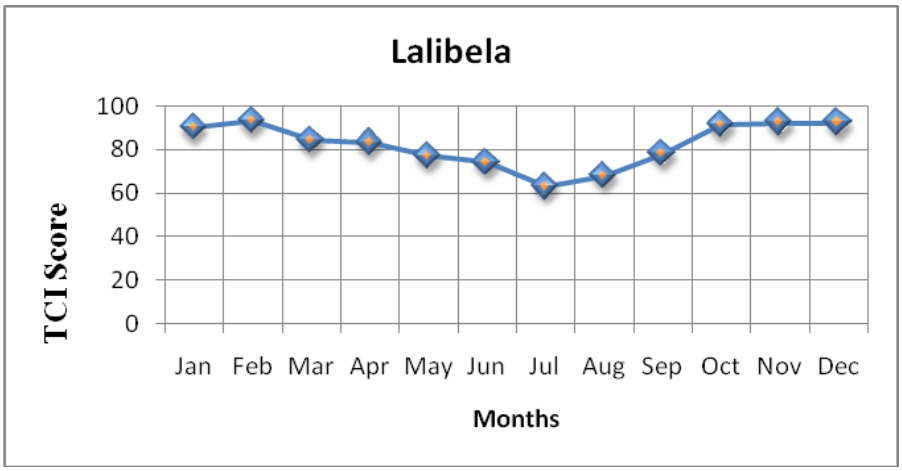

Figure 18: TCI of Lalibela(Computed by Authors, 2017)

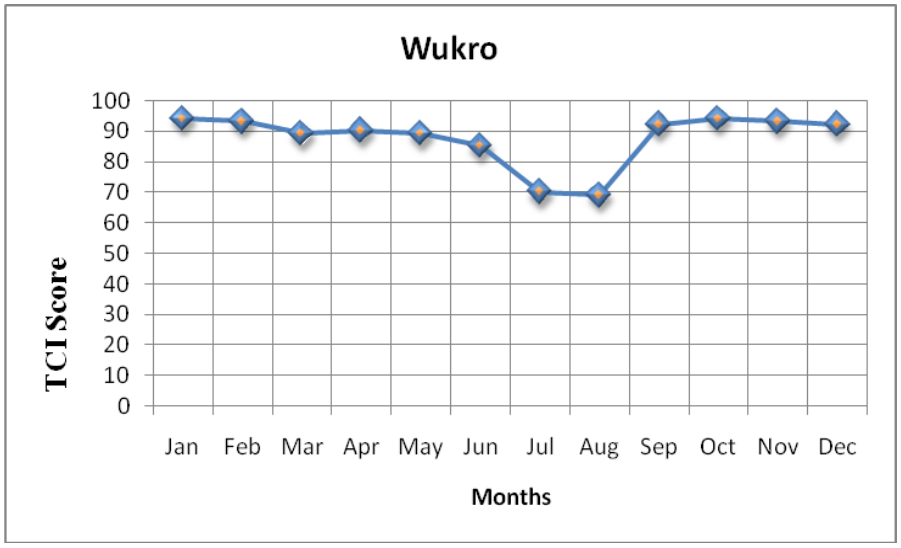

Figure 19: TCI of Wukro (Computed by Authors, 2017)

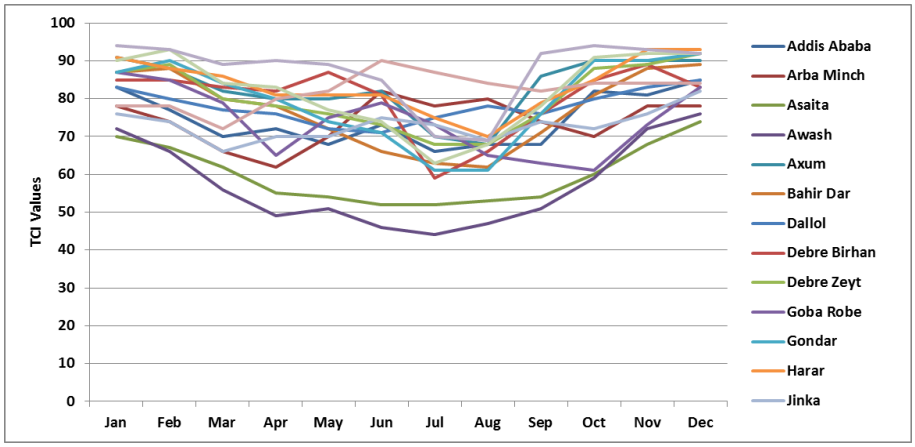

Figure 20: TCI of Sample Areas in Ethiopia (Computed by Authors, 2017)

Figures 4 to 20 all the above one data figures in graphs are own sources.

If we compare this result with TCI of some European cities which are known as major tourist destinations, Ethiopia is having an ideal climatic condition favorable for tourism industry.

In cities like London, Paris, Dublin, Amsterdam, Vienna, Berlin, Stockholm, Warsaw and Munich, the maximum TCI value is 70 (very good) and minimum is 25 (very unfavorable)(Tang, 2013). Their peaksare on June, July and August in which most tourist places in Ethiopia relatively have lower TCI. This is a good

opportunity for the country that most Europeans will have a chance to visit Ethiopia during September to February (ideal seasons in the perspective of climate favorability).

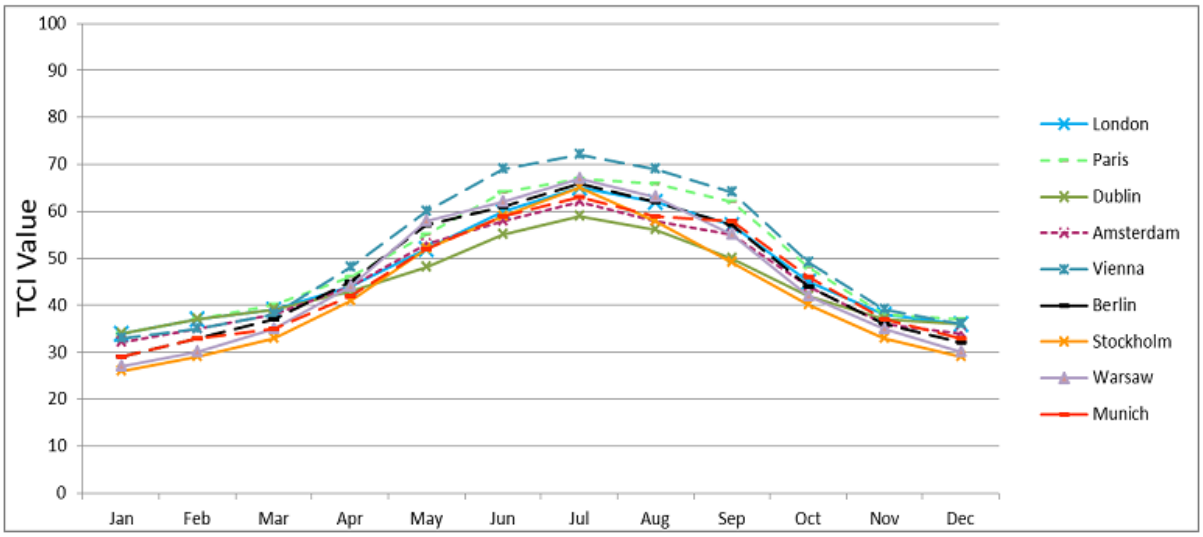

Figure 21: The TCI Values of Northern, Western and Eastern Europe (Tang, 2013)

IV. CONCLUSION

Climate is one of the most important factors influencing tourism sector. In spite of the fact that Ethiopia is characterized by varied agro-climatological zones, the country's climate is very friendly to the tourism sector. Except some of the areas (in some months) indicated in the study, the climatic condition of the country is ideal for tourists coming from every corner of the world.

Therefore, it is possible to conclude that climate is not a responsible factor for the underdevelopment of tourism in the Ethiopia. Rather the tourism sector is affected by factors like lack of marketing and promotion, lack and insufficient infrastructure developments, lack of appropriate trained man power in the sector, and political instabilities particularly in recent years.

V. RECOMMENDATIONS

For improving the tourism sector in the country, the following recommendations are forwarded.

- Promotionaland marketing should be done about not only the presence of uncountable tourist attraction sites but also the climatic suitability of these tourist destinations.
- There should be improved infrastructure developments like transportation facilities; electricity and communication networks, lodges and guesthouses, standard hotels and related facilities.
- The country should have a trained manpower in the tourist sector. The continuous training of workers in the tourism industry and the institution of stronger control and regulation over tourist related institutions has to be given emphasis.
- Tourism sector is easily affected by the two critical factors: Harsh climate and terrorism. Since the climate is conducive for tourism sector, emphasis should be given for security issues. In the last three years in Ethiopia there are instabilities almost in all parts of the country which make the image of the country horrid. Therefore, the government of Ethiopia should address the political instabilities in the country so that tourists will not be afraid of the security problems.

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