

Research Article

Evaluation of Water Resources Environment and Regional Agricultural Economic Development Based on SAR Imaging Algorithm

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Synthetic aperture radar (SAR) is a new high-tech radar that uses SAR principles and pulse compression technology to perform high-resolution imaging of ground targets. Because it is not affected by various factors such as location, time, and climate, it is widely used in the civilian and military fields, bringing huge social and economic benefits. Moreover, the environment of agricultural water resources and the development of regional agricultural economy can be studied using the SAR imaging algorithm. With the serious shortage of water resources and the increase of the world's population, the use of water resources for agriculture must not only achieve the goal of saving water, but more importantly, achieve efficient production on the premise of saving water. However, the shortage of water resources in China has become a serious constraint on the development of agriculture and rural economy and has become an important factor restricting the sustainable development of agriculture and rural economy. Therefore, the development of efficient and sustainable use of water resources is very important to establish a water-saving society for the sustainable development of China's economy and society. For the spaceborne SAR system, an azimuth-based multi-channel range ambiguity suppression method is proposed in this chapter. The simulation results show that after adopting the azimuth phase encoding technology, the azimuth spectrum of the signal in the ambiguous area can be moved to suppress the distance ambiguity.

1. Introduction

The synthetic aperture radar (SAR) unit system uses pulse compression technology and SAR principles to achieve two-dimensional high-resolution imaging of the target. This is one of the main technologies developed by modern radars [1]. Compared with other remote sensing technologies such as optics and infrared, SAR microwave radiation has a wider range and is not affected by weather and light. In addition, within a specific frequency band, electromagnetic waves penetrate the surface of hidden objects such as vegetation and walls, and can also detect targets with a depth of tens of meters or the back of the wall [2]. Based on the above characteristics, SAR systems are widely used in military, geology, surveying, map making, rescue, and other fields. Water is an indispensable resource for human survival and

development. Insufficient water is a problem on the scale of the Earth. China is one of the most water-scarce countries in the world. The shortage of water resources has brought serious impact on agricultural production and people's lives [3]. With the sustained and stable development of China's social economy and the continuous progress of urbanization, industrial and domestic water use should increase substantially [4]. With the total amount of water resources in China unchanged, agricultural water use will indeed decrease. Therefore, China's agricultural water resources will grow negatively, and the contradiction between water supply and demand will become more obvious [5]. Therefore, rational development and utilization of water resources, promotion of unified management of water resources, and strengthening of water resources protection are important content of water resources utilization. Agriculture provides a

very important material guarantee for China's economic development [6]. The steady and rapid development of the rural economy is also an important part of China's overall economic development, and it has very important significance and value for the stable and lasting development of China's future economy. Now, the importance of agriculture is becoming more and more significant. In today's society, the rural economy is one of the main factors that promote economic development [7]. With the changes in China's agricultural modernization assessment, the agricultural spatial model has also changed. Taking agricultural economic management as the starting point, we will further promote the development of the modernization level of China's rural economy and realize the sustainable development of agriculture. There are still problems in the development of China's rural economy [8]. It is necessary to analyze specific problems in detail and implement further measures to improve the agricultural economy. It is necessary to provide timely response measures related to cultural economic management, pay close attention to issues, implement them in accordance with scientific management requirements, and effectively improve the actual effects of rural economic development, avoid rural economic problems, and achieve sustainable agricultural economic development [9].

2. Materials and Methods

2.1. Overview of the Study Area. A certain county is a transition zone between the northern subtropical zone and the warm temperate zone. It belongs to the H river system and enters the H river from south to north. The H river enters a certain county from Fengtai Pass and flows through the northern end of a certain county. The length of the river in the prefecture is about 26 km. The maximum flow of rivers in this area is 12000 m³/s, and the minimum flow is 57 m³/s.

2.2. Theoretical Basis. In spaceborne SAR, a broad mapping zone can be used to complete global surveillance, and a specific area can be repeatedly monitored in a short period of time. According to the high resolution, more detailed features of the scene can be obtained. Therefore, high-resolution imaging with a wide mapping band is an important development direction for spaceborne SAR. In the previous single-channel spaceborne SAR system, due to the limitation of the minimum antenna area, a wide range of mapping bands and high azimuth resolution are mutually restricted [10]. Spaceborne SAR platforms are usually hundreds of kilometers high and have speeds of thousands of meters per second. The small-range directional beam can cover an inclination range of tens to hundreds of kilometers. On the other hand, in order to ensure high azimuth resolution, the azimuth antenna adopts a small effective aperture, and as a result, the range becomes blurred. Therefore, distance blur is an unavoidable problem of spaceborne SAR, which will reduce the image quality and seriously affect the observation performance of the spaceborne SAR system [11].

In order to suppress the ambiguity of distance, scholars at home and abroad have proposed several methods. The general method is to design an antenna pattern to reduce the antenna side lobe energy or antenna gain in the blurred area to reduce the energy of the echo signal in the blurred area. Using the alternating radiation of positive or negative linear frequency modulation signals, the fuzzy area of the echo signal distance of the point target cannot be effectively accumulated when pressing the artery and vein, the suppression range is blurred, and the signal energy of the blurred area will not be reduced, thus affecting the SAR image signal-noise ratio. Therefore, this method is only suitable for point target scenes, not for scattered target scenes [12]. Using azimuth phase coding (APC) technology, the azimuth spectrum of the signal in the blurred area is moved through modulation and demodulation, and then the azimuth band-pass filtering process is used to reduce the blur energy. This method can be implemented simply, but must completely suppress the echo in the lower fuzzy area. It can be seen from the following analysis. The PRF must be several times the azimuth bandwidth of the imaging area signal, but if the PRF is increased, the width of the mapping band of the imaging area will become narrower, so a single-channel spaceborne SAR system cannot meet the above conditions. Multiple channels are used to receive echo signals, and digital beamforming (DBF) technology is used to form an equivalent narrow beam reception that is aligned with the useful echo through appropriate weighting of each receiving channel [13]. Zero adjustment in the direction where the echo reaches the blurred area can suppress the area ambiguity. However, this method forms a good antenna pattern, because it knows the surface curve function, and it cannot effectively deal with the scenes of undulating terrain. In the azimuth scanning method, related scholars have proposed a pulse beam, which converts the distance of the blurred signal into the same azimuth multi-directional channel ambiguity signal and uses the azimuth position of the multi-channel ambiguity information solution. The method of blurring distance depends on the pulse width [14]. The interval is limited to sub-pulses, which is naturally more extensive than the measurement and mapping requirements.

For satellite-borne SAR systems, this chapter proposes a multi-channel range ambiguity suppression method based on azimuth. The core method absorbs the concept of conventional azimuth phase encoding and uses direction-encoded signals to send and receive. At the same time, it uses the fuzzy equivalent performance of the down-sampled azimuth signal to transform the fuzzy signals at different distances. At this time, in order to filter and separate the desired signal and the azimuth spectrum of the signal in the imaging area, a spatial filter will be constructed through multiple channels to obtain a high-resolution SAR image of the unblurred area [15]. In short, this method converts the ambiguity of the echo signal range into the ambiguity of the azimuth angle and then uses the azimuth angle multi-channel to suppress the ambiguity of the range [16].

2.3. *Research Methods.* The radar platform moves uniformly in a straight line along the X -axis at a speed v . The action mode of the radar is that one unit signal can receive 3 unit signals, and X_q ($q = 1, 2, 3$) is the position of the phase center of three equivalent antennas. In a spaceborne SAR, due to the large width of the mapping band covered by the beam and different illumination scenarios, the echo signals generated by the transmit pulses of different distance units can reach the receiving antenna at the same time, and the range

may become blurred. The n th echo in the imaging field and the $n + 1$ th echo in the negative first-order blurred area, R_g and $R_{amb}^{(k)}$, respectively, represent the shortest tilt from the center of the same phase to the center of the scene in the imaging area and the K -th blurred area distance.

The radar sends a linear frequency modulation signal, and the basic frequency echo signal of the target in the imaging area can be expressed as follows:

$$S_{img}(f_r, t_a) = A_g(f_r) a_a(t_a) \exp\left[-j\pi \frac{f_r^2}{\gamma}\right] \exp\left[-j \frac{4\pi}{c} R(t_a; R_b)(f_r + f_c)\right]. \quad (1)$$

If the APC technology is not used, the basic frequency echo signal of the k -order ambiguity point target in the range frequency domain can be expressed as follows:

$$S_{amb}^{(k)}(f_r, t_a) = A_{amb}^{(k)}(f_r) a_a(t_a) \exp\left[-j\pi \frac{f_r^2}{\gamma}\right] \exp\left[-j \frac{4\pi}{c} R(t_a; R_{amb}^{(k)})(f_r + f_c)\right]. \quad (2)$$

In Equation (2), t_a represents the low-speed time, c represents the speed of light, γ represents the modulation frequency of the transmitted signal, and f_c represents the carrier frequency of the radar. In addition, A_g and $A_{amb}^{(k)}$ are determined by the echo response amplitude of the target in the imaging area, the k -th order blur area field, and the frequency domain window function of the linear frequency modulation signal, and $a_a()$ represents the azimuth time domain window function. The azimuth spectrum of the echo signal of the imaging area and the echo signal of the k -th blurred area is represented by $S_{img}(f_r, f_a)$ and $S_{amb}^{(k)}(f_r, f_a)$, respectively.

$$\begin{aligned} S_{img}(f_r, f_a) &= FFT_{t_a}(S_{img}(f_r, t_a)), \\ S_{amb}^{(k)}(f_r, f_a) &= FFT_{t_a}(S_{amb}^{(k)}(f_r, t_a)). \end{aligned} \quad (3)$$

After adopting the azimuth phase encoding technology, the azimuth spectrum of the signal in the blurred area can be moved, and the energy of the blurred signal can be partially removed by the azimuth band-pass filter to suppress the distance blur. The realization of the azimuth phase encoding technology is divided into the following three steps:

- (1) The azimuth angle and phase code modulation of the transmitted signal

- (2) Demodulation of the received signal

- (3) The echo signal in the fuzzy area is suppressed by band-pass filtering

The APC modulation phase can be expressed as follows:

$$\phi_{mod}(n) = -\frac{\pi}{M} n^2, \quad (4)$$

where n is the number of transmitted pulses and $M \geq 2$ is the azimuth frequency shift coefficient.

The APC demodulation stage can be expressed as follows:

$$\phi_{dem}(n) = \phi_{mod}(n - m). \quad (5)$$

Among them, m is the blur number, which is determined by the two-way distance delay between the sending signal and the scene area of the imaging field:

$$\frac{m}{PRF} \leq \frac{(m + 1)}{PRF}. \quad (6)$$

For the image imaging scene area, the modulation item of the echo signal can be deleted after demodulation. In the k -th fuzzy region, after modulation and demodulation, the remaining modulation phase can be expressed as follows:

$$\phi_{res}(n, k) = \phi_{mod}(n - k) - \phi_{mod}\left(\frac{2\pi}{M} kn - \frac{\pi}{M} k^2 = 2\pi \frac{k \times PRF}{M} t_n - \frac{\pi}{M} k^2\right). \quad (7)$$

In Equation (7), $t_n = n/PRF$. The frequency shift area of the signal in the k -th blur is

$$\Delta f(k) = \frac{k \times PRF}{M}. \quad (8)$$

3. Results

3.1. Analysis of the Status Quo of Agricultural Water Resources Environment. As shown in Table 1, the total area of a certain lake is 122.66 billion km^2 , and the total storage capacity when the water level is 25 m is 4.12 billion m^3 . “The world’s first pond” is the main source of irrigation water for the county’s irrigation area. A pond is the main source of irrigation water for the county’s irrigation area. Its area is 387.4 km^2 , and the total storage capacity of the reservoir is 9.74 million m^3 at 29.74 meters. The Dajing Reservoir covers an area of 33.7 square kilometers and has a water level of 42.77 meters, and its total storage capacity is 53 million m^3 . The H reservoir has an area of 6.21 km^2 , a water level of 46.23 m, and a total storage capacity of 11 million m^3 .

By 2020, a county’s total water resources will reach 870 million m^3 , annual precipitation of 2.246 million m^3 , surface water resources of 775 million m^3 , and groundwater resources of 232 million m^3 . There is no need to double groundwater and surface water. The calculated water production coefficient is 39 million m^3 . The production coefficient of water is 291500 m^3 per square kilometer. In 2014, the county’s precipitation area was 2986 km^2 , and the precipitation in 2020 was 939.6 mm, which is equivalent to 2.86 billion m^3 . Last year, the county’s precipitation was 2.246 billion m^3 , and the average annual precipitation was 2.757 billion m^3 . The county’s precipitation in 2020 has increased by 24.9% compared to last year. This is an increase of 1.8 percentage points over the annual average precipitation. From the analysis of annual precipitation frequency, the county’s precipitation frequency is 43.8%, which is a normal year compared with the average annual precipitation frequency. In 2020, the county’s surface water resources will be 775 million m^3 , with an average outflow depth of 259.4 mm, which is 60.9% more than last year’s value and 2.3% less than the year’s value. In 2020, the county’s groundwater resources will be 232 million m^3 , mountainous areas 48 million m^3 , plain areas 178 million m^3 , and plains 404 million m^3 .

It can be seen from Table 2 that the total water resources of the county in 2020 will be 870 million m^3 , and the total water supply will be 729 million m^3 , of which surface water supply will be 721 million m^3 and groundwater supply will be 8 million m^3 . In 2014, the county’s total water supply was 83.79%. The county’s water supply is mainly from surface water sources, but because it is difficult to conserve groundwater sources, the water supply is limited. The water supply of the reservoir is 583 million m^3 , accounting for 80.83% of the surface water.

As shown in Table 3, the county’s total water consumption in 2020 is 729 million m^3 , of which irrigation water is 642 million m^3 , accounting for 87.93% of the total water consumption. The water consumption of forest breeding, fishery, and livestock is 18 million m^3 . Industrial

water consumption is 21.07 million m^3 ; urban public water consumption is 8 million m^3 . Household water consumption is 0.4 million m^3 ; water consumption for the ecological environment is 3 million m^3 . By 2020, our county’s total water consumption will be 465 million m^3 , of which farmland irrigation consumption will be 418 million m^3 . The water consumption of animal husbandry, fishery, and livestock is 14 million m^3 . Industrial water consumption is 6.05 million m^3 ; urban public water consumption is 24 million m^3 . The water consumption of the ecological environment is 1.7 million m^3 . The water consumption of arable land irrigation accounts for 73.68% of the county’s total water resources, making it the most important water consumption department in the county. With the development of the county’s economy, water consumption in industry, urban public, residential, and ecological environments has increased, and irrigation water for farmland has been forced to decrease.

As shown in Table 4, in 2020, the total population of the county is 1,405,208, the agricultural population is 1,242,355, and the per capita water resources are 642 m^3 . The county’s total water supply is 729 million m^3 , of which agricultural water supply is 696 million m^3 , water consumption is 465 million m^3 , water resource utilization rate is 63.79%, and per capita water supply is 518.78 m^3 . The per capita agricultural water supply is 560.38 m^3 , and the ecological environment water consumption is 140 million m^3 . The county has a total planting area of 19,633,000 hectares, an effective irrigation area of 1,599,500 hectares, and water resources of 354.66 m^3 . The water-saving irrigation area has increased from 809,200 hectares in 2014 to 835,000 hectares in 2020, but the growth is very slow. Each person in the county can get 642 m^3 of water. According to the United Nations, 1700 m^3 of water resources per person has exceeded the per capita water resource occupancy standard of 1700~1000 m^3 . It is not a water-deficient area that is moderately poor, and 1000~700 m^3 is a moderately water-deficient area. According to this regulation, the whole county belongs to the area where the per capita water consumption is relatively small in the world. As a large agricultural county, in addition to household water, agricultural water resources will become a major obstacle to the county’s sustainable development.

3.2. Analysis of Agricultural Water Resources and Environmental Issues. As shown in Figure 1, the county is affected by floods and droughts to varying degrees every year. As a result, crops have decreased to varying degrees. In recent years, disaster-affected areas have also tended to increase.

Figure 2 shows that in recent years, the investment of water conservancy funds has undergone tremendous changes, the regional investment is insufficient, and the central water conservancy investment has undergone tremendous changes. In 2017, a total of RMB 504.29 million was invested in water conservancy projects, including RMB 37.54 million from the central government and RMB 108.75 million from local governments. Local governments accounted for 34% of the total, 52.2% of the central government’s input, and less than half of the central government’s input. The total investment in

TABLE 1: Basic situation of main lakes and reservoirs in a county.

Name	Area (square thousand m)	Total storage capacity (100 million m ³)	corresponding water level m
A lake	1026.6	41.2	25
A reservoir	387.4	0.933	29.74
B reservoir	33.7	0.53	42.77
C reservoir	6.21	0.11	46.23

TABLE 2: Water supply of a county.

Water supply from surface water sources (100 million m ³)					Groundwater source water supply (100 million m ³)	Total water supply (100 million m ³)
Water storage	Diversion	Lift water	Nonengineering water supply	Subtotal	—	—
5.83	0.61	0.54	0.02	7.21	0.08	7.28

TABLE 3: Statistics of water consumption in a county.

Unit: billion m ³	Farmland irrigation	Lin, mu, fishery, and livestock	Industry		Town public	Resident life	Ecosystem	Total
			Fire (nuclear) power industry	Nonfire (nuclear) power industry				
Water consumption	6.42	0.18	0.0007	0.21	0.08	0.35	0.03	7.2
Water consumption	4.18	0.14	0.0005	0.06	0.24	—	0.017	4.6

water conservancy in 2018 included 35,647,900 yuan for the central government and 5,085,200 yuan for local governments, which was close to 85.5 million yuan, which was higher than that of the central government. In 2019, including the central government's 64.8 million yuan and the local government's 175.2 million yuan, a total investment in water conservancy is 240 million yuan. Among them, the central government's input accounted for 27% of the total input, and the regional input accounted for 73% of the total input. The total investment in water conservancy in 2020 is 287.43 million yuan, including 167.54 million yuan for the central government and 127.38 million yuan for local governments. There is almost no difference in investment in water conservancy between the central government and local governments.

It can be seen from Figure 3 that the combination of water resources environment and agricultural economy is a deep two-way connection for the purpose of achieving sustainable use of agricultural water resources. In order to ensure that the water resources environment and agricultural economy play a better role in the integration process, they must be restricted by the water resources environment.

It can be seen from Figure 4 that the combined development mechanism of water resources environment and agricultural economy is a complicated process. From a system perspective, the coupling is divided into four subsystems: water resources for agriculture, agricultural economy, water treatment, and water environment. From the perspective of process, coupling can be divided into system input, production, output, and other processes. In addition, it is also restricted by the environmental capacity of water resources, ecological understanding, comprehensive water pollution management, and water environmental safety.

3.3. Analysis of the Status Quo of Regional Agricultural Economic Development. As shown in Figure 5, the X-axis represents the gradual increase in per capita wealth in economic development. The Y-axis represents the environment. The country's economic development level is low (natural economic period, before the industrial revolution), per capita wealth is relatively small, environmental pollution is relatively light, environmental damage is small, and environmental degradation is low; however, with the acceleration of economic development, it enters the industry. In the era of globalization and sustained economic growth, the rise of the large machinery industry, the active development of agriculture and other resources, the accumulation of per capita income and growth, and the exhaustion rate of resources are higher than the purification capacity and the regeneration rate of resources, which have brought serious problems to the environment.

Environmental pollution is deteriorating with economic growth, even exceeding the ecological limit. Directly transition to the transitional period, accelerate the process of industrialization, and reach a certain level of economic development. In this process, the degree of environmental degradation will increase for the first time after a downward trend. In other words, there is a critical point for the transition point. After the turning point, the economy continued to improve. With the accumulation of per capita wealth and the alleviation of environmental pollution, the quality of alleviation began to improve. In the postindustrial era, the economic structure has changed, and the clean industry has gradually begun to vigorously develop. People's awareness of environmental protection and environmental consumption has increased, and the government has paid more attention to the implementation and improvement of environmental quality and environmental laws and policies.

TABLE 4: Population and cultivated land in a county.

Years	2012	2013	2014	2015	2016	2017	2018	2019	2020
Population (10,000 people)	133.3	134.8	135.4	136.5	137.1	137.6	137.8	138.8	140.4
Cultivated land area at the end of the year (hectares)	117288	1178711	118159	121411	122343	122234	122253	123628	196301

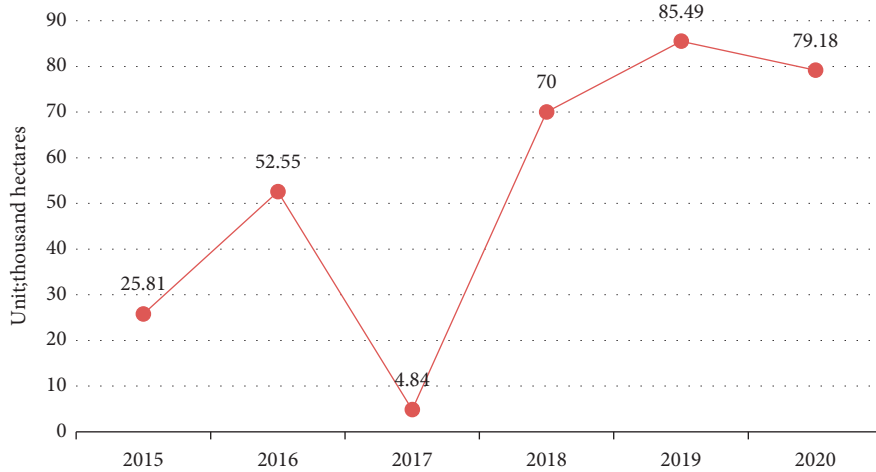


FIGURE 1: The affected area of crops in a county.

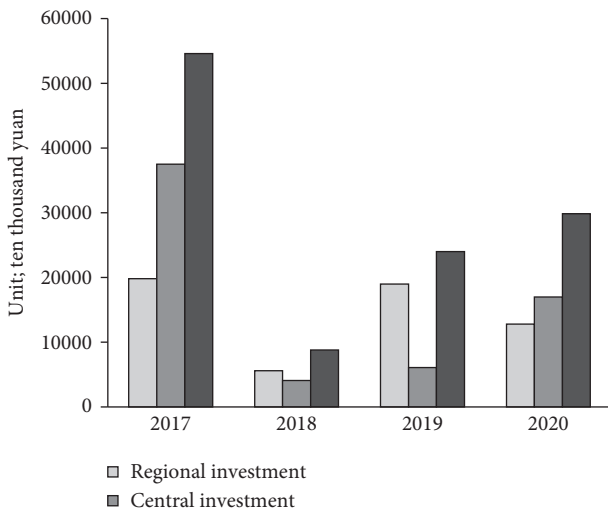


FIGURE 2: Water conservancy capital investment in a county.

It has reached a certain critical point or “turning point” and achieved certain economic development. At the same time, it has accumulated in the progress of science and technology and innovation, the continuous increase of per capita income, and the continuous improvement of related laws. There is a clear understanding of the concept, the degree of environmental pollution, the improvement of environmental quality, and the tendency to change from high to low. This phenomenon is called the environmental Kuznets curve.

According to Figure 6, the two relationships can be represented by the regression equation $Y = b_0 + b_1X + \mu$ with one variable. Y represents the per capita net income of farmers in the survey area, and X represents COD. In other

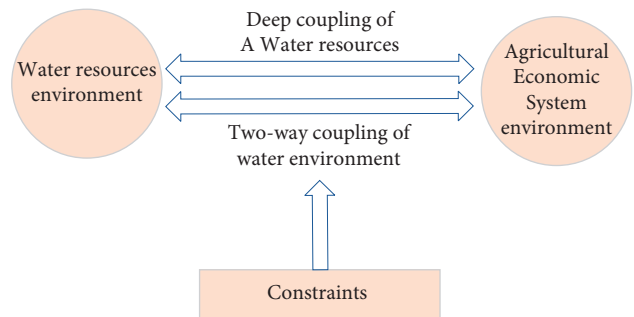


FIGURE 3: Coupling relationship between water resources environment and agricultural economy.

words, the formula $b_0 = -8293$, $b_1 = 1159$, and $\mu = 0$, and these two relations can be expressed by the regression equation $y = 1159x - 8293$ of one variable.

According to the return ceremony, COD will have a positive impact on the agricultural economic development of the surveyed area. On the other hand, from the point of view of the distribution of scattered points, the basic distribution is on both sides of the line, and the fitting results are also very good. From the perspective of the correlation index (coefficient of determination), the effectiveness is high. This article is based on the COD data of the livestock and poultry breeding industry in 2014. In an empirical study of the relationship between agricultural nonpoint source pollution and China’s economic development, apart from Beijing, agricultural pollution emissions and economic growth in Shanghai, Tianjin, and other provinces and cities are also on the rise, and economic growth has a positive relationship with COD. Therefore, the process of economic growth in the survey area will still be accompanied by an increase in COD emissions. However, if the COD emission

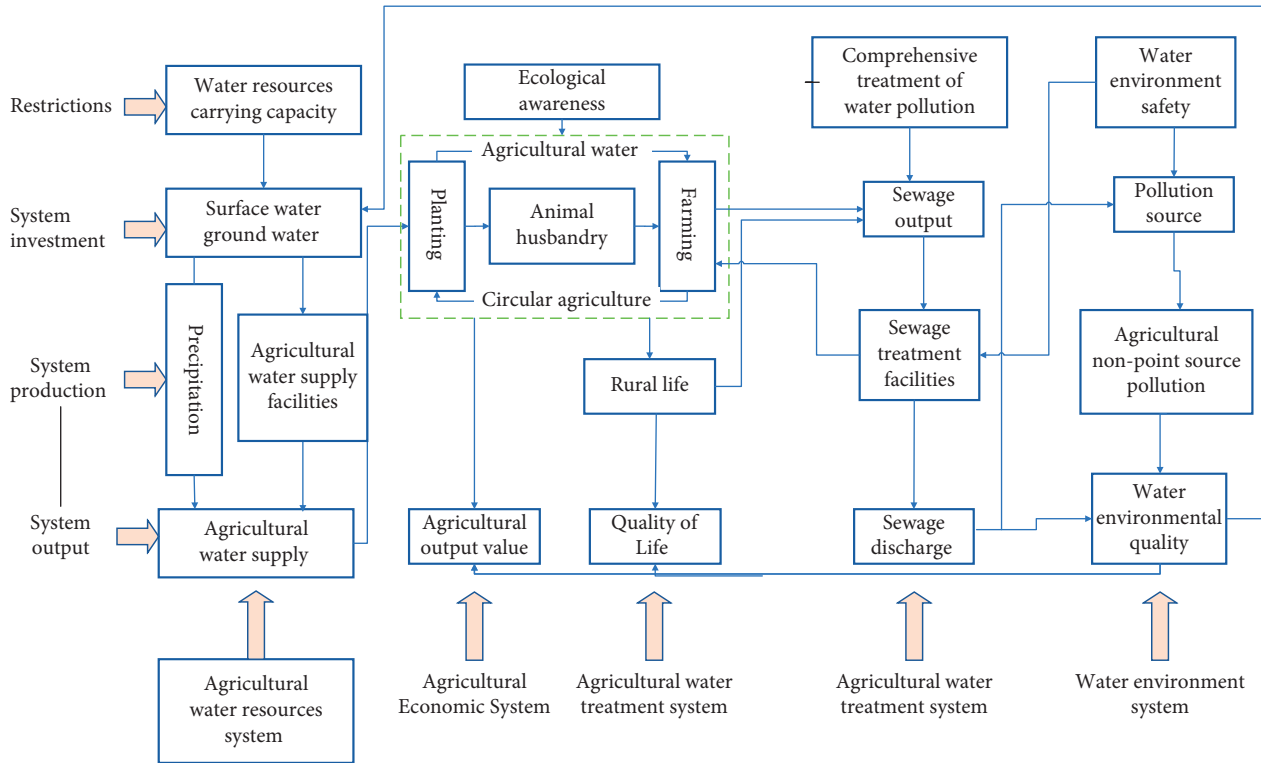


FIGURE 4: Coupling mechanism of water resources environment and agricultural economic system.

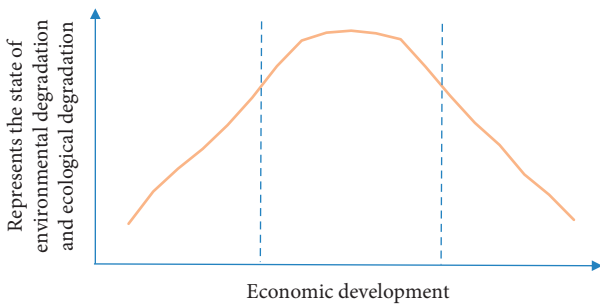


FIGURE 5: Environmental Kuznets curve.

reaches 14, the sharp increase in net income per capita is worthy of attention.

According to Figure 7, the two relationships can be represented by the regression equation $Y = b_0 + b_1X + \mu$ with one variable. Y represents the per capita net income of farmers in the survey area, and X represents TN. In other words, $b_0 = -26478$, $b_1 = 6463$, and $\mu = 0$, and the relationship between the formulas can be characterized by the regression equation $y = 6463x - 26478$ with one variable.

According to the regression formula, TN has a positive relationship with agricultural growth in the surveyed area. On the other hand, from the point of view of the distribution of scattered points, the basic distribution is on both sides of the line, and the fitting results are also very good. The correlation index shows high effectiveness.

According to Figure 8, the two relationships can be represented by the regression equation $Y = b_0 + b_1X + \mu$ with one variable. Y represents the per capita net income of

farmers in the survey area, and X represents TP. In other words, $b_0 = -24089$, $b_1 = 59961$, and $\mu = 0$, and the relationship of the formula can be expressed by the regression formula $y = 59961x - 24089$.

According to the regression formula, TP will have a positive impact on the agricultural growth of the surveyed area. Judging from the distribution of the scattered points, the basic distribution is on both sides of the line, which also shows that the fitting results are good. From the perspective of related indexes, the effectiveness is high. TP is indeed estimated data for planting and breeding of livestock and poultry, because in the surveyed area is the main agricultural production; if TP emissions increase, it means that grain production and meat production will increase in the surveyed area. In the field of research on agricultural economic growth, positive relationships are reasonable.

3.4. Measurement Analysis of the Gap in Regional Agricultural Economic Development. Since 1978, the gap in agricultural economic development between southern and northern China has been significantly reduced, and the gap in agricultural economic development between eastern and western China has narrowed. However, the gap in agricultural economic development in China has become apparent at this stage and is an important obstacle to agricultural economic development. However, the above analysis can only explain the gap between regions and cannot reflect the development characteristics of the agricultural economy in the region. For example, the relatively small Theil coefficient between the north and the south only

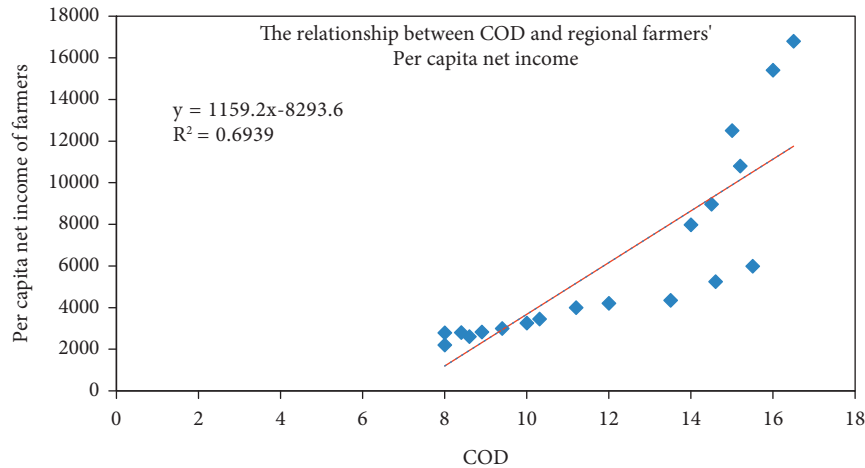


FIGURE 6: The relationship between the per capita net income of farmers and COD in the study area from 2001 to 2020.

indicates that the regional development has achieved a relative balance in the total amount and does not cover the possibility of regional differences between states. Therefore, it is necessary to further study the development model of agricultural economy in various regions. Generally speaking, the more the individuals, the higher the Theil index. From the perspective of the regional development gap, the north, south, east, central, and western regions include several administrative regions. The economic Theil index of the regional development gap is higher than the inter-regional Theil index calculated above. Therefore, the author believes that in the process of analyzing regional differences, more attention must be paid to the volatility tendency of the Theil index rather than the absolute value.

4. Discussion

4.1. Countermeasures to Improve the Agricultural Water Resources Environment. The governments should improve the organizational awareness of all levels of ecological agriculture and increase the citizens' sense of responsibility for participating in the prevention and control of water pollution. Efforts should be made to raise the ecological awareness of government departments and organizations in various fields of agriculture, and more importantly, to raise the ecological awareness of large-scale agricultural households and enterprises. Through various forms of propaganda, public opinion positions, multi-level, multi-form, comprehensive education, and propaganda, as well as relevant national policy documents, the publication and popularization of laws and regulations will make the people aware of water environmental protection and agricultural economic development. The quality of life of farmers is closely related. By formulating the compensation and punishment mechanism for water environment protection, the government should encourage rural residents to participate in agricultural water environment protection and governance, and enhance their sense of responsibility for water pollution protection and governance.

Reasonably develop and utilize water resources, strengthen effective management of water pollution, and improve the environmental containment capacity of agricultural water resources. At present, the widespread waste and shortage of water resources in agriculture have led to the contradiction between water pollution and water resources protection. It is necessary to develop water-saving agriculture, reduce the loss and waste of agricultural water resources in irrigation, transportation, and utilization, and improve the efficiency of water use. While innovating cultivation systems, rationally developing resources, and managing pollution sources, we also use pesticides and fertilizers rationally, strive to deal with livestock excrement and achieve safe production of agricultural products, and reduce water environmental pollution. Through a series of effective implementation of water resources, water pollution has been effectively suppressed, and the environmental capacity of agricultural water resources has been effectively improved.

Actively develop resource reuse agriculture and strengthen water resources and environmental protection mechanisms. Explore the construction of the ecological recycling agricultural industry system, accelerate the exchange and utilization of products and wastes in various agricultural industries, effectively combine planting and breeding, and change the extensive production mode of traditional agriculture. At the same time, it is necessary to strengthen the construction of agricultural water resources and environmental protection laws and regulations, and limit the methods and intensity of resource utilization. Establish and improve a resource protection mechanism system that combines planning guidance, red line protection, ecological compensation, capital investment, labor incentives, and long-term management of agricultural water resources and the environment.

Strengthen the main body consciousness of comprehensive treatment of agricultural water pollution, and innovate the multi-body treatment mode. In accordance with the new provisions of the Water Pollution Prevention and Management Law "Agricultural and Local Water Pollution

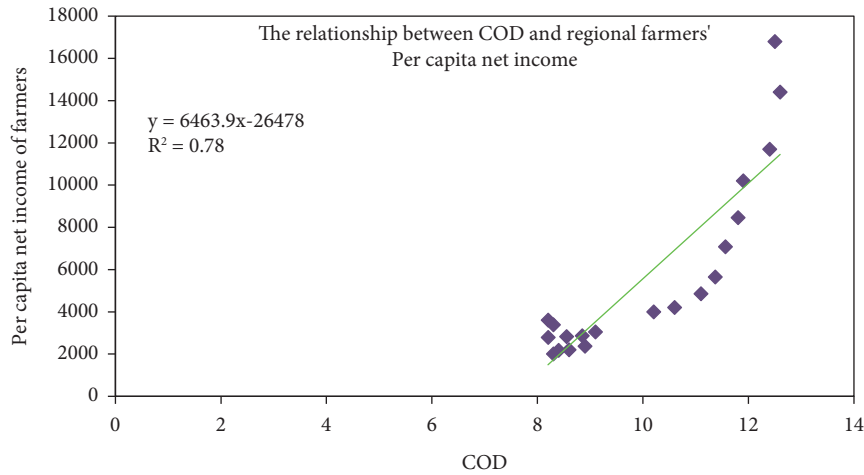


FIGURE 7: The relationship between TN and the per capita net income of farmers in the study area from 2001 to 2020.

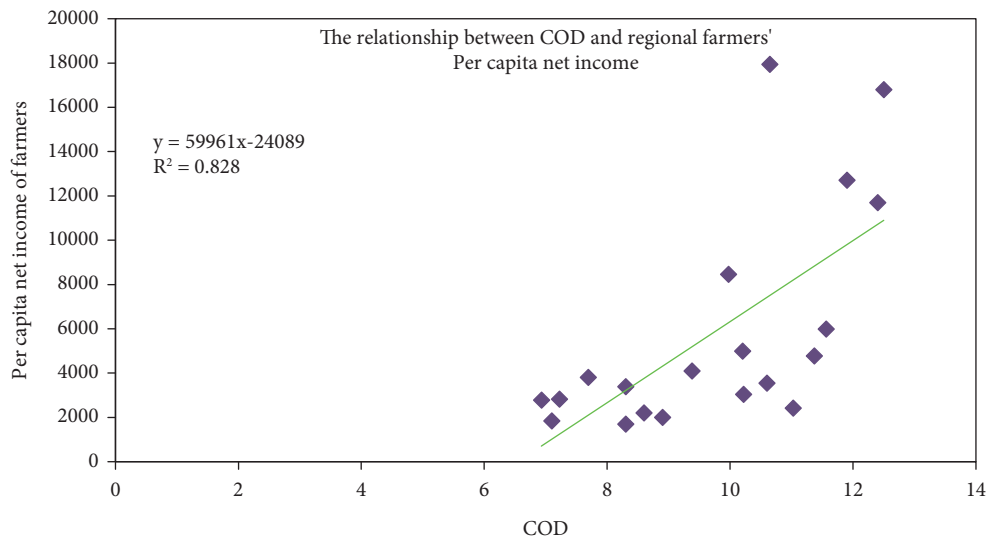


FIGURE 8: The relationship between TP and the per capita net income of farmers in the study area from 2001 to 2020.

Management and Treatment,” the agricultural department under the jurisdiction undertakes to organize, guide, and supervise the prevention and management of agricultural water pollution. Use the pollution prevention mechanism that combines finance, village subsidies, family expenses, and social capital to continuously increase the construction of environmental protection facilities required for the treatment of rural sewage and garbage. Explore the mechanism of purchasing services from profit-making service organizations, and encourage major agricultural enterprises and large-scale breeding farms to become the third party in agricultural water pollution management through performance contract services. In order to achieve effective improvement of agricultural water pollution, financial support, tax preferential measures, credit support, and other measures will be used to support the establishment of agricultural water pollution prevention and management business service systems in which multiple relevant personnel participate, so as to integrate and coordinate the development of

water resources and environment and agricultural economic system.

4.2. Measures to Promote the Development of Regional Agricultural Economy. People should pay attention to the complementary effects of regional agricultural production and improve the cooperative mechanism of regional agricultural cooperation. According to different regions, the structure of agricultural production also varies greatly. In order to realize the effective complementarity of agricultural production between regions, since the reform and opening up, the country has abolished the agricultural product procurement and transportation system, promoted the transformation of the agricultural product circulation system to the market, optimized the regional layout of agricultural production, and divided the main functional areas. However, the conclusion of this paper shows that there is still a big gap in the development of agricultural economy in some areas.

Therefore, when formulating regional agricultural policies, we should not ignore the interaction of agricultural production between different regions, but build a regional adjustment of agricultural division of labor and an effective agricultural production cooperation mechanism to improve spatial complementarity and spatial layout efficiency and ensure the effectiveness of agricultural labor productivity.

In order to optimize the input of agricultural factors, deepen agricultural capital investment, and improve the level of scientific and technological progress, more rapid action is required. The results show that although the agricultural economy in eastern China has the characteristics of a “small sector,” agricultural labor productivity is very high, which is a major factor in the deepening of agricultural capital and technological progress. In China, especially in the northern, central, and western regions, as an important method to improve the quality of agricultural economic development, it is necessary to improve the industrial structure and raise the level of agricultural mechanization. With the continuous development of the regional economy, the added value of the primary industry and the scale of labor are gradually decreasing, and the proportion of the three industries is also gradually decreasing. In the future, it is necessary to reform and improve the agricultural technology extension system and promote agricultural remote sensing and advanced production technology in drought and water-saving agriculture, the national modern agricultural industry technology system, the technological innovation alliance, the industrial innovation center, the high-tech industry demonstration zone, and the construction of science and technology parks. Strengthen the leading effects of agricultural science and technology innovation, improve agricultural production conditions, and increase the rate of agricultural mechanization.

We must attach importance to the development experience accumulated in competitive regions and give full play to the backwardness advantages of backward regions. The coordinated development of the current agricultural economy between regions must start with the industrialization of agriculture and improve the industrial structure system. Regions with relatively backward agricultural economic development can learn from the effective development experience of other regions to realize the profit scale of agricultural economic production. For example, as a region with a strong Internet economy, Zhejiang Province has accelerated the expansion of network technology to agriculture and rural areas. By constructing an Internet + agriculture model, it has given full play to optimizing the role of the Internet in the distribution and integration of agricultural production factors. The same experience can be promoted nationwide to promote the development of agricultural economy based on regional conditions, and to promote the development of regional agricultural economy with experience.

5. Conclusion

As an active ground-based microwave remote sensing technology, synthetic aperture radar (SAR) has the characteristics of all-weather and long-distance, which greatly

improves the radar’s information acquisition capabilities. Obtaining focused broadband and high-resolution images is the development goal of SAR. SAR has experienced 60 years of development, and the image technology is slowly maturing. However, in the ultra-high resolution or static configuration, SAR imaging has several difficulties to solve problems, which are also hot topics in this field. Water is irreplaceable for human existence, but the state and use of water resources can be replaced. In the process of sustainable economic development, the environmental capacity of water resources and the sustainable development of agricultural water resources must be considered. It is impossible for water resources to solve the water shortage by looking for alternative means like other energy sources. The path of sustainable use of water resources has its own characteristics. The efficient and sustainable use of water resources, the safety of water engineering, the management and treatment technology of water pollution, the use and reasonable distribution of water resources, and the management and treatment technology of water pollution must always be in line with the sustainable development of water resources. Although agricultural development is the main national plan, if there is no agriculture, the country’s economic development will be severely restricted, which is also very detrimental to the country’s food security. Promoting the development of the rural economy and establishing a complete agricultural industry chain can consolidate the status of the country. Facing the demands of agricultural development for China’s resources, talents, creativity, and system development, local governments combine the characteristics of agricultural development and the level of economic development to formulate specific economic management measures, construct an eco-agricultural economic development model, make it scientific and standardized, and enable farmers to share the fruits of national economic development and increase income.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

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