PLANNING OF TOURISM DEVELOPMENT IN MALI LOŠINJ (CROATIA)

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INTRODUCTION Mali Lošinj is one of the most popular Croatian tourist destinations situated on the island of Lošinj in northern Adriatic. Management of the Mali Lošinj Tourist Board is aware of the tourism industry vulnerability to climate change. For their planning of tourism development they ordered the climatological study of suitability of present and future local climate for different types of tourist activities. The study provided such information on the basis of climate index for tourism (CIT) determined for 06 UTC and 12 UTC.

METHODS Taking into account the fact that thermal state, precipitation, wind and solar radiation are the most important parameters for tourism, De Freitas et al. (2008) defined the second generation of climate index for tourism (CIT) that integrates thermal (T), aesthetic (A) and physical (P) facets of atmospheric environment important for tourism:

$$CIT = f [(T, A) * P]$$

The thermal component (**T**) is a measure of the body-atmosphere energy balance expressed by some biometeorological index that integrate environmental and physiological thermal variables. It is expressed as thermal sensation rather than an energy value, and here the physiologically equivalent temperature PET is used for the assessment of thermal environment (Höppe, 1999; Matzarakis et al., 1999). The aesthetic component (**A**) includes sky condition, while the physical components (**P**) are wind and rain which can haThermal and aesthetic states are combined into a weather typology matrix and produce the rating class ranging from 1 to 7. CIT should be a descriptor of the quality of climate conditions for a tourism activity for which the index is specifically designed, as indicated for 3S tourism, cycling and cultural tourism and hiking in examples on the right (Bafaluy et al., 2014). ve an overriding effect when certain values are exceeded.
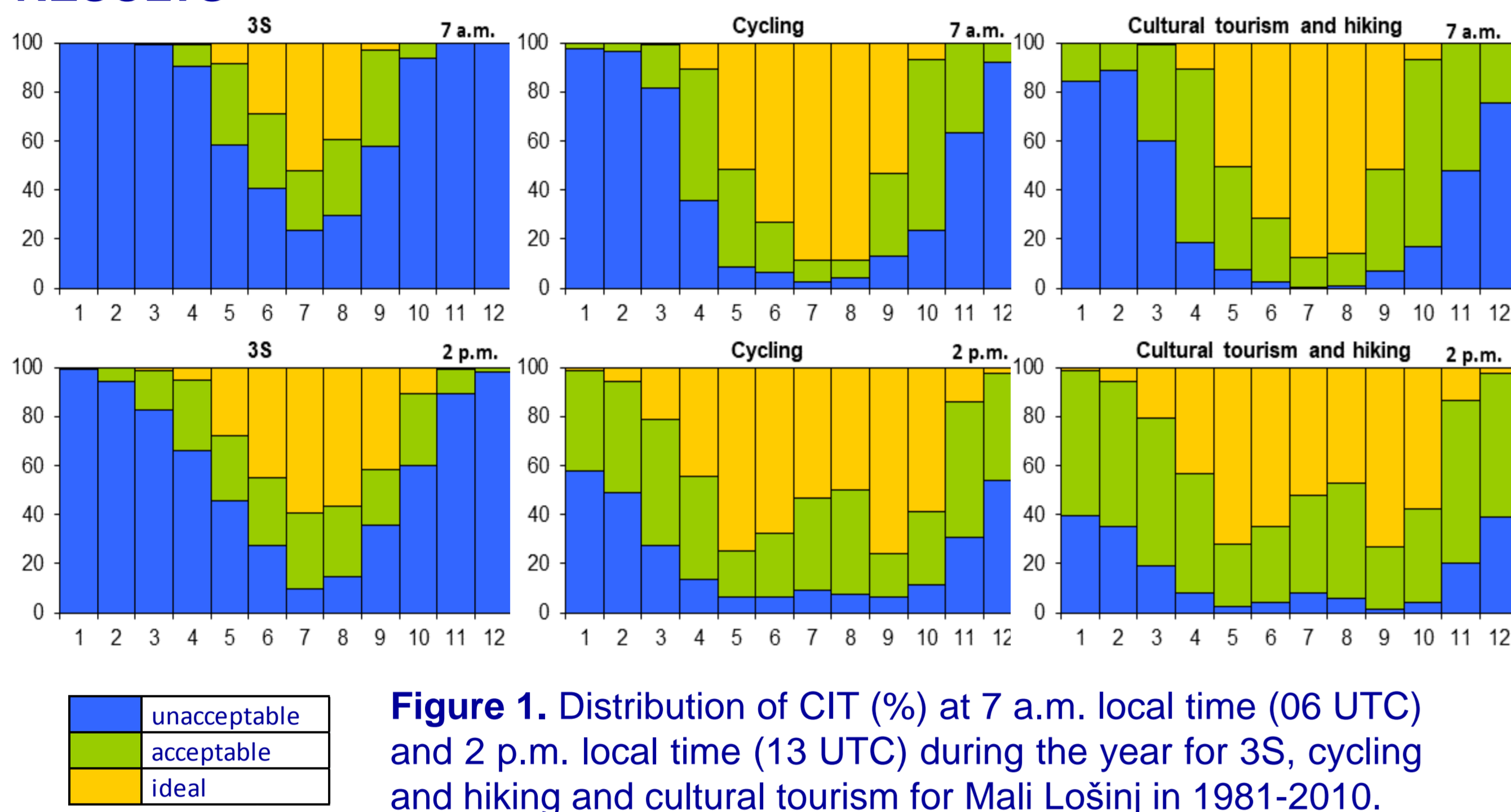
	3S				Cycling				Cultural tourism and hiking			
Thermal perception	Cloudiness ≤4/10	≥5/10	Rain >3 mm	Wind ≥6 m/s	Thermal perception	Cloudiness ≤4/10	≥5/10	Rain >10 mm	Wind ≥8 m/s	Thermal perception	Cloudiness ≤4/10	≥5/10	Rain >5 mm	Wind ≥10 m/s

(table continues — rating values per thermal perception row)

3S: very hot 4 3 2 4 | hot 6 5 2 4 | warm 7 5 2 4 | sligh. warm 6 4 1 4 | comfortable 5 3 1 2 | sligh. cool 4 3 1 2 | cool 1 1 1 1 | cold 1 1 1 1 | very cold 1 1 1 1

Cycling: very hot 3 3 3 2 | hot 4 3 3 2 | warm 6 5 4 2 | sligh. warm 7 7 4 3 | comfortable 7 6 4 2 | sligh. cool 6 5 3 2 | cool 6 4 3 1 | cold 4 3 2 1 | very cold 3 2 1 1

Cultural tourism and hiking: very hot 3 3 3 3 | hot 4 3 3 3 | warm 6 5 4 4 | sligh. warm 7 6 4 4 | comfortable 7 6 4 4 | sligh. cool 6 5 4 4 | cool 5 4 3 3 | cold 4 4 2 1 | very cold 3 2 1 1

| 1	2	3	4	5	6	7
unacceptable			acceptable		ideal	

DATA

1. Suitability of present climate for tourism is shown with CIT determined on the basis of observed values of meteorological variables during the period 1981-2010.

2. The changes in climate potential of tourism are estimated by changes of CIT in the future 30-year period 2021-2050, according to the referent present period 1981-2000. Data for both periods are provided by two different downscaled data sets, over European area with 12.5 km horizontal resolution.

The first data sets: downscaled by regional climate model SMHI-RCA4_v1 which was forced by five CMIP5 global atmosphere-ocean circulation models: HadGEM2-ES, CNRM-CM5, EC-EARTH, IPSL-CM5A-MR and MPI-ESM-LR.

The second data sets: downscaled by regional climate model RegCM4, version 4.2, which was forced by four global atmosphere-ocean circulation models: CNRM-CM5, EC-EARTH, MPI-ESM-MR and HadGEM2-ES.

In addition, future climate projections were run under RCP4.5 as well as under RCP8.5 IPCC scenarios. In this way, the uncertainty of simulations of future climate was taken into account.

RESULTS

Figure 2. Annual differences between occurences (%) of unacceptable, acceptable and ideal climate conditions for different types of tourism according to CIT between future (2021-2050) and present (1981-2000) climates at 06 UTC and 12 UTC, determined with RCA4_v1 and RegCM4 regional models, under IPCC emission scenarios RCP4.5 and RCP8.5.

Figure 1. Distribution of CIT (%) at 7 a.m. local time (06 UTC) and 2 p.m. local time (13 UTC) during the year for 3S, cycling and hiking and cultural tourism for Mali Lošinj in 1981-2010.
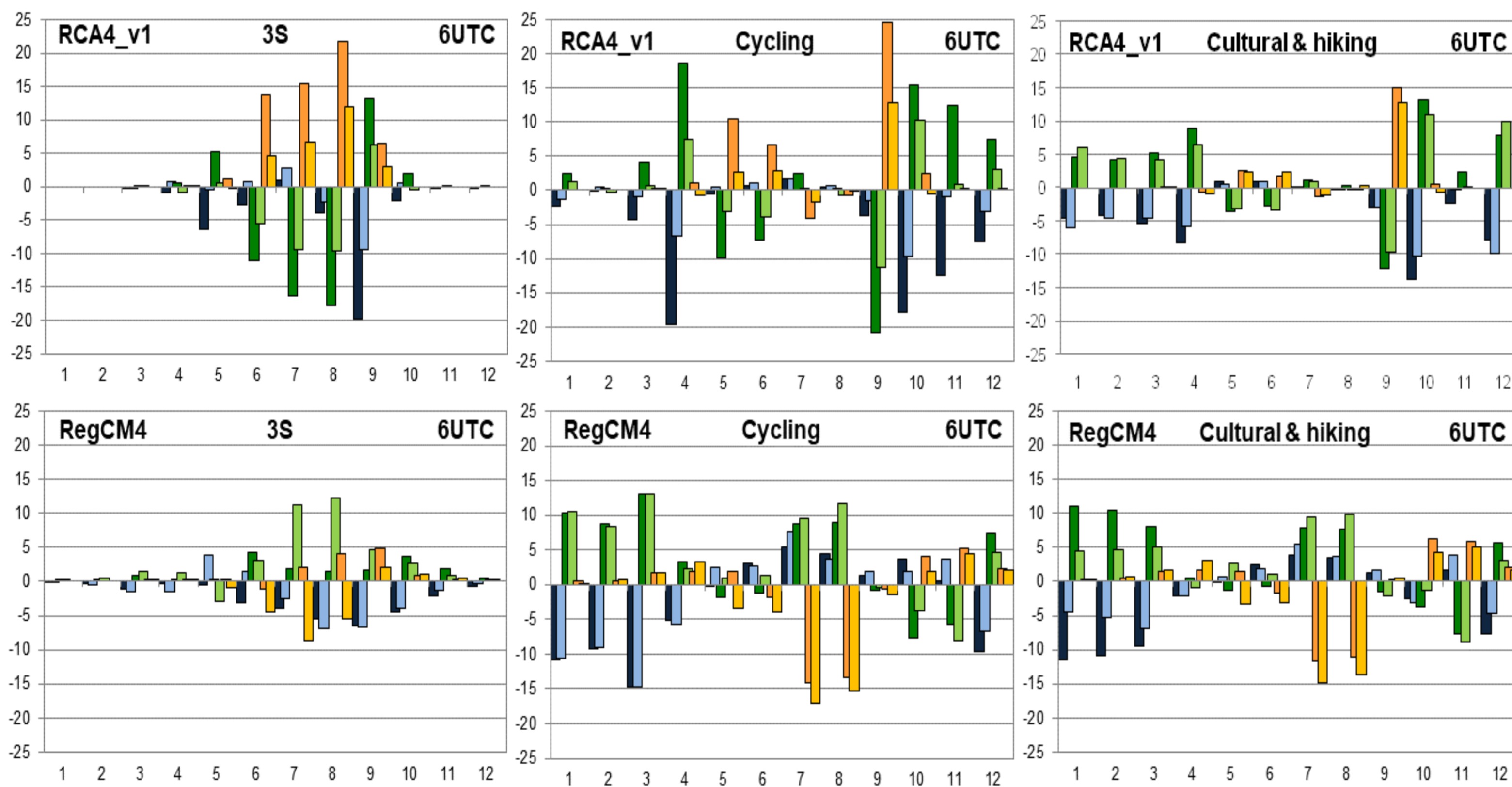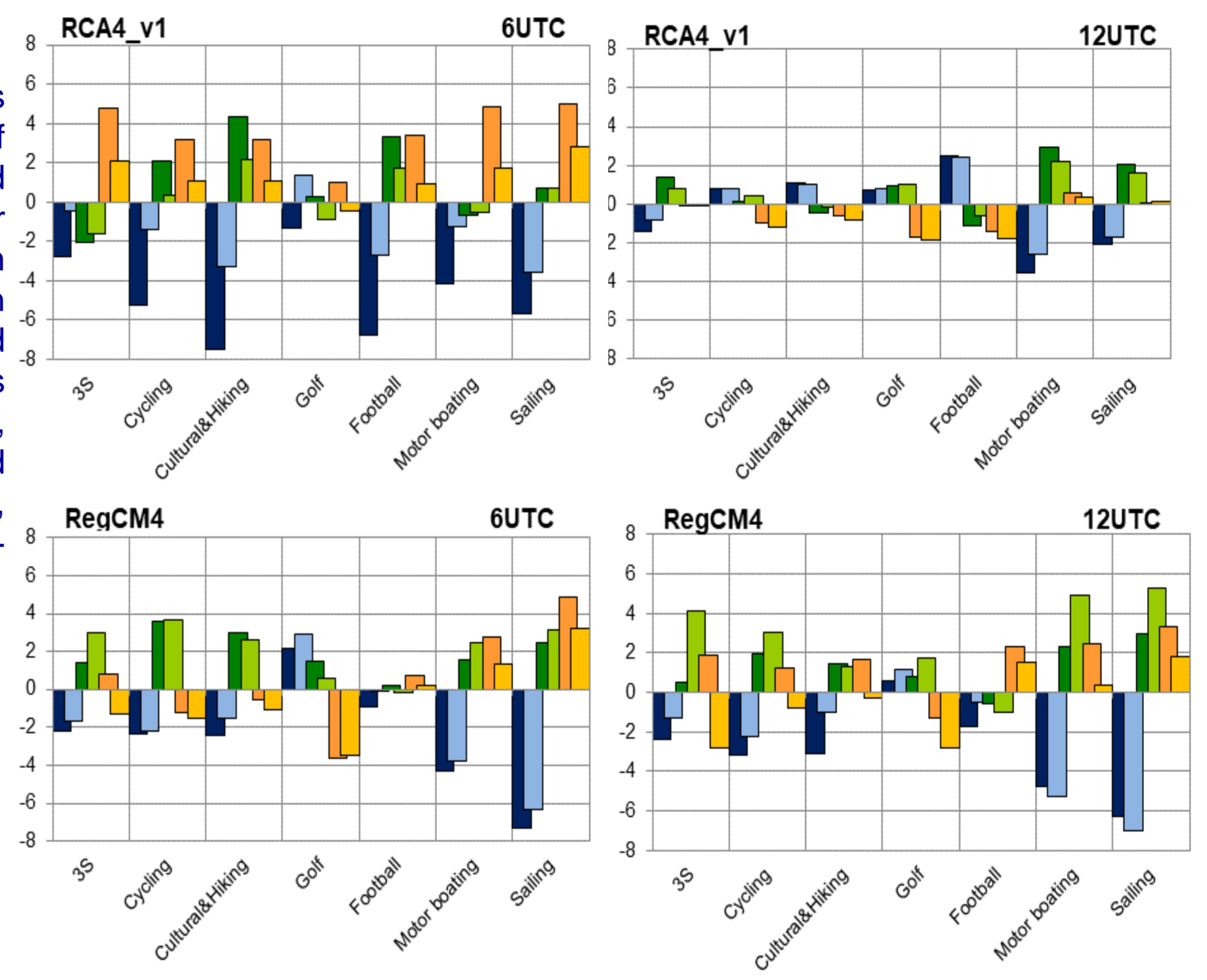
Figure 3. Monthly differences between occurences (%) of unacceptable, acceptable and ideal climate conditions for 3S, cycling and hiking or cultural tourism for Mali Lošinj according to CIT between future (2021-2050) and present (1981-2000) climates at 06 UTC (above) and 12 UTC (below), determined with RCA4_v1 and RegCM4 regional models, under IPCC emission scenarios RCP4.5 and RCP8.5.
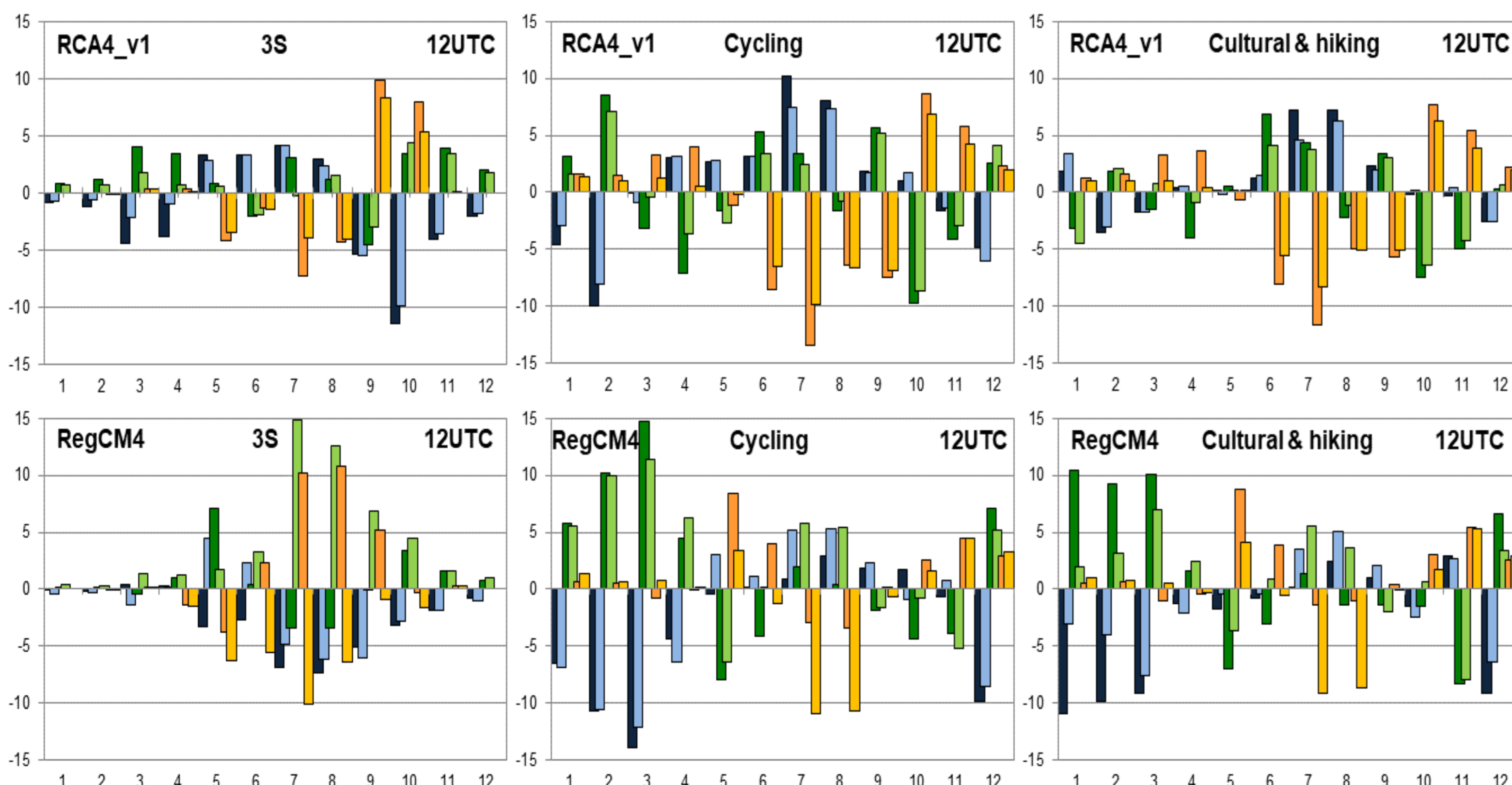
CONCLUSIONS

• According to observed data, the distribution of CIT in the morning shows the best conditions in summer. At 2 p.m. there is a bimodal distribution with maxima of ideal conditions in spring and autumn for all kinds of recreation except for typical summer activities 3S (Fig. 1).

• Generally on the annual scale, there is an increase of acceptable and ideal climate conditions for most types of tourism in future climate, especially in the morning (06 UTC). The best conditions could be expected for typical summer activities – beach tourism (3S), motor boating and sailing (Fig. 2).

• Analysing by months (Fig. 3), for beach (3S) tourism the smallest future changes of suitability are in the period from December until April. In future climate the most probable is the increase of ideal or acceptable conditions on the account of reduction of unacceptable conditions in September and October. This indicate that the season of 3S tourism will be prolonged in future.

• Hiking and cultural tourism have an increase in acceptable and decrease in unacceptable future climate conditions mostly from January until March. In future climate ideal conditions are expected to appear less often in July and August whilst more often from October until December than in present climate (Fig.3).

• Common characteristic for all future sport activities tourism is the decrease of acceptable conditions in summer and increase in colder part of year, especially in spring and autumn. For cycling, most probable is that the future climate conditions, both in the early morning and in the afternoon, will be more often acceptable in December-February and less often ideal in July and August (Fig.3). The greatest chances for football in future are the decrease of unacceptable and increase of ideal or acceptable conditions in January-March and decrease of ideal conditions in summer months, both in the early morning and in the afternoon (not shown).

• Applied approach can help in detecting the range of CIT values in future and consequently in the assessment of Mali Lošinj's tourism activities that the future climate will support.

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