GOES Aviation Weather and Hazard Assessment

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Overview

• Current research and product development includes applications of GOES imager and sounder data to detect and nowcast aviation weather hazards including:

  • Fog
  • Icing
  • Volcanic ash clouds
  • Downbursts and Microbursts
Fog Detection

Fog detection and low cloud base height algorithm

Output image product
GOES-R Fog Detection: A New Approach

- Traditional fog detection methodologies produce numerous false alarms and cannot accurately depict small-scale valley fog events.
- A new cloud object-based probabilistic approach addresses these shortcomings.

Traditional Method

New Method

This new methodology can be applied to current GOES as well.

Credit: M. Pavolonis and C. Calvert
Aircraft Icing

- In-flight icing is the accretion of supercooled liquid water (SLW) on the airframe. This SLW can be in the form of cloud droplets or freezing rain/drizzle.
Icing Detection

Icing detection algorithm

Output image product

GOES Aviation Products
Volcanic Ash

- In addition to damaging the leading edge surfaces of aircraft, ash ingested into jet engines results in loss of performance, and possibly complete shutdown.

Mt. Redoubt, AK 1750 UTC 26 March 2009

Taken from Diamond Ridge near Homer, AK

From: FAA Aviation Safety Journal Vol. 2 (3)
Volcanic Ash Detection

Volcanic Ash Characteristics in Moist Tropical Airmass

Volcanic ash detection algorithm

Output image product

GOES Aviation Products
Automated Ash Cloud Warning and Retrieval System

• First ever satellite-based automated volcanic cloud warning and retrieval system
• This AVHRR-based system is being transitioned to NESDIS operations

Credit: M. Pavolonis, J. Sieglaff, and A. Parker
Volcanic Ash Detection

26/1930 UTC

27/0240Z

27/0840Z

27/1440Z

VOLCANIC ASH ADVISORY
DTG: 20090326/2040
VAAC: ANCHORAGE
VOLCANO: REDOUT 1103-03
AREA: SOUTH CENTRAL ALASKA
SUMMIT ELEV: 10198 ft (3108m)
ADVISORY NUM: 2009-18

INFO SOURCE: POES/GOES/AVO/PILOT REPORT/RADAR
ERUPTION DETAILS: EXPLOSIVE ERUPTION AT 26/1724 UTC
REMARKS: LIGHT ASHFALL REPORTED AT HOMER BY TRUSTED OBSERVER.
NEXT ADVISORY: 20090327/0240Z

GOES Aviation Products
Downburst and Microburst Prediction

- Strong downdraft produced by a convective storm (or thunderstorm) that causes **damaging winds** on or near the ground.
- Due to the resulting **intense wind shear**, downbursts are a **hazard to aircraft** in flight, especially during takeoff and landing.
GOES Sounder Products
GOES Imager Product

Mid-tropospheric Moist layer

Amarillo, TX RAOB Temperature

Steep lapse rate

Convective storms

Dissipating wind gusts

GOES Aviation Products
Future NESDIS-CREST Collaboration

• Directed/guided student research:
  – Algorithm validation:
    • Learn and apply basic meteorological and remote sensing concepts, and research methods.
    • Understand and appreciate connection between research and operational utility of algorithms.
  – Technology transfer:
    • Virtual Institute for Satellite Integration Training (VISIT) lessons, web-based tutorials, publication of research
• Successful student mentorships can result in the accomplishment of both NESDIS and student research objectives:
  – Opportunities for professional growth for both NESDIS and the student.