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Impact of Runway Surface Wind on Afternoon and Night Flight Operation at Linzhi Airport

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Abstract: The frequent occurrence of strong tailwind and crosswind on the runway of Linzhi Airport is an important factor affecting the safety of flight take-off and landing. In order to correctly understand the impact of the ground wind field on flight operation and safety, automatic weather observing system (AWOS) data has been adopted in this paper, combined with the aircraft performance, airline dispatching and ATC control. The statistical characteristics of the flight operation security of wind field on runway surface of Linzhi Airport were analyzed. The results show that runway wind in afternoon period (14:00-19:59)-in most months-can meet the conditions of flight operation under the condition of reasonable the runway in use; in a few months, under some conditions , part of the time can meet flight operation requirement. The midnight period (20:00-23:59): the runway wind in 12 months of the year meets the requirement for flight operation.

1. Introduction

Today, Tibet has basically formed a comprehensive three-dimensional transportation network with roads, railways and aviation as its main body. The development of Linzhi transportation is a microcosm of the great changes in Tibet's transportation. The development of transportation not only promotes the rapid development of Linzhi economy, but also better unblocks the channels for people of all ethnic groups to exchange and blend, and all ethnic groups are more United and harmonious[1]. In September 2006, Linzhi Airport is officially opened to traffic, and it is the third joint military and civilian airport in Tibet after Gongga Airport in Lhasa and Bangda Airport in Changdu. Linzhi Airport, with an altitude of 2,949 meters, is a typical plateau canyon airport. Limited by geographical environment and meteorological conditions, it is recognized as the airport with the highest difficulty in taking off and landing aircraft and ensuring flight punctuality in China. It is one of the most difficult airports in the world. In order to reduce the influence of weather on flight safety, Linzhi Airport takes the lead in using RNP precision navigation technology[2] in all of Asia. It is the first airport in China to use RNP navigation program alone, and it is also the only airport in China to operate all RNP programs at present.

With the implementation of the national "The Belt and Road Initiative" strategy, the traffic volume and traffic flow of Linzhi Airport will increase day by day. Statistics show that[3], in 2019, Linzhi Airport completed a total passenger throughput of 557,878 passengers, an increase of 15.1% year-on-year, ranking 136th in the country; The freight throughput was 2,526.2 tons, an increase of 13.2% year-on-year, ranking 88th in the country; Aircraft took off and landed 6,894 times, an increase of 29.9% year-on-year, ranking 144th in China. Affected by the epidemic, there were 5,473 sorties in 2020, up by -20.68% year-on-year, ranking 178th among 244 airports. At present, the parallel taxiway project of Linzhi Airport, a key construction project in the "13th Five-Year Plan" of Tibet Autonomous Region, has been officially put into operation, which will help the planned annual passenger throughput reach 1.4 million passengers, annual mail throughput reach 5,600 tons and annual aircraft take-off and landing 15,390 times in 2030.

According to the statistics in 2020[4], weather has become the main factor affecting the normal flight of airlines, the normal release of airports and the normal departure of departure flights of airports, accounting for an average of 57.35% of abnormal flights. Due to the thin air in complex airports on the plateau, complex terrain and meteorological conditions, etc., Greatly increased the difficulty of plateau airports and flights. According to previous meteorological data statistics, the total airworthiness time of Linzhi Airport is only 100 days[2]According to statistics[5], the number of windy days in 39 stations in Linzhi city from 2009 to 2018, the annual average windy days in Linzhi city gradually decreased from southwest to northeast. The average annual windy days in Wolong Town and Lang County of Milin County in southwest China are 138 days and 135 days respectively. The daily variation of gale frequency is higher in daytime than at night, with the highest frequency from 13 pm to 23 pm, accounting for 95.6% of the total frequency, and the lowest frequency from 00 am to 12 noon, accounting for only 3.8%Linzhi Airport is located in Milin County. The wind field is complex, and strong winds often occur in the afternoon. For safety reasons, in principle, no flight[6]will be arranged after 14: 00 every day, and the aircraft can only take off and land on the morning. On the morning, the airport flight is basically unaffected by the ground wind, and the flight is relatively normal.

The frequent occurrence of strong tailwind and strong crosswind on the runway is an important factor affecting the flight safety, aircraft take-off and landing times and service efficiency of airports. In order to fully understand that influence of runway wind field on flight, this paper take Linzhi airport as an example, The wind data of runway automatic meteorological observation system (AWOS), METAR/SPECI message, and year/month summary data are used to study and evaluate the statistical characteristics of runway wind field in different periods of Linzhi Airport and its influence on flight safety, in combination with the performance parameters of airport airlines' operating models, airlines' dispatch and release, and the relevant safety specifications for air traffic control tower control[15].Finally, the conclusions and suggestions of airworthiness analysis are given, which provide data decision-making basis for correctly understanding the impact of runway surface wind field on airport flight safety, thus ensuring the safe and efficient operation of plateau mountain airports and promoting the development of civil aviation transportation industry in western China.

2. Review of Related Research

Through literature search, Xu Peizhen et al[7]made statistical analysis on the observation data of Linzhi Airport and related plateau airports in the early stage of the airport, and thought that the surface wind field was complex, the wind direction at both ends of the runway was quite different, and the crosswind was obvious Fan Bo et al[8]used meteorological observation data before and during airport construction, This paper analyzes the meteorological factors affecting the flight of Linzhi Airport, and discusses the meteorological conditions for the airworthiness of Linzhi Airport.

The conclusion is that the near-surface wind of the airport is small in the morning, which is suitable for aircraft to take off and landing. The ground wind begins to increase at 13 o'clock in the afternoon, reaches the maximum at around 15 o'clock, and then decrease; Xu Hai et al[9-11]concluded that "the threat of low-altitude strong vertical shear to take-off and landing flights at Linzhi Airport has obvious characteristics of daily and seasonal changes, and strong shear mainly occurs in the afternoon and evening of each season"; Ren Yuan International et al[12]used the statistical comparative analysis method, and concluded that strong winds mostly appeared in the afternoon, and navigation in the afternoon was unsafe. Tan Bo et al[13]used the automatic observation data of Linzhi Airport in 2006 -2007 to analyze the characteristics of airport ground gale, and discussed its causes and influence on flight. Zhang Xu et al[14]expounded the influence of the wind and no night flight at Linzhi Airport on the dispatch release of Beijing-Linzhi round-trip route; International aviation review article talks about plateau airports in western China and Tibet, In particular, it is pointed out that Ali Kunsha Airport is the third airport in the world in altitude (4274 meters above sea level), Although the surrounding terrain is slightly less complex than Linzhi Airport, its meteorological conditions are more complex, which is manifested in the drastic nonlinear changes of temperature, frequent sudden crosswinds in canyons, and its comprehensive flight difficulty is the highest in the world. In the previous literature, statistical analysis and qualitative analysis were mainly carried out by using the previous observation data and runway wind data of up to 2 years. The main conclusion is that there are many strong winds in the afternoon, so it is not recommended to arrange flights. Generally speaking, the previous literature lacks quantitative analysis combined with specific aircraft types and flight operating conditions. Therefore, this paper will conduct quantitative analysis and research on big data and high time density based on runway wind data for at least 5 years, combined with specific aircraft types, dispatch and air traffic control command and operation standards, so as to guide the specific flight operation of Linzhi Airport in the afternoon and night.

3. Data and Research Methods

3.1. Adopt Meteorological Data and Operation Standards

Data age: January 1, 2015, 00: 00: 00—December 31, 2020, 23:59:30 UTC; Source: Wind data at R05, MID and R23 of Airport Automatic Meteorological Observation System (AWOS)[16] (mainly using 2-minute average); Annual and monthly total book data; METAR/SPECI message; The specific analysis period is divided into three periods: 0600-1400 in the morning, 1400-2000 in the afternoon and 2000-0600 in the night. The specific model targeted is Airbus A319.The A319 model is special and the wind direction and speed limit of plateau airport is: the standard of Linzhi Airport runway 05 end is: tailwind ≤3m/s, crosswind (90) ≤ 10m/s; The standard of runway end 23 is: tailwind ≤3m/s, crosswind (90) ≤ 12m/s. Wind data at AWOS R05, MID and R23. The data frequency is 1 time /30 seconds. The main data used for statistical research are instantaneous wind speed averaged for 2 minutes and averaged for 10 minutes.

3.2. Airworthiness Analysis Research Methods

1) Introduce the concept of Wind usability factor

Fundamentally speaking, although the general situation of the airport can be obtained by the conventional wind field statistics analysis, it has no direct guiding effect on the specific flight operation, and the conclusion is difficult to be used in business. Moreover, there are problems that the analysis is not quantitative and detailed enough. Therefore, the concept of Wind usability factor[17]is introduced.

Shortly, the wind usability factor intuitively gives the ratio of data meeting the flight operating conditions in a specific time period. Under the data frequency adopted in this paper (once every 30 seconds), it can basically be considered as the ratio of time meeting the flight operating conditions in this specific time period.

The specific calculation formula is as follows:

Wind usability factor calculation formula: $Q= (\sum_{i=1}^{i=m} Ti) /N$

In which: Q—— Wind usability factor;

i—— the number of wind directions meeting the conditions;

m—— the total number of wind directions meeting the conditions

Ti—— the wind that meets the requirements of maximum allowable crosswind and maximum tailwind in the wind direction

N—— Total wind records.

2) Pareto distribution analysis was adopted.

Pareto distribution analysis can help us quickly and scientifically find out the most important factors and the key reasons of the main problems. Pareto chart can distinguish between "insignificant majority" and "extremely important minority", which is convenient for us to pay attention to the important categories of wind direction/wind speed data affecting the runway of Linzhi Airport.

4. Research Process Analysis

4.1. Overview of wind field at Linzhi Airport

According to the instantaneous wind speed statistics of the grounding end, the middle point and the stopping end (R05, MID and R23) of the runway, the monthly gale days are counted. Total data days are 365 x 5+1 = 1826 days. The data frequency is once every 30 seconds, so the total data volume of each station is 1826 x 24 x 60 x 2 = 5258880. There are 3 stations in total, so there are 5258880 x 3 = 15776640 pieces of data. Among them, there are 7268 data with wind speed ≥17 m/s, accounting for 0.046%. Gale days are 568 days (average annual gale days are 113.6 days and average monthly gale days are 9.5 times), accounting for 31.1%On average, there are 12.8 gale data every gale day (equivalent to lasting about 6.4 minutes).

4.2. Frequency of gale and number of gale days

Table 1: Monthly gale days statistics (according to the instantaneous wind speed statistics of R05, MID and R23 m/s)

Year \ month	jan	Feb	Mar	Apr	May	Jun	jul	Aug	Sep	Oct	Nov	Dec
2015	9	14	18	12	13	7	15	5	4	13	12	6
2017	7	14	14	13	12	4	6	7	4	5	9	14
2018	14	17	10	14	12	10	5	3	11	11	10	7
2019	9	18	16	18	10	16	4	11	3	9	18	3
2020	6	13	19	8	14	2	1	3	0	0	1	5
Ave	9	15	15	13	12	7.8	6.2	5.8	4.4	7.6	10	7
most	14	18	19	18	14	16	15	11	11	13	18	14

As shown in Table 1 and Figure 1.

It can be seen that although the number of windy days in Linzhi Airport accounts for a large proportion, the cumulative time of gale occurrence has not reached a proportional proportion. It can be roughly speculated that although there are many days of windy weather, it is not very long to a certain day, and the number of windy days changes obviously month by month, with strong seasonality. Therefore, if we can find out the law of windy weather through analysis, we can effectively avoid the influence of windy weather.

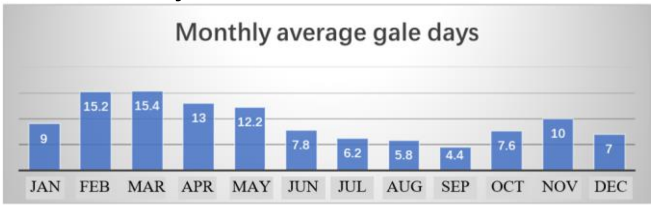


Figure 1: Monthly average windy days

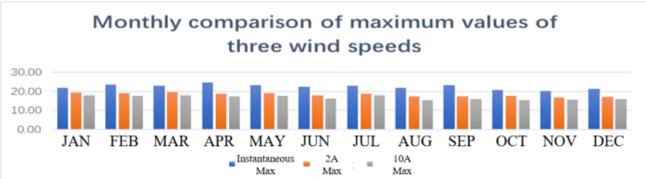


Figure 2: Monthly comparison of maximum values of three wind speeds

It can be seen from Figure 2 that the longer the averaging period is, the easier it is to smooth out the instantaneous large wind speed, so there is a big difference between the maximum values of instantaneous wind speed, average wind speed for 2 minutes and average wind speed for 10 minutes in each month. In actual work, the controller mainly pays attention to the value of 2-minute average wind, so the data of 2-minute average wind is mainly used for data analysis.

4.3. Prevailing winds

The wind direction adopts sixteen components, and the monthly average wind speed of each wind direction at the wind stations at the three endpoints (R05, MID and R23) of the runway is counted respectively. End 05: The average wind speed in the south-east direction is the largest in January-June and October-December, the average wind speed in the southwest direction is the largest in July-August, and the average wind speed in the southwest direction is the largest in September. End 23: in all months and all years, The average wind speed in the south-southeast direction is the largest; MID: In all months and all years, the average wind speed in the southeast direction is the largest;

Generally speaking, the maximum wind speed and wind direction at the three end points of the runway are basically the same, and only the 05 end has a small change from July to September.

The wind direction distribution of three automatic weather stations (R05, MID, R23) under different wind speed grades is counted. Data age: January 1, 2015, 00: 00: 00—December 31, 2020, 23:59:30; Static wind refers to wind speed less than or equal to 0.5m/s.

As shown in fig 3 and fig 4, the prevailing wind direction at 05 end is southwest, but the average wind speed is the largest in the southeast-east direction (the statistical conclusion in the previous section), and when the wind speed reaches over 5m/s, it appears most frequently in this direction. Considering the runway direction of 05-23, the influence of the winds in these two directions (southwest, southeast and east) on the runway operating conditions is reflected in both crosswind and shun wind.

With the same method, the situation of terminal 23 and mid-point (MID) is analyzed. According to the statistical results, the prevailing wind direction at terminal 23 is south-southeast and the average wind speed in this direction is the largest. When the wind speed reaches over 5m/s, the frequency of occurrence in this direction is the largest in all wind speed classes. Considering the runway direction of 05-23, the wind field at end 23 mainly affects the crosswind condition. The prevailing wind direction of MID is south-southeast, but the average wind speed in the southeast direction is the largest. When the wind speed reaches over 5m/s, the frequency of occurrence is distributed in these two directions (southeast and south-southeast) in each wind speed class.

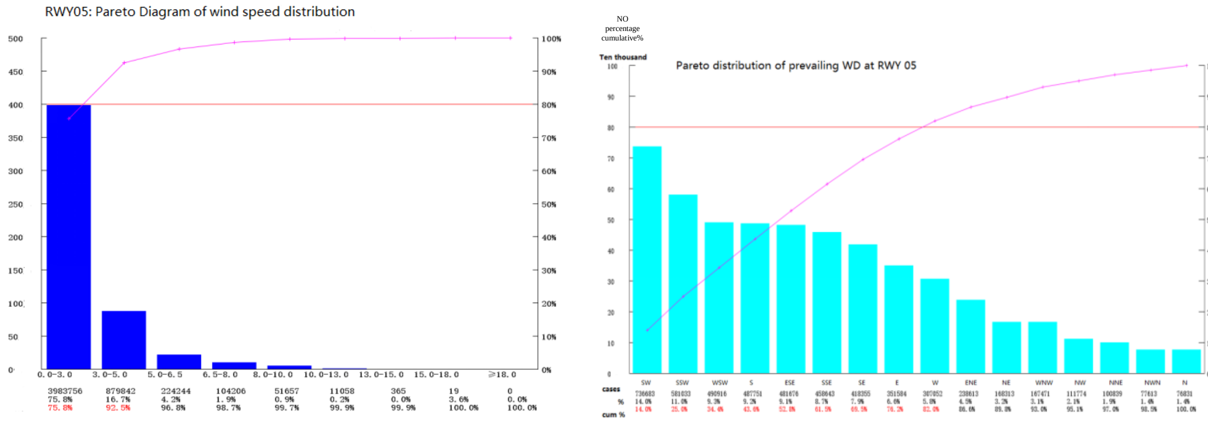


Figure 3: Pareto distribution of WS and prevailing WD at RWY 05

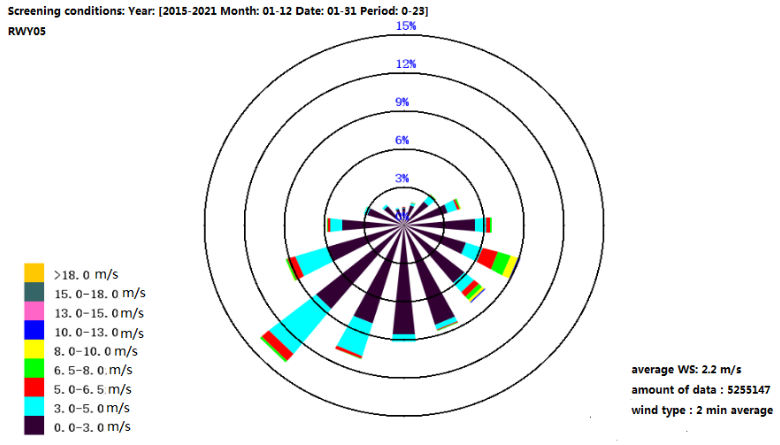


Figure 4: Wind rose at the RWY 05

Summary: Southwestern winds prevailed at the end of 05. Southeast winds prevail at the 23rd end. Southeast winds prevail in MID. The wind field situation of each station has its own characteristics, which are quite different and complicated.

4.4. General situation of Wind usability factor at Linzhi Airport

According to the above formula of usability factor, the statistical tables of wind usability factor at both ends of runway of Linzhi Airport are calculated as shown in Table 2.

The following statistical charts are used to analyze and explain the specific conditions at both ends of the runway:

05 end, only crosswind, tailwind and comprehensive consideration of crosswind and tailwind are considered by calculation respectively.

Table 2: Wind usability factor at both ends of runway of Linzhi Airport

Runway direction	crosswind (maximum allowable crosswind value)		tailwind (maximum allowable tailwind value)		comprehensive	
	$C_{crosswind}$	$Q^{crosswind}$ %	$T_{tailwind}$	$Q^{tailwind}$ %	$C_{crosswind}+T_{tailwind}$	$Q^{crosswind}+Q^{tailwind}$ %
R05	10	99	3	88	10+3	88
R23	12	98	3	97	12+3	96

Note 1: Data age: January 1, 2016-December 31, 2020

Note 2: $C_{crosswind}$ To meet the requirements of maximum allowable crosswind, $T_{tailwind}$ is the total number of winds to meet the requirements of maximum allowable tailwind.

Note 3: $Q^{crosswind}$ is the usability factor of crosswind and $Q^{tailwind}$ is the usability factor of tailwind.

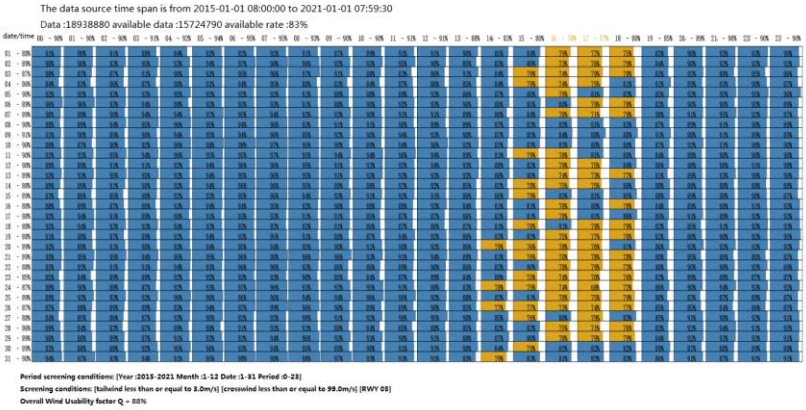


Figure 5: Wind usability factor under the condition of crosswind and tailwind considering comprehensively at RWY05

As shown in fig 5, combined with the analysis in 4.3, it can be seen from the statistical results that the prevailing wind direction at 05 end is southwest, but the average wind speed is the largest in the southeast-east direction (the statistical conclusion in the previous section), and when the wind speed reaches over 5m/s, the frequency in this direction is the most.

Considering the runway direction of 05-23, the influence of the winds in these two directions (southwest, southeast and east) on the runway operating conditions is reflected in both crosswind and shun wind, it's been shown in fig 6.

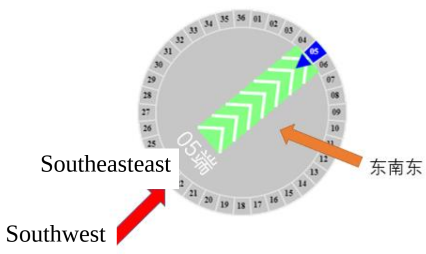


Figure 6: Schematic diagram of runway at R05 end and main influencing wind direction

It can be seen that: generally speaking, the main factor limiting the operating conditions at 05 end is the problem that the tailwind is not reach to standard; The daily change of Wind usability factor at 05 end is very obvious; The unseaworthy period at 05 is concentrated in the afternoon.

In the same way, it can be seen from the statistical results that the prevailing wind direction at end 23 is south-southeast, and the average wind speed in this direction is the largest. When the wind speed reaches over 5m/s, the frequency of occurrence in this direction is the largest in all wind speed grades. Considering the runway direction of 05-23, the wind field at end 23 mainly affects the crosswind condition. It can be seen that, on the whole, the condition of terminal 23 is obviously better than that of terminal 05. (It is probably because the prevailing wind at the 23rd end has no negative influence in the tailwind direction, and although it contributes a lot to the crosswind value, the crosswind standard is easy to meet, so the final actual influence is small.) Considering the wind field conditions at terminal 23 comprehensively, there are also a few periods that are not quite seaworthy in the afternoon.

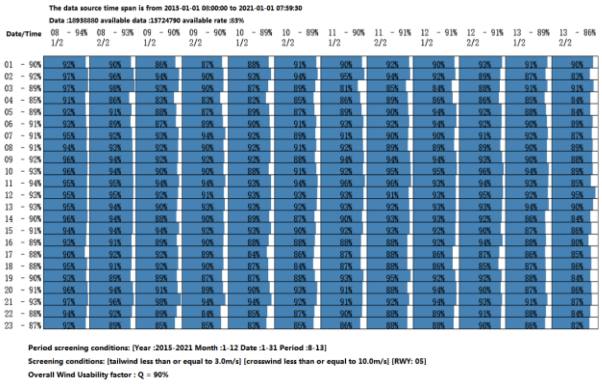
Summary: Although the overall Wind usability factor at 05 terminal reaches 88%, it is less than 80% at several times in the afternoon, so it is not enough to study the overall protection rate only, and more detailed time division and corresponding analysis should be carried out according to specific conditions.

4.5. Analysis of Annual Change and Daily Change

As the flights of Linzhi Airport were performed in the morning, the analysis results of the morning wind field were used as a reference to compare the analysis results of the afternoon (14:00-19:59) and the first half of the night (20:00-23:59), and the resolution of the time data was increased density from every hour to every half hour.

1) Analysis of Annual Change in Morning Time

As shown in fig 7, the overall Wind usability factor in the morning is 90%, and the highest value is 94% from 08: 00 to 08: 29, and the lowest value is 86% from 13: 30 to 13: 59.



The data source time span is from 2015-01-01 08:00:00 to 2021-01-01 07:59:30

Data :18938880 available data :15724790 available rate :83%

Date/Time	08 1/2 - 94%	08 2/2 - 93%	09 1/2 - 90%	09 2/2 - 90%	10 1/2 - 89%	10 2/2 - 89%	11 1/2 - 90%	11 2/2 - 91%	12 1/2 - 91%	12 2/2 - 91%	13 1/2 - 89%	13 2/2 - 86%
01 - 90%	92%	90%	86%	87%	88%	91%	90%	92%	90%	93%	91%	90%
02 - 92%	97%	96%	94%	90%	93%	94%	95%	94%	92%	89%	87%	83%
03 - 89%	97%	98%	93%	90%	87%	89%	81%	85%	84%	88%	91%	91%
04 - 85%	91%	86%	83%	83%	82%	85%	86%	89%	86%	86%	85%	84%
05 - 89%	92%	91%	88%	87%	89%	87%	89%	90%	94%	92%	88%	84%
06 - 91%	93%	89%	87%	89%	90%	91%	93%	92%	94%	92%	90%	89%
07 - 91%	95%	92%	93%	94%	92%	89%	91%	90%	90%	91%	92%	87%
08 - 91%	94%	93%	92%	90%	92%	91%	92%	89%	89%	89%	90%	89%
09 - 92%	96%	94%	92%	92%	92%	88%	94%	94%	94%	93%	90%	88%
10 - 93%	96%	94%	90%	90%	88%	91%	92%	95%	95%	96%	94%	89%
11 - 94%	95%	95%	94%	94%	93%	94%	96%	96%	93%	94%	93%	85%
12 - 93%	95%	95%	92%	91%	93%	93%	93%	91%	93%	95%	92%	95%
13 - 93%	95%	94%	90%	93%	93%	92%	93%	92%	93%	93%	94%	90%
14 - 90%	96%	94%	88%	90%	89%	87%	90%	93%	93%	92%	86%	84%
15 - 91%	94%	94%	94%	92%	93%	90%	92%	93%	92%	90%	87%	86%
16 - 89%	93%	91%	89%	90%	88%	88%	88%	88%	92%	94%	88%	80%
17 - 88%	90%	92%	92%	89%	84%	86%	87%	88%	86%	87%	86%	85%
18 - 88%	95%	91%	92%	90%	87%	84%	87%	88%	86%	85%	87%	86%
19 - 90%	93%	89%	89%	87%	87%	88%	93%	95%	92%	92%	88%	84%
20 - 91%	96%	94%	91%	89%	90%	93%	91%	88%	94%	90%	87%	86%
21 - 93%	97%	96%	98%	94%	94%	92%	91%	92%	94%	93%	91%	87%
22 - 88%	94%	92%	89%	84%	85%	87%	90%	88%	89%	91%	88%	84%
23 - 87%	92%	89%	85%	85%	83%	85%	86%	88%	88%	90%	86%	82%

Period screening conditions: [Year :2015-2021 Month :1-12 Date :1-31 Period :8-13]

Screening conditions: [tailwind less than or equal to 3.0m/s] [crosswind less than or equal to 10.0m/s] [RWY: 05]

Overall Wind Usability factor : Q = 90%

Figure 7: Summary table of Wind usability factor in the morning

2) Analysis of annual changes in the afternoon period:

Use statistical data to form a table for comparison: It can be seen from the statistical chart that in the morning, even based on the most ideal situation, the better end of the runway can always be used, and the lowest Wind usability factor is 92% at the 23rd end in August. Considering that this situation is difficult to achieve in actual operation, and the overall Wind usability factor in the morning is 90%, At the same time, in order to take care of the convenience of statistics, the reference standard of Wind usability factor is set at 90%.

As shown in Table 3, Under the subdivided period, it can be seen that at least one runway end has reached 8 months in which the usability factor reaches more than 90% in the afternoon period. That is to say, as long as the use of runway is properly switched, it is completely possible to meet the airworthiness conditions in the afternoon in 8 months of a year.

Table 3: Comparison Table of Monthly Wind usability factor in Subdivided Period

Start of month\period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Morning-05 end	93%	93%	87%	87%	91%	91%	87%	90%	88%	90%	92%	95%
Morning-end 23	95%	97%	96%	95%	93%	95%	94%	92%	96%	97%	97%	96%
Last night-05 end	92%	86%	80%	74%	77%	67%	69%	73%	70%	86%	92%	94%
Last night-end 23	88%	85%	85%	84%	85%	91%	90%	91%	94%	93%	91%	93%

Further subdivide the time period analysis:

As shown in Table 4, then further subdivide the two runway ends in February-May when the overall airworthiness conditions are not good in the afternoon. Through the analysis of statistical charts, we can find that: in February: 05, during the period from 14: 00 to 15: 29, the Wind usability factor reached more than 90%; During the period from 14: 00 to 14: 29 at the 23rd end, the Wind usability factor reached over 90%; During the period from 18: 30 to 19: 59, the wind protection reached more than 94%. March: 23 ends at 14: From 00: 00 to 14: 29, the Wind usability factor reached over 92%. During the period from 18: 30 to 19: 59, the wind protection reached more than 95%. April: During the period from 19: 00 to 19: 59 at the 23rd end, the wind protection reached more than 90%. May: During the period from 18: 30 to 19: 59 at 23: 00, the wind protection reached more than 90%. Therefore, on the whole, the Wind usability factor at both ends of the runway is low from February to May, However, there are still available time periods under the breakdown.

Table 4: Wind usability factor table for further subdivision of specific months

Start of month\period	14:00	14:30	15:00	15:30	16:00	16:30	17:00	17:30	18:00	18:30	19:00	19:30
February	90%	90%	90%							94%	96%	98%
March	92%									95%	97%	98%
April											90%	92%
May										90%	92%	90%

4.6. Analysis of annual changes in the first half of the night

Form a table from statistical data for comparison: As mentioned earlier, the reference standard of Wind usability factor is set at 90%. As shown in Table 5, under the subdivision period, it can be seen that in the first half of the night, the Wind usability factor of the runway 05 has reached more than 90% for 7 months, while the runway 23 has reached more than 97% for all 12 months, which is the lowest value. The number even exceeds the best time in the morning (08:00-08:29 94%). Therefore, the statistical results support that the wind field conditions of night flight can meet the operational requirements.

Table 5: Comparison Summary of Monthly Wind usability factor in Subdivided Period at Both ends of Runway

Start of month\period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Morning-05 end	93%	93%	87%	87%	91%	91%	87%	90%	88%	90%	92%	95%
Morning-end 23	95%	97%	96%	95%	93%	95%	94%	92%	96%	97%	97%	96%
Last night-05 end	94%	88%	84%	85%	88%	91%	85%	91%	92%	94%	95%	95%
Last night-end 23	99%	99%	99%	97%	97%	98%	99%	98%	99%	99%	99%	99%

5. Conclusion

Based on the runway wind data from 2015 to 2020 of the airport automatic meteorological observation system, the statistical characteristics of the runway surface wind field were analyzed and studied by using the wind usability factor and Pareto distribution technology, combined with the specific flight model performance, flight dispatch and air traffic control tower standards of Linzhi Airport. Qualitative and quantitative analysis of the influence of runway wind on the specific airworthiness of airport flights in afternoon and night time, and draw the following specific quantitative conclusions:

(1) Afternoon (14:00-19:59)

In January, June, July, August, September, October, November and December, under the condition of rational use of the runway, the wind field meets the conditions of flight operation;

In February, March, April and May, under the condition of rational use of the runway, the wind field in some periods meets the conditions of flight operation.

(2) The first half of the night (20:00-23:59)

Under the condition of rational use of runway, the wind field conditions in 12 months of the whole year meet the flight operation conditions.

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