



## ANALYSIS OF THE TEMPORAL AND SPATIAL DISTRIBUTION CHARACTERISTICS AND INFLUENCING FACTORS OF RELIGIOUS SITES ON THE MARITIME SILK ROAD: A CASE STUDY OF QUANZHOU

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### ABSTRACT

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Multiple religious cultures coexisted and prospered in Quanzhou. Using the data from 608 religious sites in different dynasties as the main time nodes, the spatial distribution of religious sites and their evolution process were analyzed from the perspectives of spatial distribution type, trend, density and equilibrium with Geographic Information System (GIS). Findings show: The spatial distribution of religious sites is concentrated, the agglomeration situation is obvious, and the degree of agglomeration is increasing. The religious sites as a whole show a trend from southeast to northwest, and spreading from the coast to the inland areas. The high-density core area distribution is characterized by multi-core to single-core accumulations, and the number of high-density core areas is reduced. Religious sites are spatially represented by an unequal probability distribution, with local agglomeration centered on Quanzhou City, but the overall trend is constantly balanced; the spatial distribution of religious sites is influenced by both human and natural environments.

**Contribution/Originality:** The contribution of this paper is to analyze the temporal and spatial evolution of Quanzhou religious sites in different periods from the perspectives of spatial distribution type, distribution trend, distribution density and distribution balance, and to reveal its influencing factors.

### 1. INTRODUCTION

Quanzhou - China's World Maritime Trade Center in Song and Yuan Dynasties - was successfully listed in *The World Heritage List* and became the 56th World Heritage Site in China. From the 22 representative historic sites, Quanzhou, as a dialogue window between China and the world in the Song and Yuan Dynasties, shows China's complete maritime trade system, developed economic level and diversified and inclusive cultural attitude. Coexistence and prosperity of multi-religious cultures is one of the important connotations of Quanzhou's openness, tolerance and integration. Quanzhou is known as a religious resort, including Taoism, Buddhism, Islam, Nestorianism, Hinduism, Christianity and Manichaeism, Japanese and fetishism, Judaism and many other religious sects. There are many religious sites in Quanzhou, such as Tianhou Temple, Zhenwu Temple, Quanzhou Confucian Temple, Kaiyuan Temple, Laojunyan Statue, Qingjing Temple, Islamic Holy Tomb, Buddha Statue of the Monastery, Liusheng Pagoda, Wanshou Pagoda, etc. The relationship between religion and geography has a long history. As early as ancient Greece, the construction of western world's outlook depended on religious principles

(Kong, 1990). After that, religious geography in the strict sense came into being on the basis of church geography and biblical geography (Saac, 1965). The scholars formed three main research directions on religious geography, including traditional cultural geography, new cultural geography, and religious ecology and religious sociology. As the pioneer of religious geography since the 20th century, Une and Sopher (2015) took the lead in establishing the research framework of traditional religious geography (Une & Sopher, 2015). Since the 1990s, scholars have gradually deepened their research on new cultural geography under the influence of postmodernism, and continuously expanded their research horizons. For example, Kong (2001) defined the research framework of new cultural geography, including the historical and cultural background of the formation of religion, the impact of religion on the living environment and the geographical environment. Religious ecology emerged in the 1960s and 1970s to explore the relationship between the natural environment and religion. For example, Huntington (1945) proposed that people's beliefs about objects of worship are influenced by the geographical environment, reflecting an environmental determinism (Huntington, 1945), which also includes religious determinism or the interactive influence of both.

Religious culture is one of the research subjects of religious geography and religious sites and, as one of the most direct representatives of religious culture, are of great significance to its study (Ximing & Hong, 2010). Scholars' research on religious sites has been extensive in recent years, especially from formal to informal places of worship. For instance, (Kong, 2005) examined the different meanings of state and religious community investment in schools (Kong, 2005). Through an analysis of roadside shrines, Preston (2002) suggested that suburban communities evolve to a certain extent as new folk shrines or roadside shrines prevail (Preston, 2002), or as adherents' attachment to places or locales (Mazumdar & Mazumdar, 2004). With the expansion of the research on religious places, people not only pay attention to the religious meaning implied in the space of daily life, but also put forward new challenges to the original religions in the aspects of belief and cognition (Lili & Kai, 2013). On the whole, the research direction of religious places has been deepened and changed from concrete to virtual, from material to image and from macro to micro scale. Specifically, most of the current research focuses on the management of religious sites in space, including the management of religious sites (Jianming, 2011), legal management (Jianfei, 2017) and financial management (Jie, 2011), aiming at safeguarding the normal exercise of the rights of religious believers and non-believers, and promoting the harmonious development of society and the normal conduct of religious activities.. In addition, scholars focused on the product attributes of religious tourism sites, including the development of religious resources (Quanen, 2014), tourism activities (Quanen & Yexi, 2016) and tourism product design (Jingmei, 2000). The research perspectives of religious sites are mainly management and economics, while the research based on geography (Liping & Zhisheng, 2017), sociology (Run, Yongchun, & Wei, 2014), psychology (Zequn, 2015) and religious culture (Dawei, 2011) is lacking. Isaac (1962) summarized the research methods of religious geography, and pointed out that the theory of central place, spatial interaction model and multiple regression analysis were widely used in religious geography, especially the widespread use of GIS and other technologies (Isaac, 1962). In addition, Ximing and Hong (2010) studied the temporal and spatial evolution of Christianity cases using GIS technology and mathematical statistics analysis in Guangdong from 1584 to 1910. However, most of the studies on religious sites are still qualitative studies, and the use of map analysis is deficient.

Quanzhou is recognized by the United Nations Educational, Scientific and Cultural Organization (UNESCO) as the starting point city of the Maritime Silk Road, which inherits its history and culture and has rich religious historical sites and high appreciation value. Quanzhou's religious research has always been favored by scholars, but most of its religious research focuses on how to make best use of religious resources to better carry out religious tourism activities, while the research on the spatial structure of religious resources (Qiaoying, 2016), the development of religious culture (Haiyan, 2017), religious beliefs and behaviors (Mingjun, 2013) is insufficient. Quanzhou, as the leading city in the construction of the 21st Century Maritime Silk Road, has important practical guiding significance for understanding, inheriting and carrying forward Quanzhou's multi-religious culture by

means of the research of related religious sites. To this end, on the basis of collecting data on religious sites in Quanzhou, this study aims to analyze the spatial distribution characteristics of religious sites in Quanzhou and explains their causes by using spatial analysis methods related to GIS software, to provide some reference for the construction of the new Silk Road.

## 2. DATA AND METHODOLOGY

### 2.1. Data Collection

Quanzhou has gathered a variety of religions in its history and has left a large number of religious relics. The four existing religions include Buddhism, Taoism, Christianity and Islam. According to research, temples dedicated to Buddha and Bodhisattva, and Taoist temples were built as early as the Western Jin Dynasty. The introduction of other religions was mainly due to the opening of the Silk Road and the development of maritime trade. For example, Quanzhou was one of the three major ports in China during the Tang Dynasty. Following continuous development in the Song and Yuan Dynasties, Quanzhou superseded Guangzhou as the largest port at that time. At the same time, economic exchanges effectively promoted the exchange and integration of religious culture, and the forced opening to the outside world in the Qing Dynasty further promoted the pluralistic coexistence of religious culture in Quanzhou. In this regard, this paper continued the historical context, divided the development stage of Quanzhou religion into four stages: before the Tang Dynasty, Song and Yuan Dynasties, Ming and Qing Dynasties and after the Republic of China, and analyzed the evolution of the spatial structure of Quanzhou religious sites on this basis.

Quanzhou's religious culture has a long history, with a time span of more than 1000 years. During this period, hundreds of temples and churches were built in Quanzhou. In addition to Buddhist, Taoist temples, Islamic mosques and Christian churches, there are also a large number of temples dedicated to local deities of folk beliefs. Considering the rise and fall of many temples, churches and temples of gods, the original records have been lost. Therefore, the data of religious sites in this paper were mainly based on *Quanzhou Religious Records*, which comprehensively record the representative temples and churches in Quanzhou. In addition to abolished religious sites, on the basis of clarifying the geographical location or scope and the date of construction, a total of 608 religious sites were selected as research samples, so as to establish the geographic information database of Quanzhou religious sites (see Table 1).

**Table 1.** The construction time of the main existing religious sites in Quanzhou.

Dynasty	Buddhism	Taoism	Christianity	Islam
Before Tang Dynasty	16.0	3.0	/	/
Tang Dynasty	33.0	13.0	/	1.0
Five Dynasties	13.0	10.0	/	/
Ten Kingdoms	3.0	/	/	/
Song Dynasty	75.0	66.0	/	1.0
Yuan Dynasty	10.0	8.0	/	/
Ming Dynasty	44.0	83.0	/	/
Qing Dynasty	60.0	25.0	58.0	/
The Republic of China	32.0	4.0	26.0	/
The People's Republic of China	13.0	4.0	6.0	1.0

Note: "/" stands for 0.

### 2.2. Data and Methodology

#### 2.2.1. Nearest Neighbor Index

GIS is a specific and very important spatial information system. It is a technical system that collects, stores, manages, calculates, analyzes, displays and describes the relevant geographic distribution data on the whole or part of the earth's surface space with the support of computer hardware and software systems. In this paper, we get a few indexes through this software.

The nearest neighbor index ( $R$ ) is the ratio of the average distance ( $\bar{r}_1$ ) generated by the target religious place and its nearest neighbor religious place to the average ideal nearest distance ( $\bar{r}^E$ ) generated under random distribution. If  $R$  is greater than 1, equal to 1 and less than 1 means that the distribution of target religious sites is uniform, random and concentrated respectively. Equation 1 presents the specification of a *Nearest Neighbor Index*.

$$R = \bar{r}_1 / \bar{r}^E \quad (1)$$

### 2.2.2. Standard Deviation Ellipse

The standard deviation ellipse includes center trend, dispersion and direction trend. According to the average center, we calculated the standard deviation, major axis, minor axis and direction angle of the ellipse of the element  $x$  coordinate and  $y$  coordinate to define the axis of the ellipse and create the elliptic surface element. Therefore, the distribution center and diffusion trend of religious sites in Quanzhou can be analyzed by standard deviation ellipse method.  $SDE_x$  and  $SDE_y$  in the formula represent the  $x$  and  $y$  coordinates of standard ellipse difference respectively.  $x_i$  and  $y_i$  represent the coordinate position of the  $i^{\text{th}}$  religious place;  $n$  represents the total number of religious sites. Equation 2 presents the specification of a *Standard Deviation Ellipse*.

$$\begin{cases} SDE_x = \sqrt{\frac{\sum_{i=1}^n (x_i \pm \bar{X})^2}{n}} \\ SDE_y = \sqrt{\frac{\sum_{i=1}^n (y_i \pm \bar{Y})^2}{n}} \end{cases} \quad (2)$$

### 2.2.3. Kernel Density

The spatial distribution density of regional elements is usually expressed by the kernel density estimation method, which can clearly reflect the spatial dispersion or agglomeration characteristics of religious places and clarify the changes of religious places on this basis. In the formula,  $h$  refers to the position of the  $i^{\text{th}}$  religious place within the radius;  $s$  is the location of the religious site;  $s_i$  refers to falling on religious sites with  $s$  as the center. Equation 3 presents the specification of *Kernel Density*.

$$\hat{\lambda}_h(s) = \sum_{i=1}^n \frac{3}{\pi h^4} \left[ 1 - \frac{(s - s_i)^2}{h^2} \right]^2 \quad (3)$$

### 2.2.4. Grid Analysis

This paper studied the equal grid division and network analysis of religious sites in Quanzhou to get the change of occupied grid number  $N(r)$  with the network scale. If religious sites have fractal characteristics, then  $N(r)$  satisfies the relationship in the following formula, where  $\alpha$  is the capacity dimension. The number of occupied grid cells  $N(r)$  satisfies the relationship of Equation 4:

$$N(r) \propto r^{-\alpha} \quad (4)$$

In this study, we set the number of religious sites in the grid formed by the row and column numbers  $i$  and  $j$  as  $N_{ij}$ , and the total number of religious sites as  $n$ , which can be defined as the probability  $P_{ij} = N_{ij}/n$ , then the information content is  $I(r)$ . The information content characteristic can be checked in Equation 5 with the following equation:

$$I(r) = -\sum_i^k \sum_j^k p_{ij}(r) \ln p_{ij}(r) \quad (5)$$

In the above formula,  $k$  represents the number of segments of the grid (where  $k$  is 1-10). If the distribution of religious sites is fractal, we could get the information content in Equation 6 follows as:

$$I(r) = I_0 - D_1 \ln r \quad (6)$$

In the above formula,  $I_0$  is a constant and  $D_1$  is a fractal dimension, which is an information dimension. The value range of  $d$  is  $[0, 2]$ . When there is only one grid with religious sites in the region, then  $D$  is 0; otherwise, if religious sites are evenly distributed in all grids, then  $D$  is 2.

### 3. SPATIAL DISTRIBUTION CHARACTERISTICS OF RELIGIOUS SITES IN QUANZHOU

#### 3.1. Spatial Type Characteristics

Using the average nearest neighbor tool in the ArcGIS10.2 software calculated the nearest neighbor index of Quanzhou religious sites in four different historical periods. These are: before the Tang Dynasty, Song and Yuan Dynasties, Ming and Qing Dynasties and after the Republic of China. It can be seen from Table 2 that the observed nearest distance of Quanzhou religious sites in these four historical periods is less than the ideal nearest distance, and the R value is less than 1, indicating that Quanzhou religious sites are concentrated in spatial form. From the perspective of time change, the R value of the Tang Dynasty and the previous historical period is high, which is closed to 1; and the distribution of religious places tends to be random. In the later historical periods, the R value continues to decrease, indicating that with the passage of time, the spatial distribution and agglomeration trend of religious places in Quanzhou is becoming increasingly obvious, and the agglomeration form is also increasing.

Table 2. The nearest neighbor index of Quanzhou religious sites.

Period	Observation nearest distance ( $\bar{r}_1$ )	Ideal nearest distance ( $\bar{r}_E$ )	The nearest neighbor index (R)	Significance (P)	Spatial distribution state
Tang Dynasty and before	0.042	0.055	0.762	0.000	Agglomerative
Song and Yuan Dynasties	0.022	0.032	0.689	0.000	Agglomerative
Ming and Qing Dynasties	0.015	0.026	0.557	0.000	Agglomerative
Since the Republic of China	0.013	0.024	0.545	0.000	Agglomerative

#### 3.2. Spatial Trend Characteristics

According to the calculation formula of standard deviation ellipse, the standard deviation ellipses in four historical periods before and after the Tang Dynasty, the Song and Yuan Dynasties, the Ming and Qing Dynasties and the Republic of China were obtained by data processing using ArcGIS10.2 software (see Table 3). On the whole, the center of gravity of the four historical periods mainly moved between 118.439-118.472 east longitude and 24.972-25.011 north latitude, with an east-west span of about 0.033 and a north-south span of about 0.039, all of which are located in Nan'an City, Quanzhou, and close to Quanzhou city. The X-axis represents the distribution range of religious sites, and the Y-axis represents the distribution direction of religious sites, which respectively reflect the breadth of the distribution of religious sites in the north-south and east-west directions. After the four historical periods of development and evolution, both X-axis and Y-axis have increased to varying degrees, but there are no obvious changes. The angle  $\theta$  is always kept at 90 to 180 degrees, which ensures the spatial distribution of religious sites along the southeast-northwest direction, as shown in Figure 1.

Table 3. The evolution of the spatial pattern of Quanzhou religious sites in different periods.

Period	Center of gravity longitude	Barycentric latitude	Distribution direction	Corner $\theta$	YStdDist	XStdDist
Tang Dynasty and before	118.458	24.978	Southeast to northwest	144.112	239271	393710
Song and Yuan Dynasties	118.439	25.011	Southeast to northwest	134.140	257146	455257
Ming and Qing Dynasties	118.459	24.983	Southeast to northwest	129.369	266512	436266
Since the Republic of China	118.472	24.972	Southeast to northwest	129.287	262677	426135

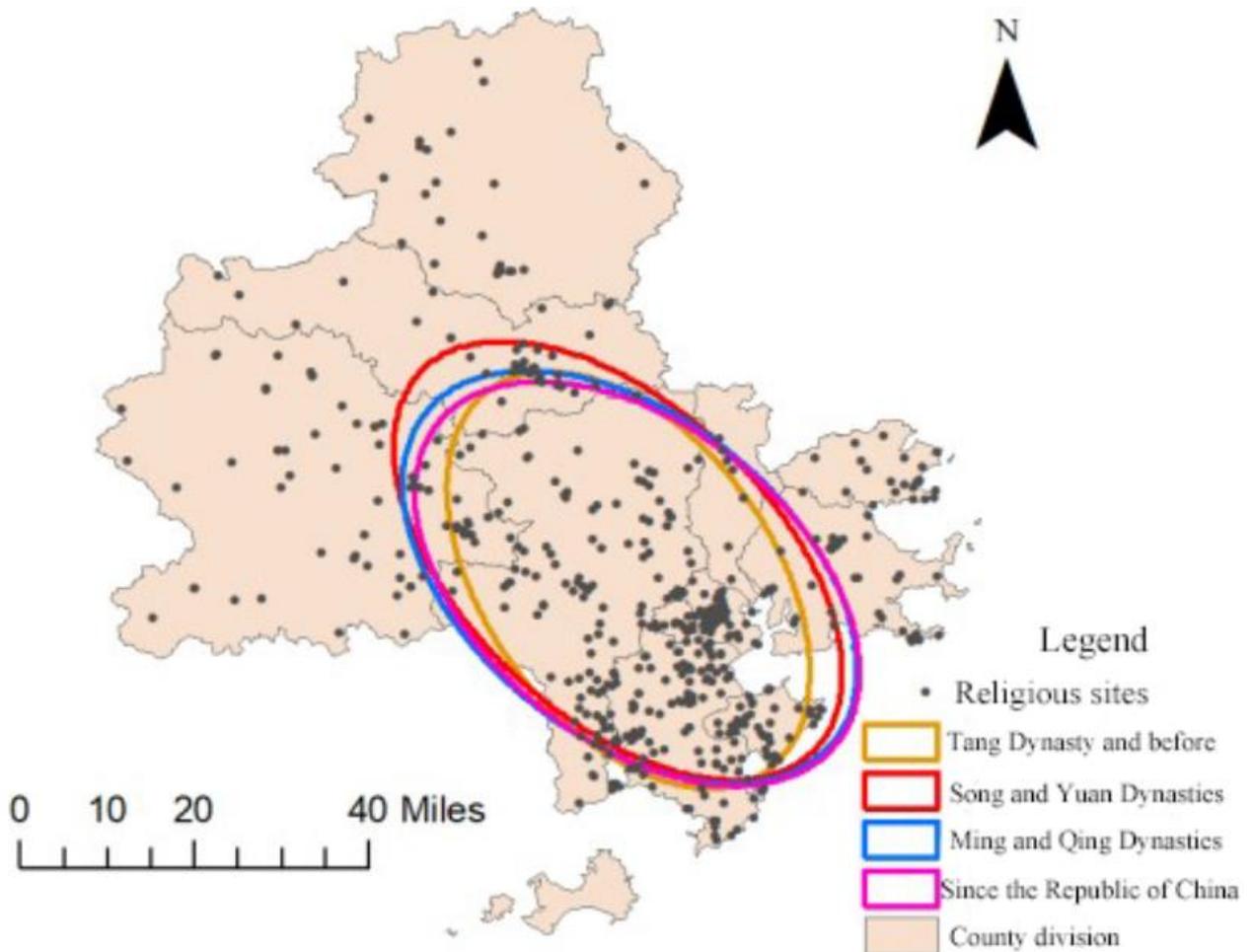


Figure 1. Standard deviation ellipse of Quanzhou religious sites in different periods.

### 3.3. Spatial Density Characteristics

Using the kernel density function in the ArcGIS10.2 software, we analyzed the spatial distribution density of Quanzhou religious sites in the four historical periods Tang Dynasty and before, Song and Yuan Dynasties, Ming and Qing Dynasties and after the Republic of China Figure 2. It can be seen from Figure 2 that in the Tang Dynasty and before, the high-density areas of religious places in Quanzhou showed multi-core distribution, mainly agglomerative in Quanzhou urban area (Licheng District and Fengze District), Yongchun and Shishi. During the Song and Yuan Dynasties, the overall spatial distribution density expanded, and the number of high-density core areas decreased. During the Ming and Qing Dynasties and the Republic of China, the high-density core area focused on the urban area of Quanzhou. Therefore, Quanzhou religious sites have experienced the development of four historical periods including Tang Dynasty and before, Song and Yuan Dynasties, Ming and Qing Dynasties and

after the Republic of China, showing that the Kernel Density within the spatial scope expanded, and the high-density core area is developing from multi-core to single core agglomeration.

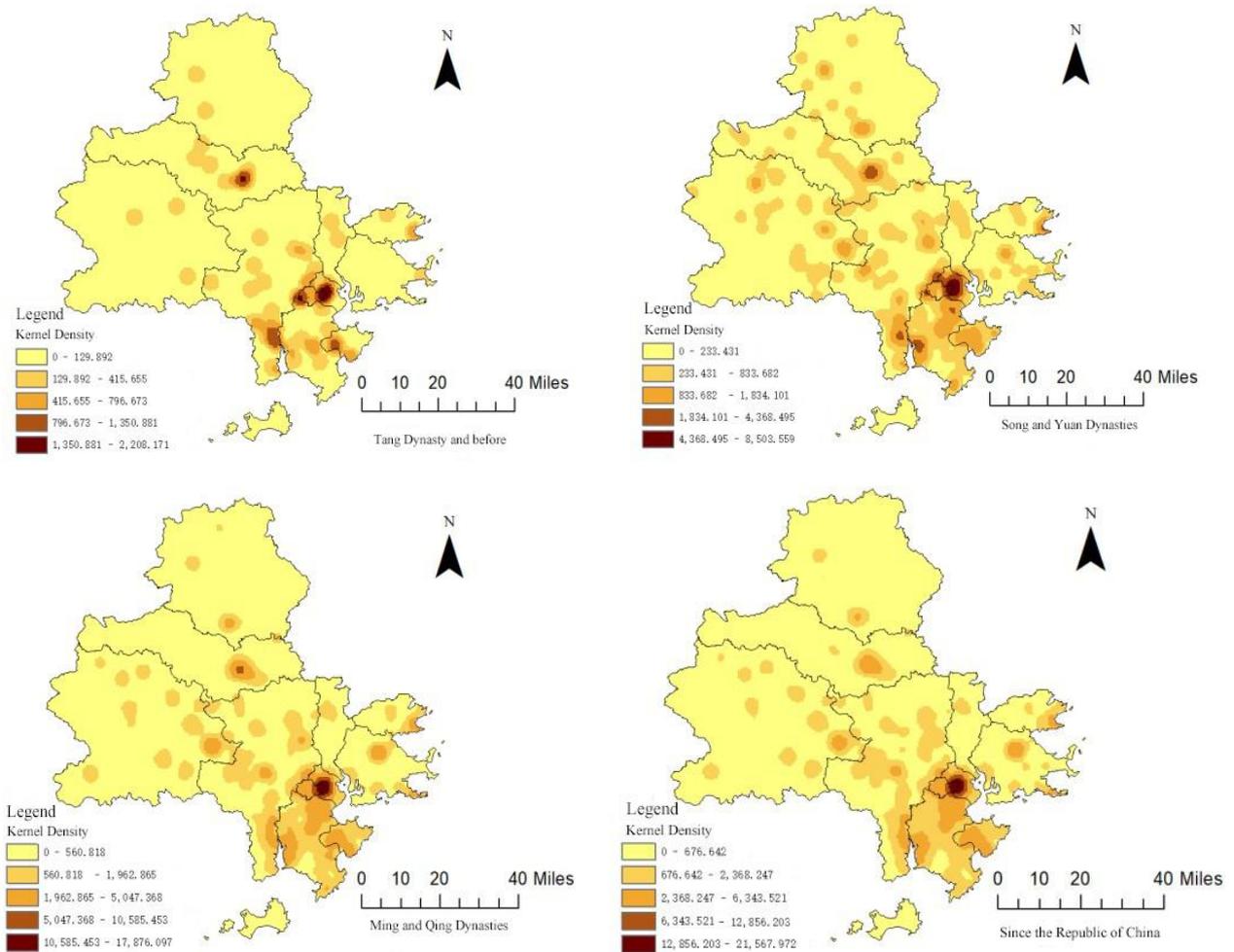


Figure 2. Kernel density estimation of Quanzhou religious sites in different periods.

### 3.4. Spatial Equilibrium Characteristics

The rectangular area was selected in the distribution map of religious sites in Quanzhou, covering all research sites. The study further divided the distribution map of religious places on different  $r$  scales, divided each side into  $k$  equal parts, and formed  $k^2$  small areas in the whole region. Firstly, the number of grids including religious places  $N(r)$  and the number of religious places  $N_{ij}$  in a single grid were counted, and then the probability  $P_{ij}(r)$  was calculated. Secondly, the amount of information  $I(r)$  was calculated according to the formula to obtain the grid dimension calculation data of religious places in the Tang Dynasty and before, Song and Yuan Dynasties, Ming and Qing Dynasties and after the Republic of China (see Table 4), and then draw the corresponding grid dimension scatter diagram Figure 3. Finally, Excel software was used for fitting regression to obtain the corresponding capacity dimension  $D_0$  and information dimension  $D_1$ .

According to Figure 3, religious sites in the Tang Dynasty and before, Song and Yuan Dynasties, Ming and Qing Dynasties and after the Republic of China all conform to the combing significance of fractal dimension on a certain measurement scale, which is shown in fractal characteristics. The capacity dimensions of the Tang Dynasty and before, Song and Yuan Dynasties, Ming and Qing Dynasties and after the Republic of China are 1.2706, 1.6092, 1.6922 and 1.6922 respectively, and the information dimensions are 0.6243, 0.7451, 0.7508 and 0.7966 respectively. On the one hand, the capacity dimension is greater than the information dimension in the four historical periods,

indicating that Quanzhou religious places show unequal probability distribution in space, and there is an agglomeration of local centers. It can be seen from Figure 2 that the agglomeration distribution of local centers mainly focuses on Quanzhou urban area, and increases over time. On the other hand, the capacity dimension values of the four historical periods range from 1.27 to 1.70 are constantly approaching 2 indicating that Quanzhou religious sites show a trend of constant equilibrium in the overall spatial scope in the process of self-organization evolution.

Table 4. Grid dimensional measurement data of Quanzhou religious sites in different historical periods.

Period	K	2	3	4	5	6	7	8	9	10
Tang Dynasty and before	N(r)	4	8	12	13	20	20	26	30	33
	I(r)	1.106	1.613	2.069	2.219	2.694	2.682	3.007	3.012	3.019
Song and Yuan Dynasties	N(r)	4	7	11	17	24	30	35	43	50
	I(r)	0.975	1.680	2.049	2.463	2.655	3.017	3.104	3.272	3.524
Ming and Qing Dynasties	N(r)	4	8	12	19	28	36	40	49	60
	I(r)	0.939	1.656	2.047	2.416	2.677	3.045	3.136	3.291	3.528
Since the Republic of China	N(r)	4	8	12	19	28	36	40	49	60
	I(r)	0.878	1.627	2.011	2.388	2.634	3.005	3.109	3.259	3.478

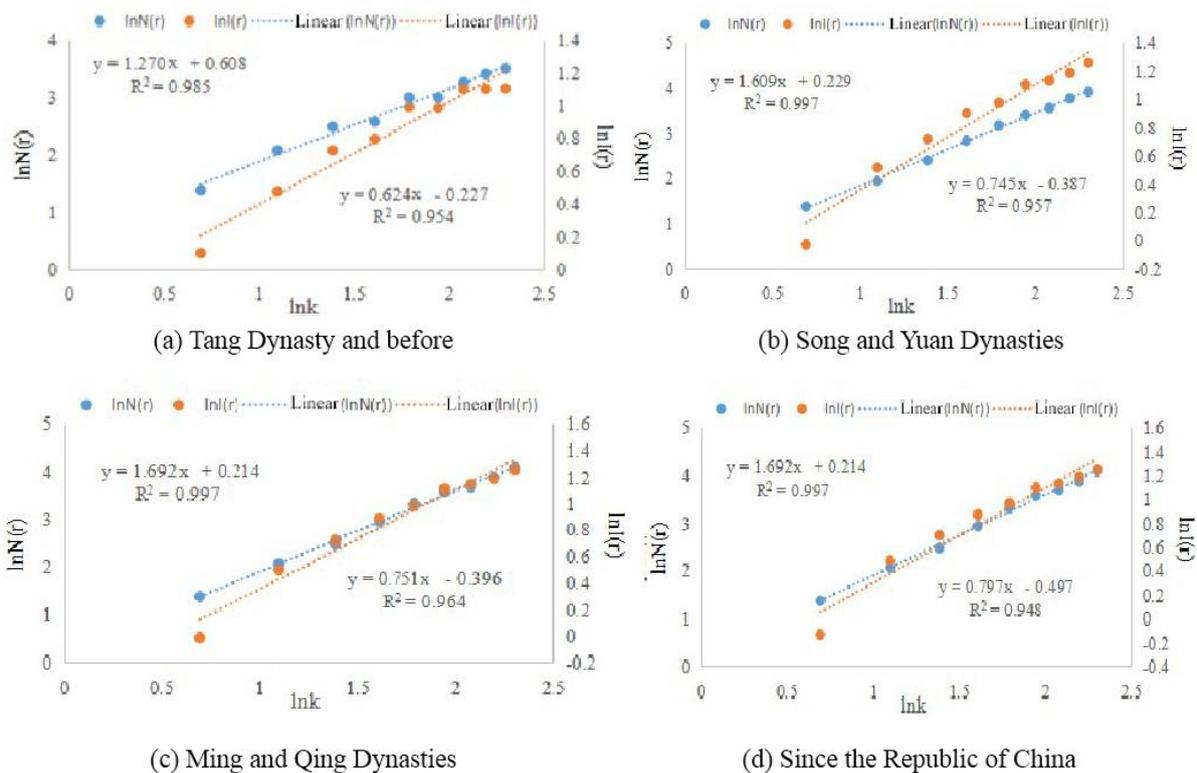


Figure 3. Grid dimensional double logarithm scatter diagram of Quanzhou religious sites in different historical periods.

#### 4. INFLUENCING FACTORS OF SPATIAL DISTRIBUTION OF RELIGIOUS SITES IN QUANZHOU

The spatial distribution and evolution of religious sites in Quanzhou is the result of the joint action of natural environmental factors and human environmental factors Figure 4. Based on this, this paper analyzed the spatial evolution mechanism of its religious sites from two aspects: natural environmental factors and human environmental factors. Natural environmental factors are the basic reasons for the spatial evolution of religious places, which are mainly reflected in the terrain and water environment. The human environment factor is the

promoting reason, which has a relatively complex impact on the spatial evolution of Quanzhou religious sites from four aspects, such as economy, population, transportation and culture.

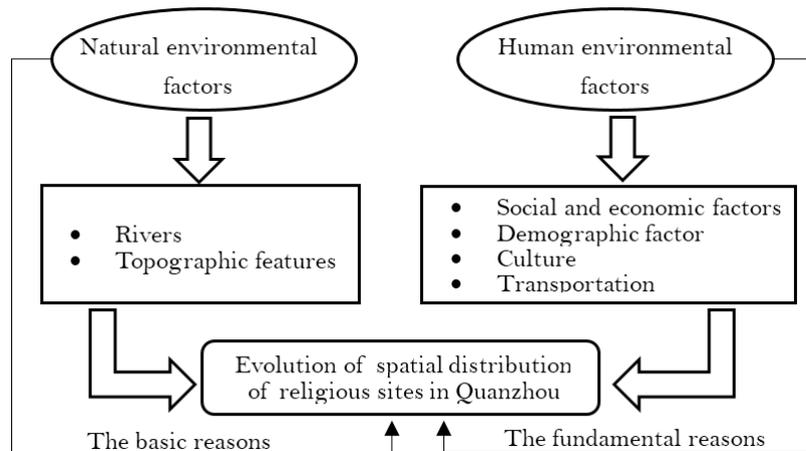


Figure 4. Influencing factors of spatial distribution of religious sites in Quanzhou.

#### 4.1. Natural Environment Factors

##### 4.1.1. Rivers

The spatial distribution of religious sites in Quanzhou is related to the distribution of water resources. On this basis, the buffer zones of 1km, 3km and 5km were analyzed in turn, and the spatial intersection with Quanzhou religious sites was analyzed (see Figure 5). From the quantitative analysis, within the buffer zones of 1km, 3km and 5km, the number of religious places in Quanzhou accounts for 40.13%, 64.97% and 76.15% respectively of the total number of religious places. From the distribution direction, religious sites are distributed along the southeast to northwest direction, which shows the trend of diffusion from coastal ports to inland rivers. On the whole, the number of religious places decreases from coastal to inland. The distribution of religious places is mostly agglomerative along the coastline, along rivers and at the confluence of rivers. In conclusion, the spatial distribution of religious sites in Quanzhou presents the characteristics of distribution along the water areas. This is because Quanzhou has a dense river network, with 34 streams and a large basin area which, on the whole, flows from northwest to southeast. At the same time, Quanzhou, as an important port in the Tang and Song Dynasties, developed water transport conditions that not only enhanced the attraction of economic, religious and cultural exchanges, but also developed river networks that connected the surrounding areas, connecting the hinterland and overseas areas and further providing convenient transportation conditions for cultural communication. In addition, in ancient times, although both land and waterways were important transportation routes, it was more convenient to travel by waterway than by overland, so people preferred to travel by waterway. Therefore, the dense river network and convenient water transportation played a strong role in promoting the spread of religious cultures. For example, in the fifth year of Tianli in Yuan Dynasties, Master Shimizu went to the county town by water transportation to pray for rain. On March 17<sup>th</sup>, Quanzhou officials went to Qingshui Rock to make a sacrifice to gods or ancestors. When they finished, they got up immediately, went to Anxi County, sailed down by night, and landed on the 18<sup>th</sup>, which was recorded in *Qingshuiyanzhi*.

##### 4.1.2. Topographic Features

The spatial distribution of religious sites in Quanzhou is related to the landform. On the one hand, Quanzhou has an advantageous geographical location and is the starting point of the Maritime Silk Road. It is located in the southeast of Fujian province, with a wide sea area, multiple natural harbors and habitable and productive climate conditions. These not only provided rich material resources for people's daily production and life, but also for the

survival of multiculturalism, and help to reduce the contradictions caused by the competition for survival resources. Thus, the coexistence of multiple religious cultures has laid a good material foundation. On the other hand, Quanzhou is high in the northwest and low in the southeast. It is a gradually changing landform of mountains, hills, plateaux and plains. The special terrain environment makes the economy, foreign trade and population flow of plains and plateaux higher than those of inland areas. At the same time, the prosperous trade also attracted the concentration of religious cultures. In addition, the dense population flow accelerated the spread of religious cultures; therefore, the number of religious places in plain and plateaux areas is more than that in hilly and mountainous areas. As shown in Figure 5, in the elevation topographic map of Quanzhou, most religious sites are distributed in areas below 200m above sea level. The overall distribution trend is that the number of religious sites gradually decreases from the southeast coastal area to the northwest inland area.

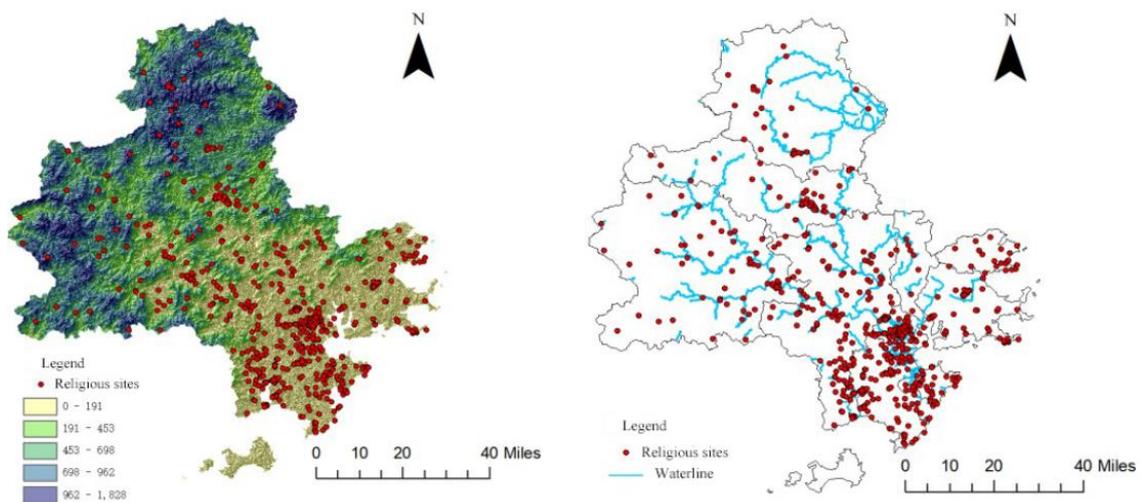


Figure 5. Coupling map of Quanzhou religious sites, landform and rivers.

## 4.2. Human Environmental Factors

### 4.2.1. Social and Economic Factors

The development of the Maritime Silk Road is the internal determinant of the formation of the spatial structure of religious sites. During the Three Kingdoms period, Quanzhou began to be governed by Dong'an County, and Zhou and Qin started economic development. By the Tang Dynasty, economic development had a certain foundation, and maritime trade began to flourish, and reached its peak in the Song and Yuan Dynasties. Quanzhou religious sites are agglomerative in Nan'an city, close to Quanzhou urban district. From the analysis of Quanzhou's historical and economic development, Nan'an city is located in the middle reaches of Jinjiang, which was once the social development center of southern Fujian, and Jinji Ancient Port in Fengzhou was the starting point of the ancient Maritime Silk Road. The nearby Quanzhou City, Jinjiang City and Shishi City have been within the scope of economic, cultural and political centers. Although the scale of these cities has been expanding over time, the economic and cultural centers have never undergone large scale migration. Thus, the sustained and prosperous economy lays the economic foundation for the spread and development of a multi-religious culture, which also constitutes an important reason for the introduction of foreign religions such as Christianity, Islam and Manichaeism. At the same time, the prosperous economy also provided strong economic support for the construction of various religious buildings, such as temples and towers.

### 4.2.2. Demographic Factor

The population factor is an important carrier and medium for the construction and dissemination of religious sites. On the one hand, the crowd is the object of spreading religious culture. Densely populated areas are often the

preferred location for religious sites. The prosperous maritime trade in Quanzhou during the Tang Dynasty resulted in the southeast coastal area becoming the intersection of internal and external economic and cultural connections. Specifically, the prosperous economy brought about large-scale population mobility, forming a densely populated area, while the high-intensity population mobility provided great possibilities for the inflow of multi-religious cultures; the densely distributed population served as an accessible and convenient audience for the spread and development of religious cultures. On the other hand, the crowd is the disseminator and receiver of religious culture. Quanzhou is located in the coastal area. In ancient times, people mostly made a living by fishing in the sea, which was often accompanied by high risks. Therefore, people prayed to the gods for protection. To sum up, although the population distribution depended on the regional socio-economic development, it also affected the spatial distribution of religious sites in Quanzhou. Even now Quanzhou City, Jinjiang and Nan'an are densely populated areas, in which nearly 62% of religious sites are distributed, and they have also become agglomerative areas of religious sites.

#### 4.2.3. Culture

The particularity of Minnan culture is an important reason for the formation of the spatial structure of religious places. From the perspective of cultural production, the essence of Quanzhou's culture is a combination of immigrant cultures and the local culture, agricultural culture and maritime culture. First of all, Fujian is located in southern Fujian, which essentially belongs to Fujian culture. During the Spring and Autumn Period (770-476 BC), the Yue culture merged to form the Min-Yue culture, which is known as the belief in ghosts and gods. Secondly, Quanzhou is far away from the Central Plains, which provides a good migration place for the Central Plains people to escape from wars and disasters, so it is easy to form immigrant culture, such as the Hakka culture. Furthermore, Quanzhou's maritime trade provided a good geographical advantage for the formation of a maritime culture. Therefore, the more open and inclusive immigrant cultures and maritime culture, coupled with Quanzhou's unique geographical location, were likely to promote the exchange and integration of various religious cultures, and the southeast coast of Quanzhou is richer in maritime culture than the northwest mountain forest area. Therefore, the religious sites in Quanzhou are mainly concentrated in the southeast coastal area, showing the trend of spreading from the southeast coast to the northwest inland. From the perspective of cultural complexity, a single culture has a strong continuity and inheritance, and it shows a more obvious rejection of foreign cultures. Whereas complex cultures constantly collide, absorb, integrate and abandon in the process of gestation, which makes them more open and inclusive. Specifically, Quanzhou's culture is a combination of various cultures, and it is a complex culture. Its cultural openness and inclusiveness are not only reflected in the acceptance and absorption of foreign religious cultures by Minnan culture, but is also reflected in the localization of foreign religious cultures in the process of development and dissemination, as well as the mutual game and integration among various religious cultures. The situation that Quanzhou now presents is the coexistence and co-prosperity of multi-religious cultures. To sum up, Quanzhou's special cultural factors had an important influence on the spatial distribution of religious sites.

#### 4.2.4. Transportation

There is a correlation between the spatial distribution of religious sites in Quanzhou and regional traffic trunk lines. The main traffic arteries in Quanzhou include high-speed rail, railways, national highways and provincial highways, etc. By generating buffer zones of the main traffic arteries and analyzing the intersection with the layer of religious sites, the number of religious sites in the buffer zones of 1km, 3km and 5km respectively accounts for 43.26%, 76.81% and 86.02% of the total number of religious sites in Quanzhou. As a result, the spatial distribution of religious sites in Quanzhou is generally consistent with the distribution of main traffic arteries. The reason is that convenient transportation can reduce the spatial obstacles in the spread of religious culture and promote the spread of religious culture. At the same time, the transportation hub area is often a densely populated area, so the

development of traffic flow guides the spread and development direction of religious culture, and the spatial distribution of religious sites is related to the regional traffic trunk line.

## 5. CONCLUSION, COUNTERMEASURES AND DISCUSSION

Quanzhou, as one of the earliest famous historical and cultural cities in China, and is known as the East Asian Cultural Capital. It is also recognized by the United Nations as the starting city of the Maritime Silk Road. Under the leadership of ancient city culture and Sea Silk Road culture, Quanzhou has created a good cultural ecology for the integration of multiple religious cultures. Pluralistic religious culture not only connects the communication channels between the East and the West, but also shows itself as a product under the background of economic and cultural prosperity. In the 21st century, the development of the Maritime Silk Road will connect the non-economic sectors of Europe and Asia, and promote communication and exchange in the fields of economy and trade, humanities exchanges, ecological environment, etc. Religious culture, as a manifestation of cultural diversity, will certainly play a vital role in the development framework of the global community of destiny. Therefore, it is helpful to provide reference and a basis for the protection, inheritance and innovation of religious culture in Quanzhou by strengthening the research on the spatial-temporal characteristics of multiple religious places and clarifying the temporal-spatial evolution law of multiple religious cultures in Quanzhou.

### 5.1. Conclusion

In this paper, the nearest neighbor index analysis method, standard deviation ellipse analysis method, kernel density and grid dimension were used to analyze the spatial evolution process and evolution characteristics of Quanzhou religious sites in four historical periods including the Tang Dynasty and before, the Song and Yuan Dynasties, the Ming and Qing Dynasties and the Republic of China. The results show that: (1) In terms of spatial types, the spatial distribution of religious sites in Quanzhou in the four historical periods is characterized by spatial agglomeration, and the degree of agglomeration is constantly strengthened. On the spatial trend, the gathering center of religious sites is always located in Nan'an City and close to Licheng District and Fengze District. The distribution direction is southeast-northwest, spreading from inland from the coast. In terms of spatial density, the religious sites show the transition from multi-core areas to single-core areas, and that the number of high-density core areas is decreasing. Spatial equilibrium: religious sites are distributed in unequal probability, and there are local centers. (2) The spatial structure of religious sites in Quanzhou is influenced by both the natural environment and the human environment. In terms of natural environment, it extends along the water area, and its distribution is mostly concentrated along the coastline, rivers and the confluences of rivers. At the same time, the distribution trend is decreasing from the southeast coastal plain to the northwest mountainous area because of topography. In terms of humanities, religious sites are concentrated in areas with a high level of economic activity, concentrated population distribution and convenient transportation. At the same time, Quanzhou's unique cultural background provides strong support for the coexistence and prosperity of multiple religious cultures. (3) The spatial structure of religious sites in Quanzhou reflects that Quanzhou's multi-religious culture has distinctive marine characteristics. The environment brings marine trade, and religious cultures form marine characteristics under the influence of marine trade. On the one hand, maritime trade attracts a variety of foreign religions into Quanzhou and forms a spread, and through the acceptance, inheritance, integration and innovation of audience groups, a unique multiple religious culture is formed. On the other hand, maritime trade make Quanzhou's religious beliefs have a strong openness, which is embodied in the interactive game between foreign religious cultures and local religious culture, and finally forms the situation of coexistence and prosperity of multi-religious cultures in Quanzhou. (4) The coastal areas of Quanzhou extend to the hinterland, showing the maritime characteristics of religious culture. The exchange of trade between port and hinterland promotes the convergence of cultural elements. Compared with the hinterland, coastal ports play a leading role in the process of cultural elements convergence because of their

important role in politics and the economy. As a result, the cultural elements in the hinterland begin to move closer to the port, and then have the characteristics of port culture.

## *5.2. Countermeasures*

According to the analysis results of the spatial distribution, time evolution characteristics and influencing factors of 608 religious sites in Quanzhou, combined with the reality of the coexistence and common prosperity of religions in Quanzhou, this paper puts forward the following suggestions:

Strengthen the repair and protection of religious and cultural sites. All religious sites in Quanzhou should rely on the protection framework of national laws and regulations, actively respond to the implementation needs of national protection and management of religious sites, and implement specific protection measures in combination with the objective and actual situation of their own religious sites. Specifically, on the basis of deepening the policy interpretation, we should take the policy as the guideline for the protection policy of religious sites and religious culture, reasonably examine the advantages and disadvantages of our own religious sites and religious culture protection, promote the repair of religious sites' building facilities, historical ancient books, ancient trees and the like, strengthen the disaster prevention measures of religious sites and the religious culture atmosphere, and further form the adaptive development path of religious culture protection. Strengthen the openness and inclusiveness of religious culture. All religious sites in Quanzhou should be based on the maritime characteristics of religious culture extending from the coastal areas of religious sites to the hinterland, and objectively evaluate the uniqueness of religious cultural characteristics in Quanzhou. At the same time, with the help of Quanzhou's advantageous geographical location at the starting point of the Maritime Silk Road, we should further deepen the maritime characteristics of religious culture to enhance the openness and inclusiveness of religious culture in Quanzhou. Specifically, give full play to Quanzhou's unique advantages as an international cultural exchange center during the Song and Yuan Dynasties, rely on the historical relics of a large number of religious sites, carry forward the inclusiveness of religious culture, promote exchanges and mutual learning among different civilizations, and highlight Quanzhou's open, diverse and inclusive maritime culture and urban spirit. Based on an in-depth understanding of the spread distribution of religious sites from coast to inland in the four historical periods of Tang Dynasty and before, Song and Yuan Dynasties, Ming and Qing Dynasties and after the Republic of China, this paper analyzed the characteristics of maritime culture and the particularity of cultural communication, and makes full use of its advantages in communication mode and audience of religious cultures to further promote the integration of multiple religious cultures and broaden the content and category of Quanzhou religious culture.

Pay attention to the cooperative protection of multi-core and single-core centers. According to the spatial differentiation characteristics of the high-density core areas of religious sites in Quanzhou, where the number of high-density core areas gradually decreases with time, and combining with the implementation framework and development process of religious protection, all religious sites should make appropriate historical textual research on the original high-density core areas and investigate their religious sites and cultures to prevent some valuable religious sites and religious cultures from irreversibly dying out and being lost. Specifically, based on the background of diversified integration and development of religious culture in Quanzhou, we should actively explore the convergence and heterogeneity of existing religious sites and religious cultures, adopt comprehensive management measures and targeted protection measures, and select religious governance methods suitable for each place, and gradually adjust and implement the protection measures that are currently misplaced or relatively inadequate in their implementation, so as to promote the coordinated development of multiple religions.

Give consideration to the harmonious symbiosis of natural and human protection. Fully understand the important role of the natural environment in the spatial distribution of religious sites and the spread of religious cultures, and at the same time pay attention to the important audience and carrier role of the people in the spread of religion, and give full play to its positive role in guiding the masses to exert positive energy and inheriting China's

excellent traditional culture (Government, 2018). Specifically, closely related to the spatial distribution of religious sites in Quanzhou, there is a significant correlation with water distribution, topography and geomorphology. The particularity of Minnan culture is an important reason for the formation of the spatial structure of religious sites. We should evaluate the current natural environment and ecological development of religious sites in Quanzhou and its surrounding areas, and carefully build religious cultural tourism projects on the basis of protection. At the same time, we should give full play to the subjective initiative of the masses, aim at the religious cultural audience, improve their religious experience satisfaction and effectively stimulate their awareness of religious protection so as to ensure the good natural landscape and religious culture of religious sites. For non-religious cultural audiences, we should further increase the publicity on the protection of natural environment and religious culture around religious sites to improve the protection awareness of the non-religious cultural audiences.

### 5.3. Discussion

This paper analyzed the spatial structure evolution and influencing factors of religious sites in Quanzhou in four historical periods. However, it did not analyze religious sites of different religious types from the perspective of time and space evolution, nor does it reveal its spatial dynamic structure evolution and influencing factors. Therefore, in the future research, we can analyze the spatial structure evolution of different types of religious sites in different historical periods from the perspective of religious types. At the same time, the spatial structure of religious sites is influenced by many factors. This paper only analyzes from natural factors and human factors. Therefore, future research could consider diversified influencing factors and reveal the differences of spatial distribution of religious sites from the perspective of various influencing factors. In addition, besides the mainstream religions such as Buddhism, Taoism, Christianity and Islam, Quanzhou is also an area in which folk beliefs occupy an important position, is extremely rich in folk beliefs, and also has numerous local gods and small temples. Therefore, future research could carry out in-depth research on the spatial distribution of religious places in combination with various folk beliefs.

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