



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

January 29, 2019

Weather Study

METEOROLOGY

CEN18FA063

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A. ACCIDENT

Location: Punta Islita, Costa Rica
Date: December 31, 2017
Time: 1156 central standard time (1756 UTC)¹
Airplane: Cessna 208B-0900; TI-BEI

B. METEOROLOGIST

Mike Richards
Senior Meteorologist
Operational Factors Division (AS-30)
National Transportation Safety Board

C. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's meteorologist travelled to Costa Rica in support of this investigation. Unless otherwise noted, all times are in central standard time (CST) for December 31, 2017 (based upon the 24-hour clock), directions are referenced to true north, distances are in nautical miles and heights are above mean sea level (msl).

Accident location: 9.86525° north latitude, 85.36605° west longitude, elevation of about 215 feet.

D. WEATHER INFORMATION

1.0 Surface Observations

According to a report produced by the *Instituto Meteorológico Nacional* (IMN) in Costa Rica (Attachment 1; in Spanish), the closest IMN weather station to the accident site was in Paquera, Costa Rica, and was located about 25 miles east of the accident location at an elevation of about 128 feet. Siting, maintenance and reporting standards for this station are unknown. Reported parameters² (converted and rounded to nearest whole number) from this weather station during the times surrounding the accident time are presented here:

<u>Time</u>	<u>Temp</u>	<u>RH</u>	<u>W_Mag</u>	<u>W_Dir</u>	<u>G_Mag</u>
1100	32	58	2	east	9
1200	32	55	4	east	12
1300	32	52	3	northwest	11

¹ UTC – abbreviation for Coordinated Universal Time

² Temp=temperature (°Celsius[C]); RH=relative humidity (%); W_Mag=average wind magnitude (knots); W_Dir=predominant wind direction; G_Mag=gust wind magnitude (knots)

2.0 Satellite Data

Geostationary Operational Environmental Satellite (GOES)-16 “visible” ($0.64\mu\text{m}$) data were obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison. Imagery from 1200 CST is presented in figure 1. This imagery depicted cloudy conditions across the accident region.

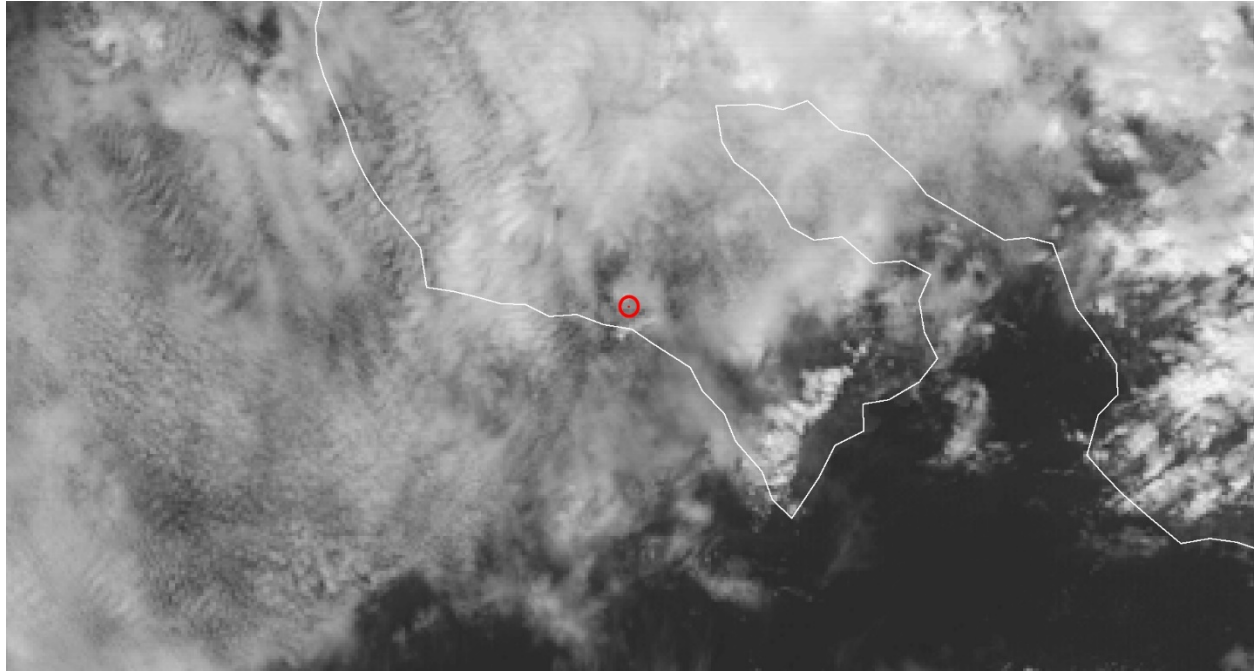


Figure 1 – GOES-16 visible ($0.64\mu\text{m}$) imagery from 1200 CST. Accident location is denoted by the red circle.

3.0 Model Data

An additional IMN report (Attachment 2; in Spanish) presents results from a Weather Research and Forecasting (WRF) Model run (Advanced Research [AR] core) that simulated the 10-meter wind (above ground level) over the accident region during times surrounding the accident time. Attachment 2 also contains results from the WRF-AR model run for wind conditions at 850 hectopascals and 10-meter wind gusts.

The WRF-AR results for 10-meter winds show that at 1000 CST (figure 2), the wind over the accident area was offshore from the northeast at about 5 knots. By 1100 CST (figure 3), a southerly wind had developed off the coast of Costa Rica to the south of the accident location, but the wind over the accident location remained from the northeast or east at about 5 knots. At 1200 CST (figure 4), onshore flow from the southwest or south had developed along the coast, with the accident site lying along the boundary between the (generally) 5 knot southerly winds to the south and the (generally) 5 knot northeasterly winds to the north.

Attachment 2 provided WRF-AF estimates of 10-meter maximum wind gust (Max_G; knots) and 10-meter average wind (Avg_W; knots) at the accident site³ during times surrounding the accident time.

<u>Time</u>	<u>Max_G</u>	<u>Avg_W</u>	<u>W Dir</u>
1000	22	15	northeast
1100	20	12	northeast
1200	15	10	east
1300	15	10	southwest

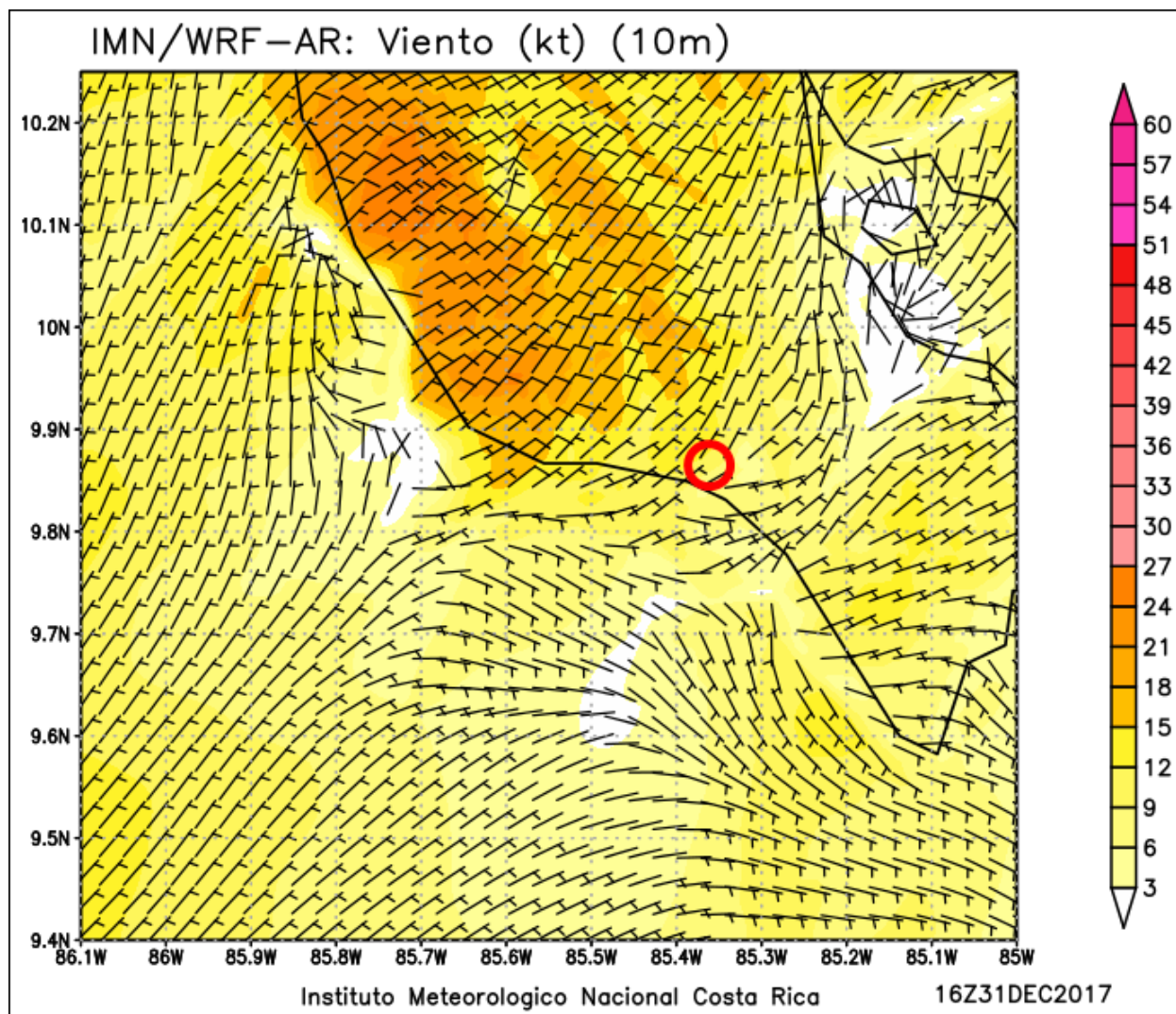


Figure 2 – WRF-AR 10-meter wind valid at 1000 CST. The accident site is denoted by the red circle.

³ There may be a difference of one kilometer between the points where the maximum wind gust and the average wind were calculated.

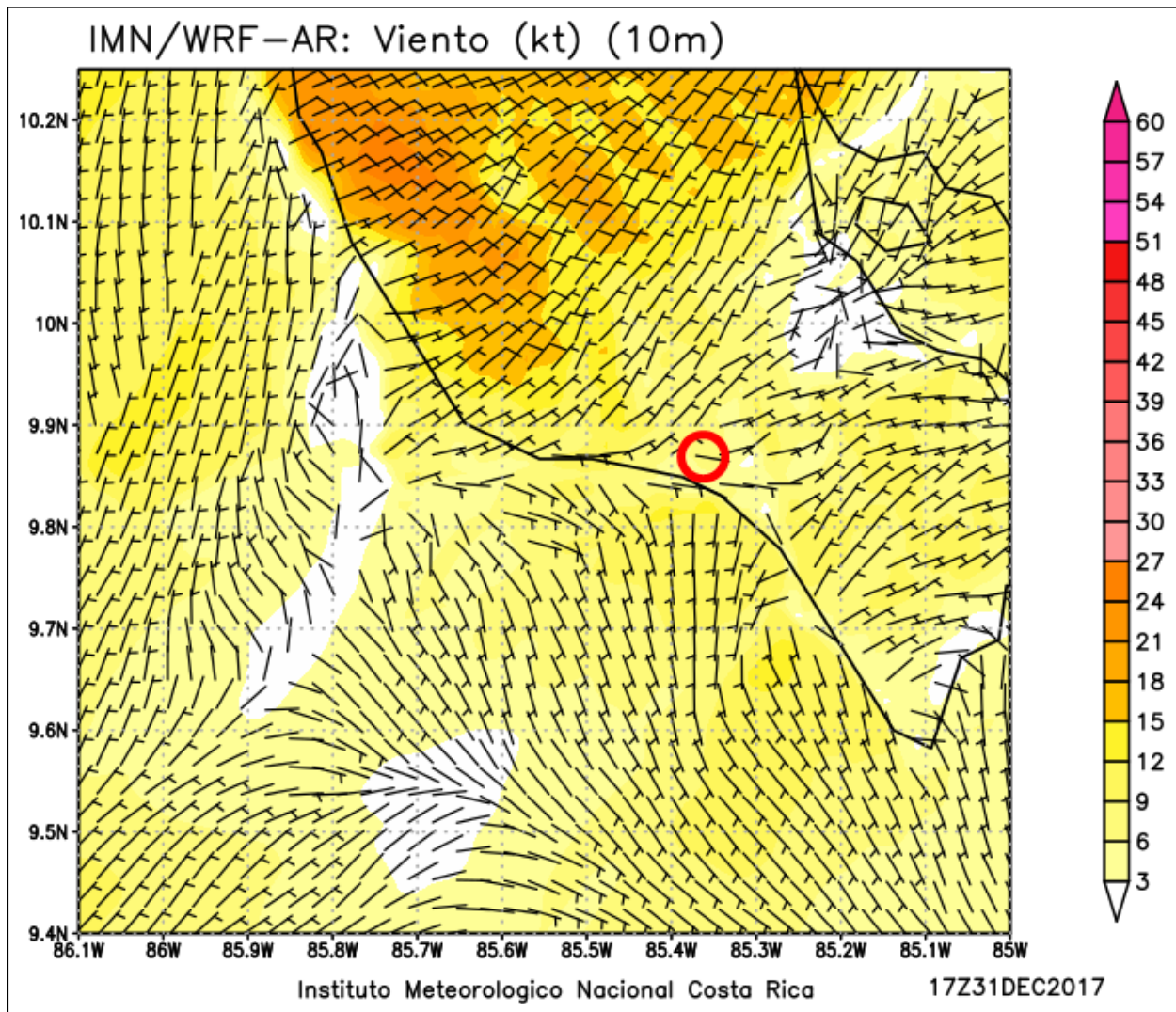


Figure 3 – WRF-AR 10-meter wind valid at 1100 CST. The accident site is denoted by the red circle.

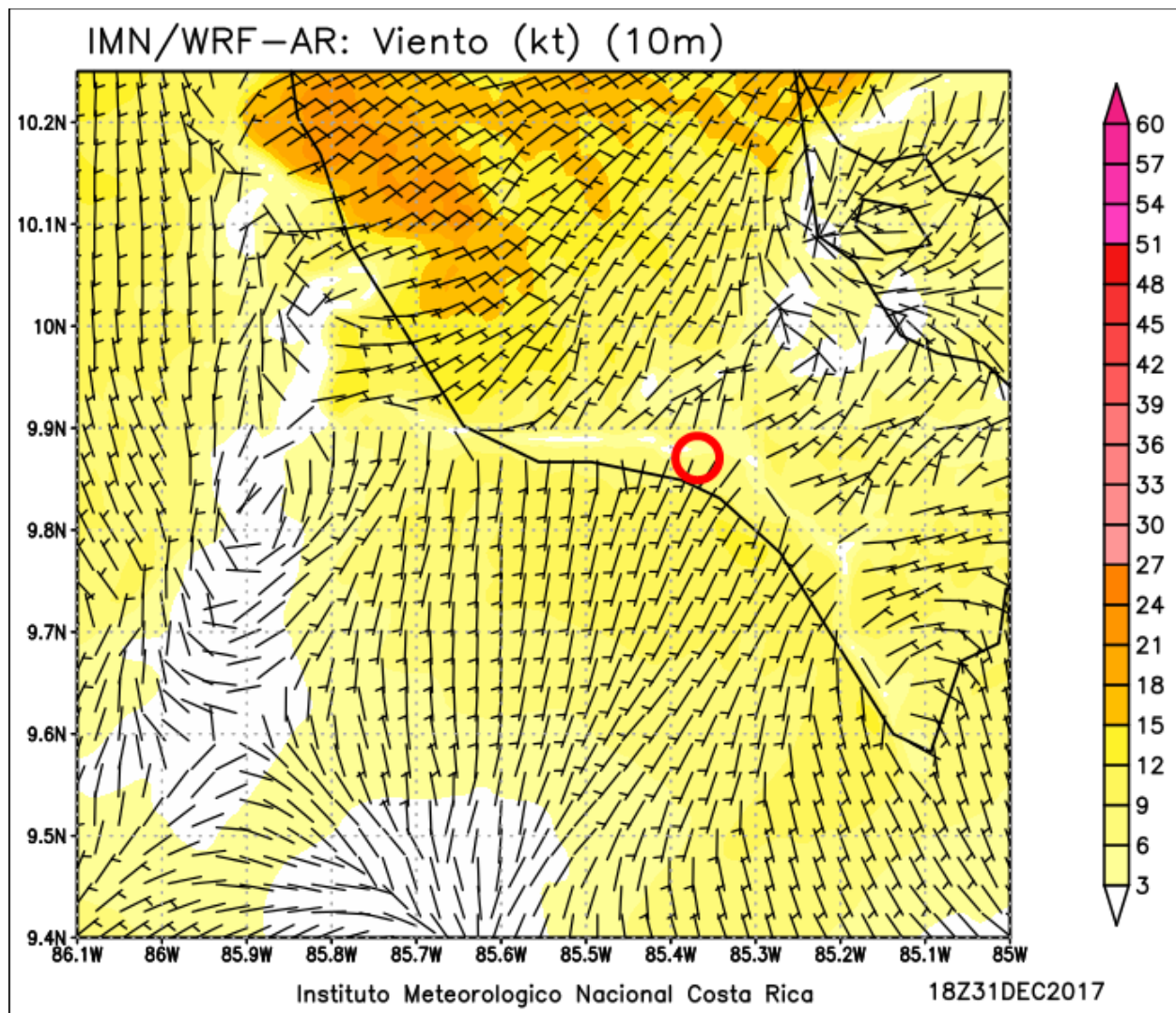


Figure 4 – WRF-AR 10-meter wind valid at 1200 CST. The accident site is denoted by the red circle.

4.0 IMN Advisory

According to the IMN (Attachment 1), their agency issued a meteorological advisory at 1045 CST, and that information issued by the IMN is sent to the institutions that make up the Centro de Operaciones de Emergencia of the Comisión Nacional de Prevención de Riesgos y Atención de Emergencias, the country's media, and is posted on their webpage. The advisory indicated that the forecast for the Pacific Slope region of Costa Rica for the accident day was for partly cloudy conditions, with a probability of rain mainly on the country's southern Pacific coast.

Aviso Meteorológico
Este domingo continuarán las lluvias en el Caribe y Zona Norte a causa del sistema de baja presión
31 de diciembre de 2017
10:45 a.m.

Diagnóstico: El sistema de baja presión que se localiza sobre Panamá ha comenzado a desorganizarse; sin embargo, sigue generando condiciones nubladas y lluviosas en las regiones del Caribe, Zona Norte y el Valle Central. Los montos registrados durante el día de ayer rondaron entre los 10-50mm, siendo los mayores acumulados en las partes altas de Cariblanco y del Bajos del Toro.

Pronóstico: Durante la tarde y noche de este domingo continuarán las lluvias ocasionales y de variable intensidad tanto en el Caribe como en la Zona Norte, con montos estimados que no sobrepasen los 50mm en 24 horas. En el Valle Central predominará nublado con lluvias en los sectores montañosos y en forma ocasional alcanzarán la GAM

Por el contrario, en la Vertiente del Pacífico predominará parcialmente nublado, aunque con probabilidad de aguacero principalmente en la costa del Pacífico Sur.

Los análisis indican que el sistema de baja presión continuará desorganizándose, en el transcurso de mañana lunes, previéndose un cambio en las condiciones del tiempo a lo largo de este día.

Debido a lo anterior, el IMN recomienda:

- ✓ Seguir las recomendaciones que emite la Centro de Operaciones de Emergencia.
- ✓ Prevención a los conductores ante la presencia de bancos de neblina y lluvias en los pasos de montaña, los cuales pueden reducir la visibilidad; además de deslizamientos que pudieran presentarse en estos sectores.
- ✓ Estar atentos a la emisión de los avisos meteorológicos del IMN que se publican en:
Twitter: @IMNCR, Facebook: Instituto Meteorológico Nacional, Página WEB:
www.imn.ac.cr

Juan Diego Naranjo Díaz
Meteorólogo
DMSA-IMN

Figure 5 – Text of the IMN meteorological advisory issued at 1045.

5.0 IMN Twitter

The IMN issued several Twitter posts (via @IMNCR) on the accident day. A few of these are presented here. The IMN meteorological advisory from 1045 CST (section 4.0) was also issued on the accident day by the IMN via Twitter.



Figure 6 – IMN Twitter post during the morning of the accident day that presents satellite imagery and indicates that the Caribbean, North Zone and Central Valley regions of Costa Rica are cloudy due to a low pressure system, and the Pacific Slope region is partly cloudy.



IMN, Costa Rica
 @IMNCR

Follow

✓

#IMN_pronóstico regional del tiempo para la tarde y noche de este 31 de diciembre, último domingo del 2017

Pronóstico regional del tiempo

Válido para: Domingo 31 de diciembre de 2017

Elaboró: Juan Diego Naranjo

Región	Tarde	Noche	Temperaturas extremas		
			Ciudad	T. Max. °C	T. Min. °C
Valle Central	 Mayormente nublado con lloviznas en partes altas	 Nublado	San José	22.6	18.1
			Alajuela	26.0	19.6
			Cartago	19.4	14.3
			Heredia	23.9	18.3
Pacífico Norte	 Parcialmente nublado	 Parcialmente nublado	Puntarenas	33.3	20.8
			Liberia	33.2	20.6
			Nicoya	30.6	20.3
			Sagaces	28.8	18.7
Pacífico Central	 De nublado a parcialmente nublado. Posibilidad de lluvia de corta duración	 De nublado a parcialmente nublado	Quepos	26.8	22.5
			Parrita	31.3	20.3
Pacífico Sur	 De nublado a parcialmente nublado. Posibilidad de lluvia de corta duración	 De nublado a parcialmente nublado	Golfo	31.8	22.9
			Isla del Coco	31.2	20.3
			San Isidro de El General	27.5	19.6
Caribe Norte	 Nublado con lluvias ocasionales	 Nublado con lluvias ocasionales	Guápiles	22.0	18.0
			Tortuguero	27.7	22.6
Caribe Sur	 Nublado con lluvias ocasionales	 Nublado con lluvias ocasionales	Limón	27.0	22.6
			Sixola	27.6	22.1
Zona Norte	 Nublado con lluvias ocasionales	 Nubosidad variable	Ciudad Quesada	25.3	16.4
			Upala	31.1	21.6
			Sarapiquí	25.3	20.7

Comentario General

Este domingo la presencia de un sistema de baja presión ubicado sobre Panamá aportará, además de inestabilidad atmosférica, humedad y nubosidad al país.

Se prevén lluvias entre débil a moderada intensidad en las regiones de la Zona Norte y el Caribe a lo largo del día, alcanzado en forma de lloviznas las montañas del Valle Central.

Por otra parte, en la Vertiente del Pacífico se espera cielo parcialmente nublado durante la mañana, aumentando la nubosidad en la tarde, pero sin precipitaciones importantes para este día.

Efemérides (San José)



Sale
05:53 a.m.



Sale
04:14 p.m.



Fase lunar
Hacia Luna llena

Se pone
05:26 p.m.

Se pone
04:10 a.m.

8:13 AM - 31 Dec 2017

Figure 7 – IMN Twitter post during the morning of the accident day states that the North Pacific region of Costa Rica will be partly cloudy during the afternoon, and comments that the Pacific Slope region overall will be partly cloudy in the morning, with increasing cloudiness in the afternoon, and no significant rainfall during the day.

MET WEATHER STUDY

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6.0 Additional Information

There were no automated weather sensing equipment at Islita Airport (MRIA), which was the departure airport for the accident flight. A review of a surveillance video from MRIA that captured the accident sequence did not yield information through which surface wind direction could be determined. While onscene at MRIA on January 6, 2018, NTSB investigators learned from a witness who was at the airport at the time of the accident that the wind magnitude at MRIA during the time of the accident was likely between 10-15 knots or slightly less. Review of the surveillance video did not yield information that conflicted with that witness' assessment.

MRIA was equipped with structures to accommodate windsocks. There was one windsock structure at each end of the airstrip's runway pavement. However, investigators believe that at the time of the accident, neither structure was fitted with a windsock.

The following image (figure 8) was taken by Costa Rican investigators the day after the accident and shows the windsock structure located at the departure end of runway 03 at MRIA.



Figure 8 – Windsock structure at departure end of runway 03 at MRIA with missing windsock on the day following the accident.

On January 6, 2018, NTSB investigators visited MRJA and noted that the windsock structure located at the arrival end of runway 03 at MRJA was also missing a windsock, and it appeared that the windsock had blown into a tree located adjacent to the windsock structure.

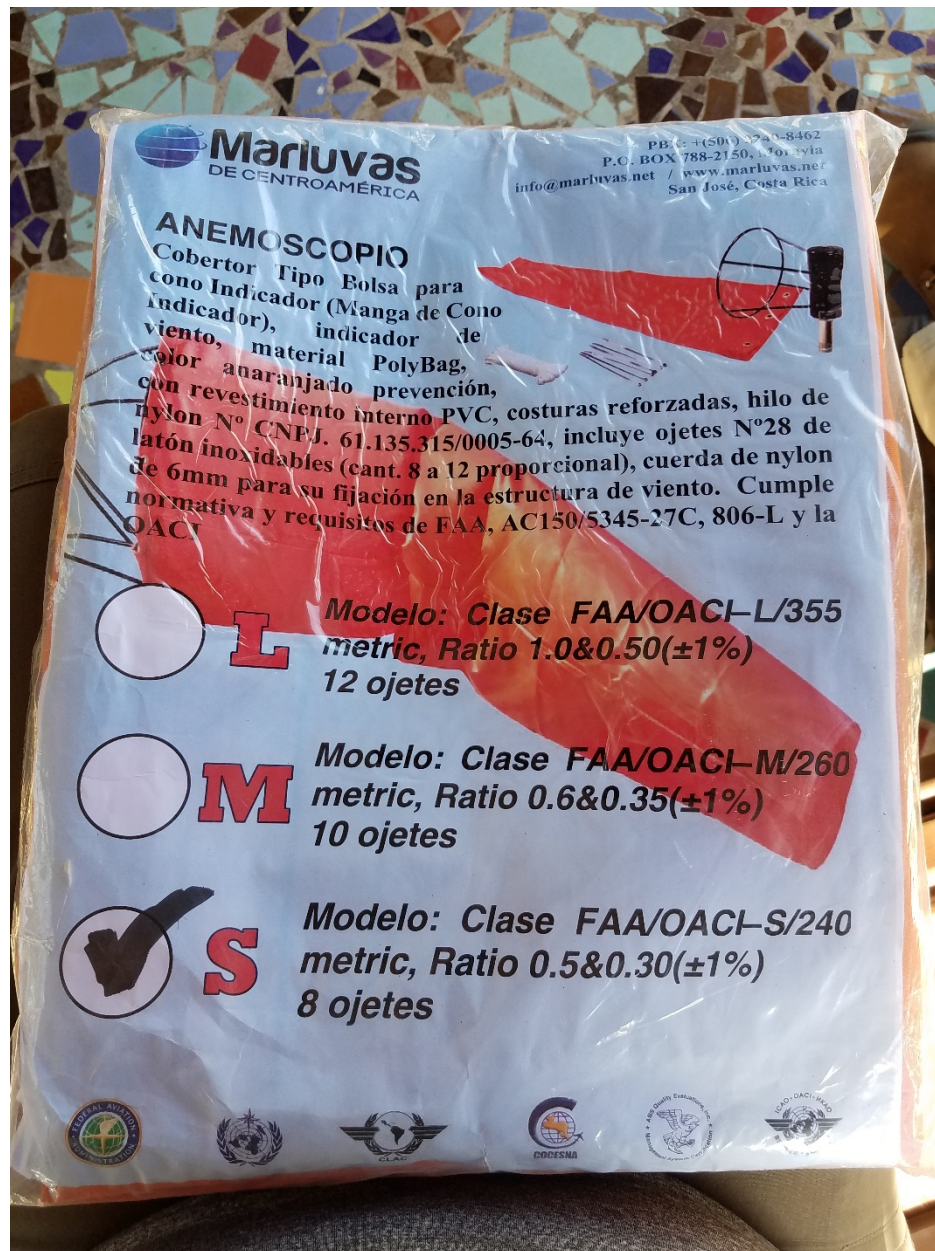


Figure 9 – Type of windsocks used at MRJA.

With regard to the MRIA missing windsocks and any protocol for monitoring the status of windsocks at Costa Rican airfields, on October 23, 2018, the Dirección General de Aeronáutica Civil (DGAC) in Costa Rica stated to the NTSB (Attachment 3): “The situation of the wind socks [at MRIA] was corrected, both are already one in each runway head and in the place that was recommended. And with respect to a formal monitoring protocol for local aerodromes, nothing has changed. There is no procedure or protocol on the part of the DGAC Authority, nor on the part of the operators.”

According to a passenger on the aircraft that departed MRIA about 20 minutes prior to the accident aircraft (Attachment 3): *“The morning started as windy toward the sea. The wind did abate, but there were strong occasional gusts. Of course we departed a fair amount of time before the second plane took off so we have no knowledge of actual conditions at the time of [the accident aircraft’s] departure. [We] threw a Frisbee at the airstrip while waiting for the planes to be able land. It made us aware of the variable nature of wind conditions.”*

A pilot from another operator who had a lot of experience flying into MRIA told NTSB investigators that he would never turn left while departing runway 03 at MRIA because the way the wind comes through the mountains that downdrafts and wind shear could be experienced to the left of the runway centerline.

E. LIST OF ATTACHMENTS

Attachment 1 - IMN report number 1.

Attachment 2 - IMN report number 2.

Attachment 3 - Emails from the DGAC and a passenger onboard aircraft that departed MRIA about 20 minutes prior to the accident aircraft.

Submitted by:

Mike Richards
Senior Meteorologist

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