Monsoon climate change based on cloud data and numerical simulation of basketball

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Abstract
Holocene is an important period for the evolution of human civilization and the study of the relationship between climate change and the development of human society. In the Asian monsoon region, monsoon climate change is an important factor affecting social culture and the change of historical dynasties. Therefore, the evolution of Holocene East Asian monsoon and the abrupt change of Millennium scale are the focus of scientific research. Holocene, as a typical interglacial period, is characterized by a series of abrupt climatic events on a millennium scale, such as Holocene rapid climate change (RCC) and high latitude bond events. In this paper, the quality of point cloud data and the quality of point cloud processing and rendering algorithm can be indirectly evaluated by evaluating the image quality of point cloud data directly drawn, so as to study the monsoon climate change. This paper also analyzes the origin of basketball, which originated in Massachusetts. It was invented by James Naismith, a Christian in Springfield, in 1891. It was introduced to China’s Tianjin YMCA in 1895. In 1896, the Tianjin YMCA held a basketball game performance. As a result, modern basketball officially began in China and gradually spread to the whole country extension. Basketball has been invented for more than 100 years. This paper analyzes and simulates the kinematic data of basketball players in the four stages of holding the ball preparation stage, kicking off stage, shooting in the air stage, and landing buffer stage, such as the movement time, joint angle change, and speed change. It promotes the improvement of basketball players’ shooting skills.

Keywords Cloud data · Monsoon climate change · Basketball · Numerical simulation

Introduction
Based on the stalagmite hf01 records of H cave in J mountain area of C City, a typical monsoon region in China, this paper reconstructs the Asian monsoon climate change since Holocene. The multi-stage fitting analysis of the Holocene stalagmite records is carried out by using the rampfit regression analysis method, and the fitting analysis is verified by the Bayesian analysis method. Based on the geological carrier records of other regions during the Holocene, the stepped variation characteristics of Asian monsoon intensity during the Holocene are discussed. A large number of Asian monsoon reconstruction records show that the monsoon intensity in the Holocene was dominated by solar radiation on the orbital scale, but different from the smooth change of solar radiation intensity. Some studies have shown that the monsoon intensity has the characteristics of step-by-step change during this period, suggesting that there may be a threshold effect in the monsoon change, and the complex state change of monsoon may be an important driving factor for human migration, civilization change, and the collapse of ancient society (Kiros et al. 2016). This paper uses the point cloud data processing, which will be converted into polygon patches after processing, and these patches representing 3D objects will be drawn by the graphics rendering engine (Kothawale et al. 2007). This indirect rendering method has a high frame rate, but it has a high requirement for 3D object surface reconstruction; otherwise, it will affect the imaging effect. By introducing sprite and other rendering methods into GPU hardware, point clouds can be drawn directly through Sprite, and realistic images can also be obtained (Kwarteng et al. 2009). Then, the possible

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differential response mechanism of Asian monsoon climate change to the North Atlantic Millennium scale cold events in the Holocene is briefly discussed (Liu 2012). Then, taking basketball as an example, this paper uses virtual reality technology to integrate computer simulation technology, sensor technology, computer technology, artificial intelligence, numerical simulation, and many other advanced technologies and subject knowledge to form realistic virtual things or environment in the computer system, giving people the feeling of being on the scene and being able to interact with it (Medina et al. 2010). The advantages of virtual technology enable it to meet the requirements of current competitive sports training and teaching activities, and become an indispensable part of competitive sports training and teaching steps. It not only plays a great role in people’s exploration of the world and the application of objective laws, but also makes use of the example of basketball. The realization process of 3D simulation is analyzed by using virtual reality technology and numerical simulation technology (Mahanta et al. 2013).

Materials and methods

Data source

The stalagmite hf01 used in this research was collected from the H cave of J mountain, n District, C City. As an 80-m-long pit, H hole is located at the end of a ditch in the southeast of Q Ping, and is located in the north of J mountain, facing the northwest, 816.6 m long and the lower area is more than 4300 m². This is the lowest elevation ambulatory cave, with the smallest space and late development. The reason for its formation is closely related to the continuous erosion and screening of surface flux during the rise of the crust. The j area is controlled by southeast monsoon and southwest monsoon, and the rainfall type is mainly monsoon precipitation, which forms the humid subtropical monsoon in the climate area (Pal et al. 2015). The annual average precipitation in this area is about 1434.5 mm, the average temperature in several years is about 14.5 °C, and monsoon weather occurs in the same warm and rainy period, which provides favorable conditions for the development of karst cave system in the region.

Analysis of monsoon climate change

Bayesian turning point algorithm is a kind of parameter change that can be used to describe the climate series, whether the change is the average value of climate signal, or the change of trend or variance. The most prominent feature of this method is that it can objectively evaluate the uncertainty probability of the selected turning point, including the number and location of the turning points, which is more advantageous than the previous analysis methods (Prathipati et al. 2019). The posterior probability of Bayesian analysis is shown by red “peak,” and the high and narrow “peak” represents the relatively greater uncertainty of turning point selection, while the short and wide “peak” indicates that the uncertainty of turning point is larger. Therefore, the analysis method can not only detect the turning point accurately, but also improve the effectiveness of the turning point (Zeri et al. 2019).

Bayesian analysis is a multi-turning point problem that can reduce the computational burden to the time series of any length by using the dynamic programming recurrence (Rajeevan et al. 2008; Valle et al. 2013). The key to dynamic programming recursion is to decompose multiple turning point problems into a group of gradually decreasing subproblems, and the youngest problems (the position of a single turning point) can be easily solve. Then, we can get the complete solution by combining the mathematical algorithm into these subproblems effectively. The Bayesian analysis algorithm is as follows: given the dependent variables y and m, known predictive variables X1,..., Xm and linear regression methods are based on statistical models.

\[
Y = \sum_{j=1}^{m} \beta_j X_j + \varepsilon
\]  

Therefore:

\[
X = (Y - N(X_0^m, \sigma^2)I)
\]  

Therefore, in order to verify the existence of human subjective factors in the multi-stage fitting segment of rampfit analysis method, this paper uses the software cycle to carry out Bayesian turning point analysis on the oxygen isotope sequence of stalagmite hf01, and attempts to use the turning point probability obtained by this analysis method to compare with the results of rampfit analysis of stalagmite hf01, in order to prove the accuracy and effectiveness of the turning point selection of stalagmite oxygen isotope value change.

Cloud data computing architecture design

Components of different layers of cloud environment are closely related. Multiple virtual machines are running on each physical server (Ramakrishnan 2001). If it is a virtual group with application deployed, a subset of all virtual machines represents the virtual machine, and multiple programs running on the virtual group provide the enterprise code execution platform (Valdez-Cepeda et al. 2012). In order to better distinguish the components of each cloud platform layer and realize the integration of complex instructions, it is necessary to separate each cloud platform layer component first, and then analyze the relationship between the layers (Rangarajan and Sant 2004).

Figure 1 illustrates the cloud environment architecture that the monitoring model is based on: the lowest physical layer contains the physical resources of the data center and all the
components it manages. The virtualization layer contains virtual resources and corresponding management components. Above the virtualization layer is the application layer, which contains a set of software needed to run business code. For example, if the cloud runs a web application, the software includes a series of related programs, such as servers and databases. The top level is the business layer, mainly the business code running in the cloud (Sen and Balling 2004).

Three-dimensional simulation principle of basketball

Combined with the requirements of basketball 3D simulation, the matrix is expressed as follows:

\[
\mathbf{R} = \begin{pmatrix} n_x & o_x & a_x \\ n_y & o_y & a_y \\ n_z & o_z & a_z \end{pmatrix}
\]

In the simulation application, the variable relationship of each positive feedback system can be expressed as:

\[
d(LEV) = RATEL
\]

In order to improve the training effect of one motion shooting skill, the simulation and optimization of the action are carried out by using the 3D simulation system of basketball based on virtual reality technology.

Build the elastic model of shooting joint of athletes:

\[
E = \frac{F_2 - F_1}{S} \times \frac{L_2 - L_1}{L} \times (\Delta \sigma - \Delta \varepsilon)
\]

Assuming that the ultimate strength is 3.0 Hz and the yield strength is 3.5 Hz, the stress difference is 0.009, the load formula is obtained:

\[
F_{\text{max}} = 0.009 \times \frac{\sigma_{\text{min}}}{\varepsilon_{\text{max}} - \varepsilon_{\text{min}}} \times SP + F_{\text{min}}
\]

Results

Response of stalagmite data to monsoon climate change

Stable oxygen isotope measurements of stalagmites (δ18O) is widely considered as a substitute index of precipitation change. δ18O is controlled by different factors including water vapor source, cave temperature during deposition, and local cave background. The climatic significance of 18O remains controversial. At present, stalagmites are widely used in EASM area. There are three main explanations for 18O: (1) stalagmite δ18O represents the regional strength of EASM, (2) Stalagmite δ18O is the index of local precipitation, (3) Stalagmite δ18O reflects the change of water vapor source. Based on the δ18O composite record of 16 cave stalagmites in the area, Yang (2019) found that the δ18O of stalagmites as a whole follows the changes of the monsoon intensity in the East Asian monsoon region, rather than as a single indicator of precipitation in the cave area. Although Cheng (2019) pointed out that due to the high diversity of climate in the East Asian monsoon region, there will be differences in the reconstruction of total precipitation and seasonal precipitation. However, modern cave monitoring records in the j mountain area show that the precipitation in the j mountain area is relatively low. δ18O showed a
significant seasonal trend, and was negatively correlated with local temperature and precipitation. The study shows that due to the existence of complex hydrogeological conditions, the precipitation in different time periods may be mixed in the epikarst zone, but the soil water and dripping water are not the same. The δ18O monitoring data show that there are similar changes with precipitation on both the seasonal and interannual scales, which indicates that the water in the cave drips is the main source of precipitation. δ 18O can accurately inherit the interannual variation signals of stable isotopes in precipitation. Therefore, it is considered that the stalagmites in J mountain area are of great significance. Therefore, this article believes that the stalagmite δ18O in the J Mountain area can be reflected as the EASM intensity in a wider area, where a lower δ18O indicates a stronger EASM, and a higher δ18O indicates a weaker EASM whether it can refer to the local precipitation needs further study, which is consistent with the previous research.

The change trend of the stalagmite HF01 δ18O record of H cave in C city on the orbital time scale (Fig. 2) is basically the same as that of other stalagmites in the monsoon region of China. The value of δ18O was negative in the early and middle Holocene and positive in the late Holocene, which followed the change trend of the northern hemisphere solar radiation in the Holocene. The δ18O value of HF01 stalagmite varies from -6.37‰ to -10.34‰, with an average value of -8.81‰, and the overall change range is large, reaching 3.71‰. During the early Holocene, the oxygen isotope values of stalagmites ranged from -8.43 to -10.10‰, with an average value of -9.57‰, and a variation range of 1.67‰. During the middle Holocene, the oxygen isotope values of stalagmites were rapidly negative, ranging from -7.19 to -10.34‰. The average value of δ18O is -9.17‰, and the variation range is 3.15‰. The range of stalagmite HF01 δ18O during the Late Holocene was -6.64‰ to -8.13‰, with an average value of -7.22‰, and a variation range of 1.49‰. The most negative stage of oxygen isotope value of stalagmite appeared in the initial period of middle Holocene, and a variation range of oxygen isotope value of stalagmite hf01 in this period was the largest, and the average value was in the most negative stage of Holocene.

Using the software rampfit, we found that the most significant feature of stalagmite hf01 record is that the Holocene monsoon change has the characteristics of nonlinear and stepped change (Fig. 3). It can be divided into six steps (equilibrium step 1 ~ 6), and the oxygen isotope values of stalagmites in each step remain relatively stable, and there is a jump (or descent) transition stage between the two steps, in which there are five transition stages (transition 1 ~ 5). There are two steps and two transitional periods in the early and middle Holocene, four steps and three transitional periods in the middle and late Holocene, and the weakest step in the late Holocene.

There are two monsoon stationary periods and one monsoon transition period in the early Holocene: (1) During 11.50–10.50 ka BP, the fluctuation range of δ18O value is -8.43~9.22‰, and the average value is -8.90‰. The fluctuation range of stalagmite δ18O value is relatively small, which indicates that the monsoon was stable in the early Holocene (S1). (2) In the period of 10.50~10.0 ka BP, the average value is -9.25‰, and the fluctuation range is -8.12~ -10‰. The δ18O value has a fluctuation range of nearly 2‰, which indicates that the monsoon state rapidly jumps from the strongest stage of 10.5 ka BP in early Holocene to the stronger stage of 10.2 ka BP in early Holocene. The monsoon state fluctuates greatly in this stage, and the monsoon rapidly strengthens, so it is defined as the first turning period of Asian monsoon in Holocene (T1). (3) In the period of 10.0~8.2 ka BP, stalagmites were formed. The average value of δ18O is -9.57‰, and the fluctuation range is -8.82~ -10.01‰. The δ18O value is in a relatively stable medium negative state, which indicates that the monsoon is in a relatively stable and moderate intensity state. This stage is the second strong period of Asian monsoon in Holocene, lasting for 2 Ka, which is also the second stable period of Asian monsoon in Holocene (S2).

According to the results of Bayesian analysis method (Fig. 4), the data model of Bayesian turning point analysis is highly
similar to the results of rampfit analysis. Except for the sixth step S6 of Holocene, the first five steps (S1 ~ 5) of Holocene can be verified and supported by Bayesian analysis. It can be seen from the figure that the five transition stages (T1 ~ 5) obtained by rampfit analysis can pass the posterior verification of Bayesian analysis method. The posterior probability of T2 transition stage is the highest, reaching 66%, while the posterior probability of T1 (50%), T4 (52%), and T5 (48%) is about 50%, and the posterior probability of T3 is relatively small (38%). In general, the Rampfit analysis of the stalagmite HF01 δ18O can be supported by Bayesian mathematical analysis methods. It also further illustrates that the six equilibrium states and five transition states of the Holocene monsoon states that we have classified can be supported by mathematical algorithms.

Through the above analysis, we can clearly find that the Holocene East Asian monsoon recorded by the HF01 stalagmite δ18O shows an obvious stepwise change. The monsoon began to strengthen gradually in the early Holocene, and there was a relatively stable and moderate intensity period in the early Holocene 10.0~8.0 ka BP. It also corresponds to the Holocene Optimum. After 7.1 ka BP, the monsoon gradually weakened step by step, and the trend continued to the late Holocene.

Holocene East Asian monsoon climate change analysis

The summer monsoon index (SMI) of Lake Q from the edge of the Asian monsoon region shows that although the Asian monsoon was extremely unstable in the early Holocene, there were several large millennium scale Oscillation events (Fig. 5B), so the early Holocene monsoon variability could not be obtained by rampfit regression analysis.

The lake records from the monsoon region of China show that the monsoon changes in the early Holocene are complex, and there are several monsoon instability events. However, in the middle Holocene, the monsoon change pattern is basically the same, and they all have a typical stepped change pattern. Although some records show that strong monsoon occurred in the early Holocene, the strongest monsoon occurred in the early Middle Holocene in terms of monsoon intensity and duration, which supports the traditional view of the appropriate period of the middle Holocene. In the whole monsoon region, there is a three-step change trend throughout the north and south, which indicates that the Holocene monsoon step change is universal in the monsoon region of China.
Fig. 5 Comparison of lake records and rampfit results in monsoon area

Fig. 6 Comparison of driving mechanism of Holocene monsoon mutation
The driving mechanism of the Holocene East Asian monsoon step change

O’Brien et al. First found that the earth’s atmospheric system changed significantly during the Holocene according to the changes of sea salt concentration and ground-based dust in Greenland ice core, which indicated that there were a series of cold events in the Holocene climate. Bond et al. (1997) confirmed the existence of a series of cold events on a millennial scale in the Holocene through the North Atlantic ice drift debris event (IRD), and then identified nine cold events in the North Atlantic during the Holocene (Fig. 6A). The percentage of ice drift debris in the North Atlantic mainly reflects the change of surface hydrological cycle in the North Atlantic.

The variation of δ18O oxygen isotope sequence of stalagmites follows the trend of solar radiation value in the northern hemisphere in Holocene (Fig. 7A), but the negative peak recorded by δ18O and the maximum solar radiation intensity are about 2–3ka delay, which may be due to the large amount of global ice in the early Holocene, which delayed the arrival of the Holocene suitable period. The data comparison shows that the stalagmite hf01 T1, T2, T4, and T5 recorded by δ18O can be correlated with the northern Atlantic ice drift debris events (IRD), such as bond 7 and bond 5 events, which are exactly corresponding to T1 and T2 in the early Holocene. During this period, each weak monsoon event is well matched with a period of rapid monsoon enhancement; especially after bond 5 and bond 7 events, the monsoon intensity is the largest, and the monsoon reaches the highest and subpeak respectively. This may be related to the high level of solar radiation in the early Holocene, when the monsoon intensity is in the cumulative enhancement stage, and the bond event in the North Atlantic may trigger the monsoon to jump to stronger stage after a short weakening.

For regular monitoring, this paper analyzes the data of veve-hf 01z 18O with the software of past 3.5, and obtains the contour map from the visible light power spectrum (Fig. 8). The power spectrum profiles generated by the past 3.5 software show the period, and the stations show the average
interval of samples. The larger the ferry power is, the stronger the profile is. Therefore, this method requires linear tile interpolation. In this paper, the average time interval is 34.28 a. Hf01 stalagmite discovered by wavelet analysis δ 18O data have a quasi Millennium period, which further supports the response of stalagmite hf01 oxygen isotope record to the North Atlantic bond event. The period of 1448a is close to that of 1500A in the North Atlantic, which confirms our view that the abrupt change of Asian monsoon is affected by the North Atlantic bond event. It also shows that the Asian monsoon is related to the existence of high latitude climate. The increase of sea ice in the North Atlantic may lead to the decrease of surface water temperature and salinity during the North Atlantic bond event, which may lead to the decrease of the hot Hallelujah circulation and affect the Asian monsoon region through the atmospheric and oceanic circulation.

There are different explanations for how the North Atlantic bond event affects the Asian monsoon. Previous studies have found that when ITCZ moves northward, the Asian monsoon increases. When ITCZ moves south, the Asian monsoon decreases, while the Ti content sequence in Cariaco basin, Venezuela, and South America has a sensitive response to the North-South movement of ITCZ. Comparison of stalagmite hf01 δ 18O records shows that ITCZ moves northward, which corresponds to the enhanced transition period of monsoon; for example, 10.1ka BP and 8.1ka BP correspond to the rising stage of Ti content sequence, which is just in the first and second turning periods (T1 and T2) as defined by us. At 7.0 ka BP, 5.8 ka BP and 4.2 ka BP, the monsoon is in the period of sharp weakening, and ITCZ is also in the period of southward movement, which is also consistent with our three-step weakening of monsoon intensity in the Miocene (T3, T4 and T5). The overall trend of Ti content sequence and stalagmite hf01 in Cariaco Basin δ 18O records were generally consistent during the Holocene, which also verified the stalagmite hf01 δ 18O reflects the variation of the Holocene monsoon change. The mechanism of the relationship between the Millennium scale climate change of the North Atlantic and the climate change in Asia may be closely related to the impact of fresh water injection on the transatlantic meridional gyration (AMOC) changes. When AMOC is weakened, the temperature gradient difference of high and low latitudes increases, westerly jet increases, and Asian monsoon decreases. Some studies have also shown that due to the shrinking of ice cover, the surface water of the North Atlantic is affected by fresh water injection, and the formation of deep water in the North Atlantic is blocked, which causes the interruption of "ocean conveyor belt," causing climate mutation, and thus affecting the change of Asian monsoon. There are similar changes between the Millennium scale events in the North Atlantic and the monsoon changes in the Asian monsoon region. The relationship and mechanism between them are complex. At present, scholars still have many disputes about geological carrier and climate index.

Table 1 Joint angles at the end of the ball holding preparation stage (unit: degrees)

| Joint      | National level athletes | National level | National secondary | Sig  |
|------------|-------------------------|----------------|-------------------|------|
| Wrist joints | 137.003±15.914          | 145.178±4.381 | 145.478±6.528     | 0.16 |
| Elbow joint   | 69.259±10.375           | 64.342±20.604 | 62.535±5.979      | 0.57 |
| Shoulder joint | 52.551±13.912           | 59.828±1.501  | 51.928±7.005      | 0.14 |
| Hip joint     | 141.539±4.142           | 145.331±8.058 | 145.199±12.006    | 0.58 |
| Knee joint    | 109.545±2.603           | 119.446±14.783| 123.880±17.483    | 0.08 |
| Ankle joint   | 69.594±5.285            | 68.961±5.498  | 72.036±5.015      | 0.44 |

Table 2 Comparative analysis of joint angles at the end of the ball holding preparation stage

| Joint      | Master vs level 1 (Sig) | Master vs level 2 (Sig) | Level 1 vs level 2 (Sig) |
|------------|-------------------------|-------------------------|--------------------------|
| Wrist joints | 0.093                   | 0.105                    | 0.951                    |
| Elbow joint   | 0.456                   | 0.310                    | 0.783                    |
| Shoulder joint | 0.101                   | 0.885                    | 0.076                    |
| Hip joint     | 0.363                   | 0.380                    | 0.974                    |
| Knee joint    | 0.127                   | 0.031                   * | 0.486                    |
| Ankle joint   | 0.801                   | 0.335                    | 0.228                    |
**Numerical simulation of each joint angle of basketball movement**

Through the single-factor analysis of variance, the significance of Table 1 shows that at the end of the ball holding preparation stage, there is no significant difference in the joint angle movement variables between different grades of athletes.

Through multiple comparative analysis of joint angles at the end of ball holding preparation stage of athletes at different levels, the results are shown in Table 2.

There was no significant difference in other joints except knee joint between national master and national second class athletes ($P=0.031<0.05$). It shows that the national elite athletes’ body center of gravity is lower than that of the national second-level basketball players after receiving the pass, and the knee joint at this stage is in the state of “pedaling and stretching upward force accumulation” for the whole technical action. The more the angle of the knee joint is, the lower the center of gravity of the athletes is. Studies have said that the ankle angle is greater than the hip angle and greater than the knee angle, which affect the size of the velocity variable produced by the body center of gravity. But according to the data obtained in this study, it is not consistent with this study.

Theoretically speaking, the smaller the angle of force, the more sufficient the storage force is, and the greater the speed will be. From the above data, it can be seen that in the preparation stage of holding the ball, the joint angles of the right elbow joint and shoulder joint are all acute angles. This is because when the athletes shoot, the lower limb joint is in the state of “pedaling, stretching, and accumulating force,” and the upper limb as the key point of cooperating with the lower limb to complete the three-point shooting, also does the process of accumulating force. At the same time, combined with the video, it is found that the body center of gravity keeps a stable state in the process of falling from high to the lowest point after receiving the ball. When the body center of gravity reaches the lowest point, the upper part of the body slightly “leans forward,” and there is no center of gravity moving backward, which also proves that the athletes have common characteristics in shooting posture.

According to the significance of one-way ANOVA, Table 3 shows that there is no significant difference in the joint angle movement variables between different grades of athletes at the end of the take-off stage.

Through the single-factor analysis of variance, it can be concluded in Table 4 that there are significant differences in the lower limb angular velocity between different grades of athletes in the take-off stage.

**Discussion**

**Implementation scheme of basketball 3D simulation based on cloud data**

A large amount of basketball movement data collected by the motion capture system is stored in the database, and the vhskd5.0 virtual anthropomorphic synthesis software is used to do a three-dimensional simulation of the collected basketball movement data (Jhajharia and Singh 2010). The three-dimensional simulation software selected here can provide visualization function, which is conducive to the correction of players’ basketball movement and gives new movements, and improves the basketball technical and tactical level; in order to ensure the smooth development of the visual design

| Joint      | National level athletes | National level | National secondary | Sig   |
|------------|-------------------------|----------------|--------------------|-------|
| Wrist joints | 129.62±13.983        | 129.74±8.037   | 125.94±15.133     | 0.775 |
| Elbow joint | 89.44±9.402          | 85.20±5.689    | 81.99±2.204       | 0.257 |
| Shoulder joint | 91.74±6.068       | 89.82±1.556    | 92.85±2.860       | 0.210 |
| Hip joint   | 169.76±3.783         | 169.08±4.027   | 165.04±6.739      | 0.120 |
| Knee joint  | 151.49±11.432        | 149.32±5.174   | 143.75±5.484      | 0.122 |
| Ankle joint | 118.19±11.634        | 115.16±4.555   | 120.67±7.245      | 0.388 |

| Joint      | National level athletes | National level | National secondary | Sig   |
|------------|-------------------------|----------------|--------------------|-------|
| Hip joint   | 219.94±60.098           | 188.56±16.198  | 158.36±52.226      | 0.035*|
| Knee joint  | 411.24±40.096           | 280.87±47.336  | 228.21±37.343      | 0.000*|
| Ankle joint | 541.34±68.950           | 481.40±52.072  | 428.29±84.471      | 0.008*|

Table 3: Joint angles at the end of take-off stage (unit: degrees)

Table 4: Angular velocity of each joint of lower extremity during the kick-off stage (unit: m/s)
of basketball movement, we can set the human motion and modify the pose of the players to obtain the new pose of the players (Dhar and Nandargi 2000).

In the process of 3D simulation of basketball, there may be a large number of data of players’ movement posture. Building a special 3D simulation database can facilitate the later model management. Using the search engine provided by the database, we can quickly and accurately locate the specific information of a team and a player. It is convenient for basketball coaches, teachers, and other users; the database stores the video clips related to 3D simulation of basketball separately (Deka et al. 2013).

Taking one motion shooting technology as an example, this paper analyzes the specific application of basketball 3D simulation system based on virtual reality technology (Guhathakurta and Rajeevan 2008). One motion is a consistent shooting action, which is mainly due to the fact that since the second grading action, the inertia and speed of forward shooting remain unchanged (Das and Goswami 2003). In one motion shooting, the waist of the player is slightly bent, and the force of the leg can be transmitted to the shoulder smoothly. In the process of taking off, the transmission of the force is not interrupted. When the trunk reaches the highest point, the force is also transmitted to the basketball position to push it out (Goswami et al. 2006; Jain et al. 2012). Comparatively speaking, the main characteristics of one motion shooting skills are as follows: first, reduce the physical consumption of athletes in the shooting process (Hosseinizadeh et al. 2015); second, the shooting process is shorter, which can provide a longer range; third, in the process of basketball shooting, the rotation speed is higher and the stable flying posture is maintained (Ashok and Saji 2007). Although one motion shooting has obvious technical advantages, it also has some shortcomings, that is, because the shooting speed is faster, it puts forward high requirements for the accuracy of athletes’ shooting, and it must be trained for a long time to effectively use this skill. In addition, in the teaching of basketball skills, the focus of teaching should be on the transmission of leg strength, rather than the description of upper limb posture.

**Basketball suggestions based on basketball numerical simulation**

The preparatory stage of holding the ball: it is suggested that the national first- and second-level athletes should lower the body center of gravity and reduce the angle of the knee joint, so that the knee joint can accumulate more force to do the upward movement.

Take-off stage: the second-level athletes should strengthen the leg muscle practice and complete the coherence of the whole technical movement, so as to strengthen the speed of push up and reduce the time to complete the whole shooting technique (Almeida et al. 2016).

The stage of shooting in the air: it is suggested that the first- and second-level athletes should strengthen the practice of wrist and arm small muscle group, which is conducive to increase the speed of hand, and the speed of hand affects the initial speed of the ball, as well as the stable flight path of the ball in the air.

Landing buffer stage: it is suggested that the national first- and second-level athletes should strengthen the coordination of upper and lower limbs in the future training, speed up the speed at the same time to buffer the range, and reduce injuries (Bal and Bose 2010).

**Conclusion**

In this paper, the evolution of Asian monsoon since Holocene is reconstructed by using stalagmite HF01 records from H cave in J mountain area of Y City, a typical monsoon region in China. The multi-stage fitting analysis of Holocene stalagmite records is carried out by using rampfit regression analysis method, and the fitting analysis is verified by Bayesian analysis method. Based on the geological carrier of other regions during the Holocene, the paper discusses the stepped variation characteristics of Asian monsoon intensity during the Holocene. By comparing with the record curve of the North Atlantic climate, and processing the data with the software of jet 7.5, this paper briefly discusses the possible differential response mechanism of Asian monsoon climate change to the North Atlantic bond event in the Holocene. It is helpful to optimize the training plan and improve the training level. The combination of virtual reality technology and basketball skill teaching can effectively improve the efficiency of basketball training and make students better grasp the characteristics and details of each skill.

**Declarations**

**Conflict of interest** The authors declare that they have no competing interests.

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