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GOES–R Applications for the Assessment of Aviation Hazards

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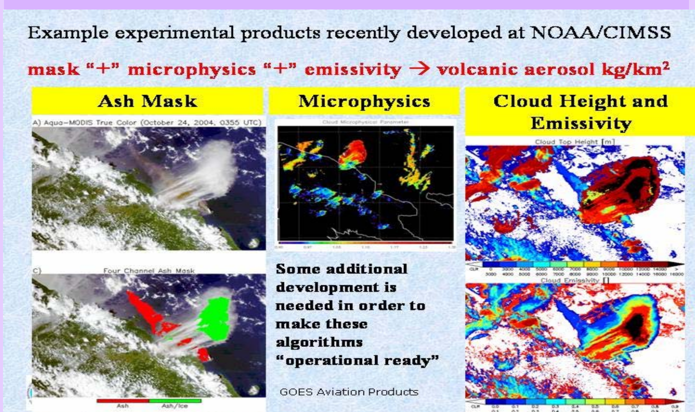
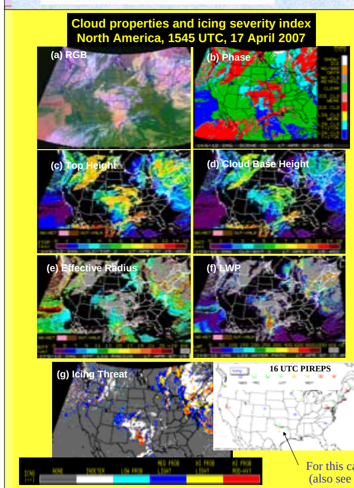
1. INTRODUCTION

A suite of products has been developed and evaluated to assess meteorological hazards to aircraft in flight derived from the current generation of Geostationary Operational Environmental Satellite (GOES). The existing suite of products includes derived images to address seven major aviation hazards: fog, aircraft icing, microbursts, turbulence, volcanic ash, convective initiation, and enhanced-v and overshooting top detection. Some products have been developed for the purpose of implementation into the National Weather Service AWIPS. The fog, icing, volcanic ash, convective initiation, and enhanced-v and overshooting top detection products, derived from the GOES imager, utilize algorithms that employ temperature differencing techniques to highlight regions of elevated risk to aircraft. In contrast, the GOES microburst products employ the GOES sounder to calculate risk based on conceptual models of favorable environmental profiles for convective downburst generation. It is proposed to adapt the current suite of aviation product algorithms, with modifications and enhancements, for the GOES-R Advanced Baseline Imager (ABI). In addition, a product for nowcasting convective initiation based on the GOES imager developed at CIMSS is anticipated to be incorporated into the suite of GOES-R derived aviation products. This poster will provide a general overview of legacy candidate algorithms as well as outline proposed development activity pertaining to aviation weather applications.

2. VOLCANIC ASH



3. ICING



Basis for Icing Detection

Aircraft icing conditions depend on

- supercooled liquid water (*SLW*) in cloud
- liquid water content, *LWC*
- presence of large droplets, SLD
- VISST detects SLW: $T_c < 272$ K, phase = water
- liquid water path: $LWP = f(LWC)$
- effective radius, $re = f(SLD)$

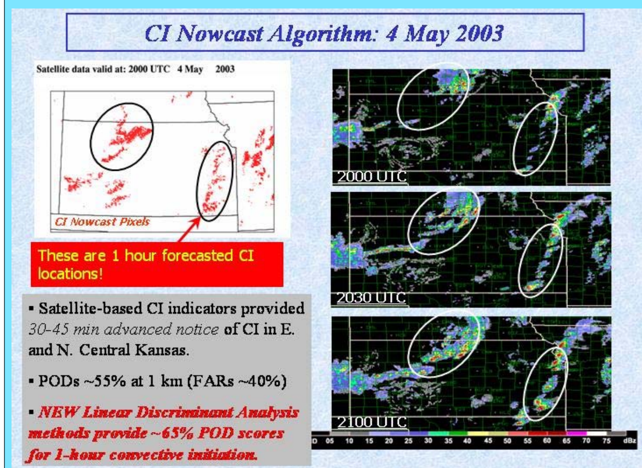
Develop threshold criteria from PIREPS & in situ data (Smith et al., 2003, Minnis et al., 2004):

Preliminary Icing Classification Algorithm

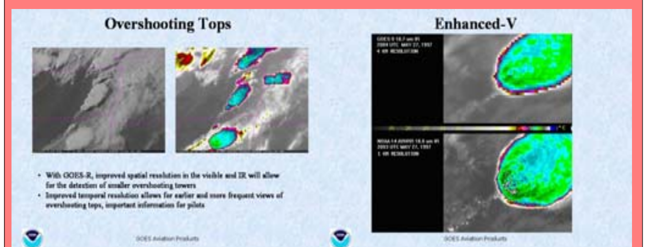
- No icing: Tc > 272 K, clear, or ice cloud with OD > 6
- Indeterminate: ice cloud, OD > 6
- Icing probability (IP)
  - For $r_e = 5$ μm, $IP = 0.147 \ln(LWP) - 0.084$ (1)
  - For $r_e = 16$ μm, $IP = 0.138 \ln(LWP) - 0.024$ (2)
  - For observed r_e, $IP(r_e) = f[IP(5), IP(16)]$
  - low, $IP < 0.4$; medium, $0.4 \leq IP < 0.7$; high, $IP \geq 0.7$
- Icing severity (IS)
  - IS = light, if LWP < 432 gm^{-2}
  - IS = moderate-heavy, if LWP > 432 gm^{-2}

For this case, moderate icing PIREPS confirm satellite-derived icing threat (also see Poster by Smith et al.)

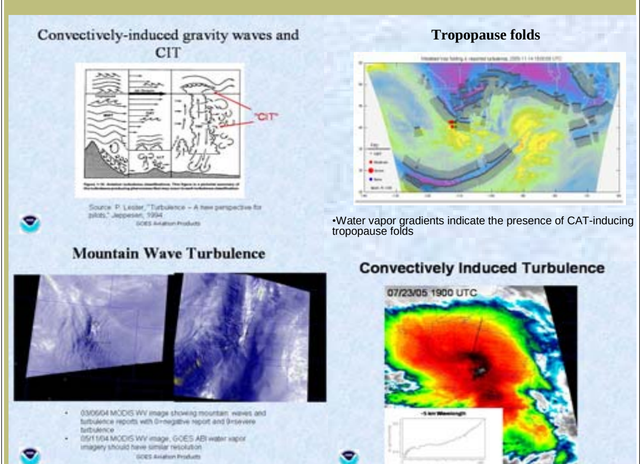
4. CONVECTIVE INITIATION



5. OVERSHOOTING TOPS/ENHANCED-V DETECTION



6. TURBULENCE



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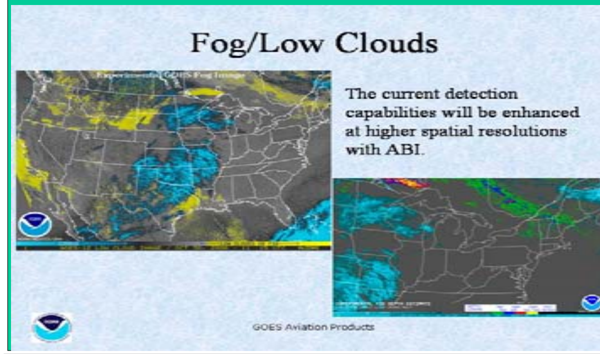
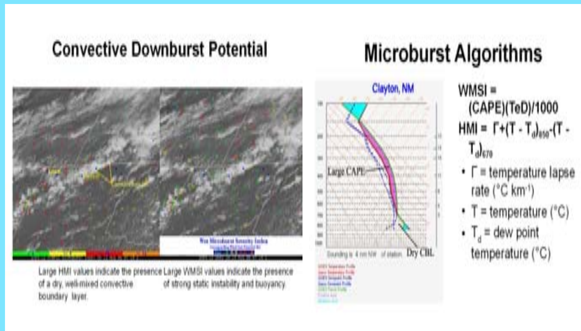
More information can be found at http://cimss.ssec.wisc.edu/snaap/.

7. FOG AND LOW CLOUDS



8. MICROBURSTS



The GOES Microburst Windspeed Potential Index (MWPI) algorithm, derived from merging the WMSI and HMI, is designed to infer the presence of a convective boundary layer: $MWPI = (CAPE/100) + G + (T - Td)_{850} - (T - Td)_{670}$ Although there is not currently an observational requirement for microburst potential for the GOES-R Advanced Baseline Imager (ABI), the ABI does have promising capability to generate a sounding profile.

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