Identifying stratospheric air intrusions and associated hurricane-force wind events over the north Pacific Ocean

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INTRODUCTION

Motivation
- Ocean data is sparse
- Reliance on satellite imagery for marine forecasting
- Ocean Prediction Center (OPC) - "mariner's weather lifetime"

- Proposed functions:
  - Pacific, Atlantic, Pacific Alaska surface analyses - 24, 48, 96 hr
  - Wind & wave analyses - 24, 48, 96 hr
  - Issue warnings, make decisions

- Geostationary Operational Environmental Satellite - R Series (now GOES-16)

- Compared to the old GOES:
  - 3x spectral resolution
  - 4s spatial resolution
  - 5x faster coverage

- Comparable to Japanese Meteorological Agency’s Himawari-8, used a lot throughout this research

Research Question: How can integrating satellite data imagery and derived products help forecasters improve prognosis of rapid cyclogenesis and hurricane-force wind events?

Phase I - Identifying stratospheric air intrusions

- Water Vapor 6.2, 6.9, 7.3 µm channels
- Airmass RGB Product
- ASCAT (A/B) and AMSR-2 wind data

BACKGROUND

Stratospheric Air Intrusions

AKA: tropopause folds, stratosphere-troposphere exchange (STE), dry intrusion

- Exchanges of air between stratosphere and troposphere
- Importance to weather systems
  - PV anomaly changes in vertical distribution of potential temperature & vorticity
- Promotes rapid cyclogenesis

DATA & METHODS

Himawari-8 Airmass RGB

- Each color band represents a wavelength (difference)
- Different wavelengths capture different layers of atmosphere

Himawari-8 Water Vapor:
- Upper layer: 6.2 µm channel
- Lower layer: 6.9 µm channel
- Lower layer: 7.3 µm channel
- Peak response at ~350 mbar

Scatterometer & Microwave Radiometer:
- Used to verify hurricane-force

Total Column Ozone & Ozone Anomaly
- Used to help quantify Airmass RGB

Examples of instruments:
- 1. Aqua’s Atmospheric Infrared Sounding Sounder (AIRS)
- 2. NPPS Cross-track Infrared Sounder/Advanced Technology Microwave Sounder (CRIS/ATMS)
- 3. Metop-B’S Infrared Atmospheric Sounding Interferometer (IASI)

CONCLUSION

Future Work

- Finishing case studies
- Similar satellite imagery

- Incorporating MERRA-2 global reanalysis model visualization

- Preview of Jan 17 Intrusion

- Build instructional material for OPC and Alaskan Weather Forecast Offices

- Present real-time use

- Training for RGB Airmass and ozone products as supplementary information about stratospheric air intrusions

- Apply to GOES-16

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