

Climate and Surfing

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Surfing is one of the most popular activities in coastal tourism resorts. However, the sport depends strongly on the met-ocean weather conditions, particularly on the surface wind-generated waves that reach the coast.

Keywords: resilience ; wave climate ; tourism management ; surfing ; climatology ; decision making ; climate service ; sustainability ; adaptation

1. Introduction

Climate services are defined as the provision of climate information to help individuals and organizations make climate-resilient decisions. The World Climate Conference-3 (WCC-3), organized in 2009 by the World Meteorological Organization, established the Global Framework for Climate Services (GFCS) ^[1]. Climate data and information are transformed into customized products to provide decision makers in climate-sensitive sectors with better information to adapt to climate variability and change ^[2]. The goal of climate services is to provide access to scientific knowledge and, thereby, to reduce vulnerability and create opportunities to promote innovation, business opportunities, and employment, highlighting the importance of involving users in developing climate services ^[3]. Research has revealed ^[4] that peer-reviewed literature on the availability and use of climate services in the operations and management of tourism is scarce, and that a need exists for a new generation of specialized climate information products that can enhance climate risk management amongst tourism suppliers. Adaptation to climate change is becoming more urgent, but the wealth of knowledge that informs adaptation planning and decision making is currently not being used to its full potential ^[5]. In this context, climate services can provide valuable information that can help society enhance resilience, survival, and even prosperity in the face of climate risk ^[6].

Climate assessment for recreation and tourism have increasingly become dynamic research topics, especially in the age of the anthropogenic climate crisis ^[7]. Coastal destinations can offer different tourist activities in the same territory and all of them are influenced by meteo-climatic conditions to a specific degree ^[8]. Researchers assert that there is a need to explore the climatic viability of different activities. By doing so, the development of climate services with tailored climate information about particular destinations can shed light on system changes.

2. Climate and Surfing

Several authors have defended the idea ^[9] that climate change communication and user engagement can work as a tool to anticipate climate change. The visual communication of climate information is one of the cornerstones of climate services; thereby, the characteristics that make a climate service self-explanatory rely on the type of representation used. In this context, guidance on the climate information published by official bodies should adopt a consistent approach, with a clear narrative that describes the transition from science to guidance ^[10]. The form in which climate services information is needed for the required end-user decisions requires careful thought, including appropriate communication of the associated uncertainties using best practices and experiences from related sectors ^[11].

Numerous authors have discussed the importance of climate ^[12], weather ^{[13][14][15][16][17]}, and extreme weather ^{[18][19][20]} in the establishment and choice of tourism destinations. Outdoor recreation is strongly and increasingly affected by climate change and its impacts present marked seasonal and geographical variations that determine its viability ^[21]. In the past, the Tourism Climate Index (TCI) ^{[22][23]} has been used in suitability analyses. Several studies calculated this index to determine the climatic comfort conditions for tourism in different areas ^{[24][25]}. Specific research has focused on exploring the state of weather and climate information for tourism and explored sustainable tourism and the grand challenge of climate change ^{[26][27]}. Regarding the idea of the TCI, other studies have developed the Holiday Climate Index (HCI) ^{[9][10]} and computed it, in a reshaped formulation, for beach and urban destinations with climate data downscaled dynamically ^[27]. Other studies ^[8] have proposed the co-creation of specific indices for each specific activity/destination. One such study described indices for beach and snow tourism ^[28], while others developed indices for skiing ^{[29][30]}, and still others

have focused on surfing ^[31]. Sports tourism, based either on attending a sports event or on practicing the sport, has experienced considerable growth in the last several decades. Surfing as a tourist activity has traditionally been labeled as sports tourism ^[32] or nautical, maritime, or marine tourism ^[33]. Most recently, researchers defined it as 'blue tourism', a concept intimately related to the blue economy and the blue growth strategy ^[34]. Blue tourism highlights the sea as the central resource for leisure and recreation activities and leisure and tourism industries ^{[35][36]}.

Surf and surfing tourism affect the environment and depend on its preservation and there is a concern regarding not only the quality of the activity but also its sustainability. New research has ranked Cape Town beaches in terms of sustainability by using surf-tourism-related indicators ^[37]. Similarly, other authors have used the Driving Forces-Pressures-State-Impacts-Responses (DPSIR) framework to propose indicators to measure human activities affecting surf breaks ^[38]. Similarly, it has been affirmed that surf breaks are finite, valuable, and vulnerable natural resources that not only influence community and cultural identities but are also a source of revenue and provide a range of health benefits ^[39]. Despite this, surf breaks lack recognition as coastal resources and, therefore, the associated management measures required to maintain them. It has also been recognized that conserving biodiversity and ecosystem services requires diverse models that empower communities to act steward of such resources and also to benefit from them. They investigate the potential of surfing resources and the consciousness of surfing communities as beacons of environmental and marine biodiversity preservation. In fact, the sustainable management of these resources ensures their ability to provide for the character, economy, and development of coastal communities worldwide ^[40]. Valencia et al. ^[41] studied how surfing tourism's effects are perceived by local residents; the results of their research have implications for surf tourism management at the destination.

Fox et al. ^[42] focused their research on recreational ocean users, specifically surfers, and how their blue space activities may inform the understanding of ocean processes and human–ocean interconnections. They presented novel insights about the opportunities for integrating ocean sustainability strategies through blue space activity mechanisms and coastal community engagement. They defined the surfing social-ecological system adapted from McGinnis et al. ^[43] and demonstrated how the human (social) and ocean (ecological) systems provide opportunities for interactions between surfers (users) and waves (resource units), producing ocean literacy understanding and awareness.

Another aspect that has an impact on the perception and development of surf is the safety of the practitioners. Mindes ^[44] analyzed hazards perceptions among surfers in Southern California. Rip currents are a primary mechanism associated with dangerous situations ^[45] and have been the focus of beachgoer education and awareness strategies ^[46]. Surfers and lifeguards often utilize rip currents to expedite their journey across the surf zone ^[47]. Attard et al. ^[48] found that 63% of surfers believe they have saved a swimmer's life. The enjoyability and safety of the surfing experience are enhanced when the right information is communicated in the right way. Boqué et al. ^[49] surveyed surfers in the Iberian Peninsula to explore which meteorological and climatological information they find necessary for a better surfing experience.

De Andrés et al. ^[50], who studied surfers' balance during surfing activity between competitive surfers and non-competitive surfers in Somo, in collaboration with Escuela Cantabra de Surf and Somo Surf Center, defended that surfing in training and competition is characterized by a great variability of environmental factors such as different sizes and breaking shapes of the waves and changing weather conditions. Nevertheless, there are limitations and possibilities for the world surfing reserves ^[51] that can be assessed by surfing climatology and surfing forecasts ^[49].

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