ISSN: 2664-9640

Influence of advection fog on flight operation and case analysis

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Abstract

Airport fog has a great impact on civil aviation flight operation, involving all links of flight dispatch and release and operation monitoring. Through the analysis of the actual operation case of a flight, this paper summarizes the characteristics of advection fog and the precautions and Countermeasures of operation control under advection fog conditions, so as to improve the operation and disposal ability of airline dispatchers for advection fog, improve flight normality and reduce the cost of flight return and alternate landing due to weather reasons.

Keywords

Advection fog; Flight operation; Case analysis; Flight dispatch.

1. Introduction

Fog is the phenomenon of water vapor condensation or condensation while reducing the prevailing visibility (VIS) to less than 1000 meters. According to the different formation conditions, fog is divided into radiation fog, advection fog, front fog, uphill fog, evaporation fog and other [1]. Fog is a kind of visual range restricter weather phenomenon that mainly affects the airport visibility and runway visual range (RVR). If the visibility/RVR of the take-off or landing airport is below the operating standard, the flight can not take off or land on time, resulting in flight delay or flight diversion. We take a practical case to analyze the impact of the advection fog on the operation and the countermeasures.

2. An actual case of flight operation

CSS6889 flight release and monitoring process:

Date: March 19, 2014; Aircraft registration number and flight number: B2832, CSS6889;

Flight: HGH-SZX 0610-0815 (PEK time); NOTAM: no significant NOTAM

Due to the influence of advection fog, the visibility of Shenzhen Airport fluctuated greatly, and CSS6889 (HGH-SZX) cancelled the alternate landing during Guangzhou approach.

2.1. Analysis of flight release conditions

(1) Crew qualification: Captain Lee, foreign crew, non new captain.

(2) Aircraft status: airworthiness.

(3) NOTAM: there is no NOTAM affecting the operation of the relevant airport.

(4) Analysis of Hangzhou Airport Weather Information

METAR ZSHC 182030Z 09002MPS 2200 BR BKN023 12/10 Q1013 NOSIG=

TAF ZSHC 181917Z 182106 06004MPS 2400 BR BKN023 TX21/06Z TN11/21Z BECMG 2324 1400 -SHRA BR =

The METAR (Meteorological Terminal Aviation Routine Weather Report) released by Hangzhou Airport at 04:30 Beijing time shows that the visibility is 2200 meters and there is light fog. The wind direction is 90 degrees and the wind speed is 2m/s. The ceiling is 690 meters.

ISSN: 2664-9640

The TAF(Terminal Aerodrome Forecasts) released by Hangzhou Airport at 03:17 Beijing time (effective time: 05:00-14:00) shows that the visibility of Hangzhou Airport is 2400 meters, with light fog, wind direction of 60 degrees, wind speed of 4m/s, the ceiling is 690 meters. Between 07:00 and 08:00, the visibility will drop to 1400 meters, with light showers and mist.

Hangzhou airport operation standard: takeoff standard, RVR400 meters, VIS800 meters. Landing standard: RVR550 meters, VIS800 meters.

Take off weather analysis of Hangzhou Airport: by comparing the weather information and operation standard, it can be seen that Hangzhou Airport meets the take-off standard and landing standard, and there is no need to select a take-off alternate airport.

(5) Weather information analysis of Shenzhen Airport

METAR ZGSZ 182030Z 36002MPS 330V040 3500 BR BKN040 20/19 Q1014 NOSIG =

METAR ZGSZ 182000Z 33002MPS 310V040 3500 BR BKN040 20/19 Q1013 NOSIG =

TAF COR ZGSZ 181908Z 182106 24003MPS 2000 BR SCT015 BKN030 TX24/06Z TN18/22Z TEMPO 2101 0900 FG BECMG 0102 3500 =

The METARs released by Shenzhen airport at 04:30 and 05:00 Beijing time show that the visibility is 3500 meters and there is light fog. The wind direction changes from 360 ° to 330 ° and the wind speed is 2m/s. Ceiling is 1200 meters. The TAF released by Shenzhen airport at 03:08 Beijing time (effective time 05:00-14:00) shows that the visibility of Shenzhen airport is 2000 meters, there is light fog, the wind direction becomes 240 degrees, the wind speed is 3 meters/s, the ceiling is 1200 meters. There is fog between 05:00 and 09:00, the visibility will drop to 900 meters for a short time, and the visibility will rise to 3500 meters between 9:00 and 10:00.

Operation standard of Shenzhen Airport: landing standard, decision height is 60 meters, RVR800 meters.

Landing weather analysis of Shenzhen Airport: by comparing the weather information and operation standard, it can be seen that Shenzhen Airport meets the landing standard, but the visibility will decline for a short time. According to the provisions of the company's manual, the visibility of Shenzhen airport is in marginal weather conditions, so a reliable alternate airport needs to be selected.

(6) Weather information analysis of alternate airports

TAF ZGGG 181910Z 182106 12003MPS 4000 BR SCT011 OVC030 TX27/06Z TN19/22Z TEMPO 2202 2000 =

TAF ZGOW 181934Z 190024 18003MPS 0300 FG BKN002 BKN030 TX26/07Z TN19/22Z BECMG 0102 1000 BR SCT006 BKN040 BECMG 0304 2100 =

TAF ZGHA 181915Z 190024 36005MPS 2000 TSRA BR BKN008 FEW040CB BKN050 TX18/00Z TN12/22Z BECMG 0506 -RA BR BKN011 OVC050 BECMG 1213 3500 BR BKN040 =

Alternative airports around Shenzhen Airport include Guangzhou, Jieyang and Changsha, of which Guangzhou has a visibility of 4000 meters, light fog, wind direction of 120 degrees and wind speed of 3 meters/s. The sky is full of clouds. The ceiling is 900 meters. From 06:00 to 08:00, the visibility drops to 2000 for a short time. The alternate landing standard of Guangzhou airport is 120 meters visibility, which meets the requirements. Jieyang airport is foggy, with visibility of 300m and cloudy bottom of 60m, which does not meet the alternate landing standard. Changsha airport has moderate thunderstorm, light fog and visibility of 2000. It is not suitable to choose an alternate airport in thunderstorm weather. Therefore, Guangzhou is selected as the destination alternate for this flight. Considering that the flight time from Guangzhou airport to Shenzhen airport is only 29 minutes. In order to cope with the detour caused by changes in weather conditions, an additional 36 minutes of additional fuel was added.

(7) EN-route weather analysis

ISSN: 2664-9640

Check the important weather map and aeronautic weather radar chart. There are no thunderstorms, turbulence, ice accretion and other bad weather affecting flight operation on the flight route.

2.2. Flight release process

After consulting the airport meteorologist, we learned that Shenzhen airport may be affected by advection fog in the morning, resulting in short-term low visibility. The weather of Guangzhou airport is relatively stable. Considering the weather factors and the support capacity of the airport, Guangzhou is selected as the alternate airport and 36 minutes of additional fuel is added. The actual payload of the flight is 46259lbs, and the flight plan is made according to 46296lbs. See Figure 1 for the specific fuel volume information of the flight. The fuel volume during the flight is 14468lbs, and the flight time is 1 hour and 54 minutes. The fuel volume to Guangzhou alternate airport is 4198lbs, and the flight time is 29 minutes.

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ATTN CAPT.                                          B2832

FLIGHT RELEASE CSS6889 ZSHC/ZGSZ ON 18/MAR/14.NONSTOP COMPUTED 2012Z

A/C  REG    ENGINE     SELCAL  PRF  WX PROGS    AVG WIND/TEMP  UNIT
752  B2832  RB211-535  DH-LR    F   BRK 1812UK      M046/M45   1  LB

SPEED SKD   CLB-250/290/CRZ-  30 DSC-.78/290/ APD 03.0  PCNT. IFR

           FUEL     TIME      DIST  NAM        PLAN        AGTOW 212400
TRIP       014468   01:54     0707  0769       DOW 116246  RWY   240000
ALTN/ZGGG  004198   00:29     0127  0129       PLD 055000  ACL   067800
HOLDING    000000   00:00                      ZFW 171246  MZFW  184000
CONT       005318   00:45                      TOF 028336  TOF   028336
REQD       023984   03:08                                  MZTW  212400
EXTRA      004352   00:36                      TOW 199582  MTOW  240000
TAKE OFF   028336   03:44                      TIF 014468  TCAP  240000
TAXI       001000                              LDW 185114  MLDW  210000
RAMP       029336   03:44

FOD        013868   01:50
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Figure 1 flight plan fuel information

2.3. In flight monitoring process

After taking off, the dispatcher focuses on monitoring the weather at Shenzhen Airport: the following are the METAR issued at 07:00, SPECI report issued at 07:10 and the METAR issued at 07:30 and 08:00. The wind speed of Shenzhen airport is kept within 2 meters per second, and the wind direction changes from north to west. As Shenzhen airport faces the sea in the west, the westerly wind is conducive to the generation of advection fog [4].

(1) At 07:12, Shenzhen Airport METAR reported that the visibility had dropped to 1000 meters. The dispatcher monitored that the visibility of Shenzhen airport had decreased rapidly due to advection fog. He called Shenzhen Airport meteorology to learn that the visibility would continue to decline, which is expected to last about one hour; The METARS of Shenzhen airport from 07:00 to 08:00 is as follows：

METAR ZGSZ 182300Z 00000MPS 1000 R16/0900V1100N BR NSC 19/18 Q1014 BECMG TL2340 1600 BR=

SPECI ZGSZ 182310Z 28002MPS 0600 R16/0275V0600N FG NSC 19/18 Q1014 BECMG TL2340 1600 BR=

METAR ZGSZ 182330Z 26002MPS 0200 R16/0175V0250N FG NSC 19/18 Q1015 NOSIG=

METAR ZGSZ 190000Z 00000MPS 1300 R16/0900V1300N BR NSC 20/19 Q1015 BECMG FM0100 1500=

ISSN: 2664-9640

(2) The weather of Guangzhou Baiyun Airport is good. The dispatcher called the Airport Operation Center of Guangzhou airport and learned that the flight can alternate to Guangzhou airport, but there are not many parking stands. It may be necessary to wait for the parking stand after landing. The weather information of Guangzhou airport shows that the visibility is 3000 meters, light fog and the weather is relatively stable. The METAR of Guangzhou airport at 07:00 is as follows:

METAR ZGGG 182300Z 00000MPS 3000 BR SCT011 OVC016 20/19 Q1014 NOSIG=

(3) CSS6889 is expected to land at 07:59. The dispatcher contacts the crew through ACARS and suggests that the crew continue to fly to Shenzhen and alternate to Guangzhou if necessary; Meanwhile, continue to monitor the real-time RVR observation data of Shenzhen airport.

(4) At 07:26, the dispatcher contacted the crew through VHF to report the weather conditions of Shenzhen airport and suggested alternate landing in Guangzhou; The crew agreed to go to Guangzhou for alternate landing.

(5) The dispatcher informed the flight alternate information of each seat and did a good job in the guarantee of alternate flights; At the same time, inform Guangzhou airport of the flight plan to alternate to Guangzhou;

(6) At 07:40, the dispatcher monitored that the visibility of Shenzhen airport was improving through the runway real-time monitoring system. At the same time, he learned from the airport weatherman that the weather trend was improving, and it is expected that it can be higher than the standard at 8 o'clock;

(7) The dispatcher could not contact the crew through VHF, called Guangzhou approach, learned that the aircraft was approaching Guangzhou airport, requested Guangzhou approach controller to convey the information about the improvement of Shenzhen weather to the crew, suggested that the crew return to Shenzhen for landing, and asked the crew to use VHF to contact the dispatcher;

(8) At 07:48, the flight crew used VHF to contact AOC to inform that the flight terminated the approach at Guangzhou airport and was returning to Shenzhen Airport;

(9) At 08:13, the flight landed at Shenzhen airport, 14 minutes longer than the planned landing time. An alternate flight was avoided.

3. Case analysis

This is a relatively successful actual operation case to avoid flight alternate landing. The dispatcher mainly considers the following four factors:

The possible weather factors shall be fully considered before the flight takes off: Shenzhen airport is expected to have short-term heavy fog and the flight has the risk of alternate landing, so the plan for alternate landing to Guangzhou is formulated before the flight takes off, and additional fuel is appropriately added.

After the aircraft takes off, monitor the weather changes in real time, and provide the latest meteorological information and operation suggestions to the flight crew in time.

Keep in touch with the flight crew during flight and make joint decisions with the flight crew. With the change of weather conditions, the flight handling decision shall be decisively adjusted on the basis of establishing sufficient communication with the flight crew and air traffic controller.

In the whole process of monitoring and disposal, VHF or air traffic controller is mainly used to establish contact with the flight crew, which improves the efficiency of information transmission. If the flight is equipped with satellite phones, the convenience of communication can be further improved.

ISSN: 2664-9640

4. Suggestions on strengthening dispatch release and monitoring in this case

On the basis of mastering the theory and process of dispatch release, flight dispatchers should summarize more operation experience, so as to sensitively find operation risks in dispatch release and operation monitoring, take measures to resolve risks, move forward the safety gate and do a good job in the operation control of each flight.

Before the flight is released, the dispatcher shall carefully analyze the weather data such as aviation weather telegrams and important weather charts, grasp the weather at the departure airport, destination airport, alternate airports and en-route, and appropriately add additional fuel under the condition that the landing weight is not limited. Closely monitor the weather changes before the flight takes off. If the weather does not meet the operation standards, the release will be cancelled and reevaluated.

During flight operation, strengthen weather monitoring and timely send important weather and notices related to operation to the crew. Considering the subsequent satellite phone modification of the company's fleet, the efficiency of communication between dispatchers and flight crew and the normality of flight operation can be improved.

Strengthen the study of the generation of weather phenomena such as the principle of advection fog, weather characteristics, the process of generation and dissipation, and summarize the characteristics of fog in different airports, such as the characteristics of fog in Chongqing Airport: The advection fog of Chongqing Jiangbei Airport mostly occurs at 23:00-24:00, which is the peak of flights in and out, and has a great impact on the takeoff and landing of flights. However, the advection fog maintenance time of Chongqing Jiangbei Airport is short, generally 30-60min [2]. Characteristics of fog in Pudong Airport and Hongqiao Airport: in terms of radiation fog, advection fog and "low cloud fog", the fog in Hongqiao Airport is less than that in Pudong Airport, and the main difference is in spring (March, April and may). Radiation fog is prevalent in Hongqiao Airport, while "low cloud fog" is the most in Pudong airport [3]. Characteristics of fog in Guangzhou Baiyun Airport: there are East-West mountains 10km away from the north and northeast of Guangzhou Baiyun Airport, and the south is the Pearl River delta plain, which makes Liuxi River gather near the airport in appropriate weather to produce fog [5]. The increase of temperature or wind speed can dissipate the heavy fog.

5. Conclusion

Flight dispatchers are the core personnel of the airline operation control center. In their work, flight dispatchers need to receive and summarize many aspects of information and plan the flight operation of the whole company. The effective control of flight operation requires the accurate grasp of weather information. Through the detailed analysis of the actual operation case of a flight, this paper expounds the importance of strengthening the understanding and grasp of weather information in the process of flight operation, and summarizes the characteristics of heavy fog at several airports, which can help airline dispatchers improve their dispatch release level and flight operation control ability.

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