



# Overview of PODEX

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# PODEX - Introduction



- Background: Draft ACE report calls for suborbital experiment to:
  - Help optimize a polarimeter design most suitable for providing measurements called for by ACE science requirements



AirMSPI

Multiangle SpectroPolarimetric Imager (JPL) (JPL)



PACS

Passive Aerosol and Cloud Suite (UMBC/GSFC)



RSP

Research Scanning Polarimeter (GISS)

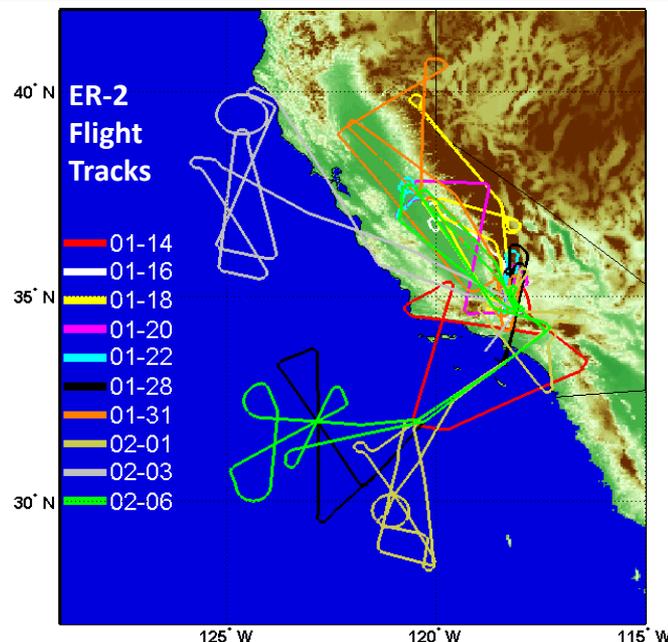
- Intercompare various methods to measure aerosol absorption, phase function, and refractive index
- Stimulate algorithm development and automation for L1 and L2 data products
- Implementation: Draft ACE report call for Airborne field experiment on NASA ER-2 to:
  - Observe bright desert and dark ocean surfaces, episodic pollution, fire events
  - Compare atmospheric total and polarized radiances
  - Optimize spectral and angular range of observations that yield L2 products for comparison with validation measurements
- Recommendation: Fly other aircraft to carry radiometric and in situ sensors to test polarimeter L2 retrievals



# PODEX - Experiment Details



- Mission conducted from January 14 – February 6, 2013
- Augmented by additional ER-2 sensors (AMS, CPL, SSFR)
- Coordinated with:
  - DISCOVER-AQ (EV-S) (NASA/WFF P-3, NASA/LaRC King Air)
  - DRAGON AERONET ground based Sun photometers
- Support from MODIS, MISR science personnel
- 49 hours of data acquired during 10 ER-2 flights
- Polarimeter observations include:
  - Clear ocean with visible wave structure, sunglint patterns
  - Farmland, foothills, mountains, rivers, lakes, urban areas, snow fields, desert
  - Pollution aerosols
  - Fog, broken stratus, stratocumulus, scattered cumulus, and cirrus
  - Glories, supernumerary bows, cloudbows
  - Calibration target: Rosamond Dry Lake





# AirMSPI and PODEX

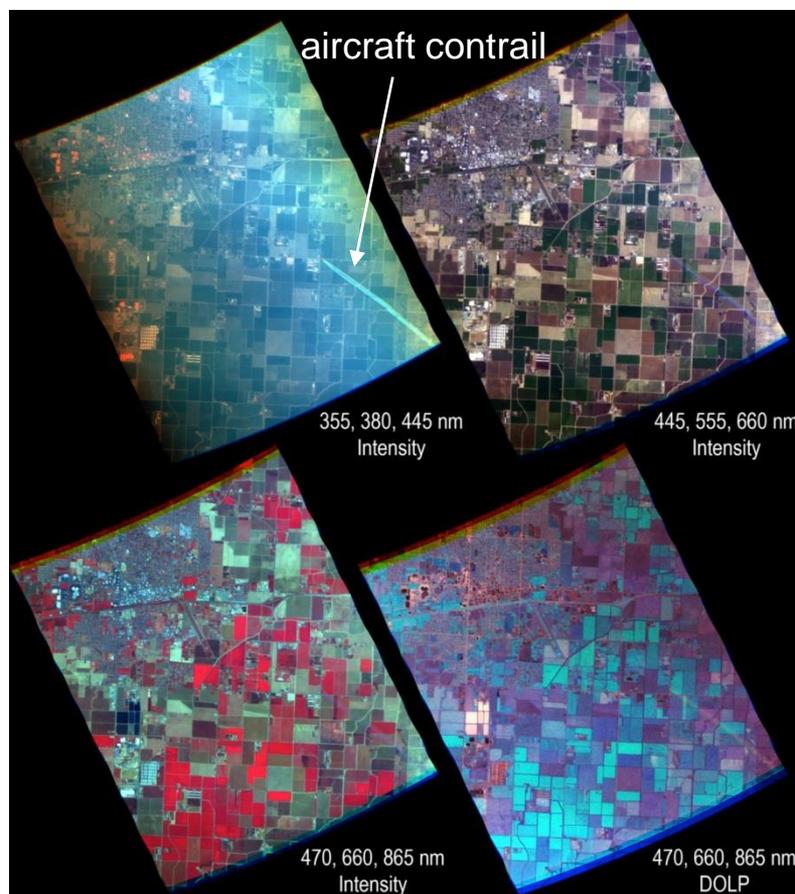
June 2, 2014

# AirMSPI (Multiangle SpectroPolarimetric Imager)



- AirMSPI PODEX scientists: Dave Diner (PI-JPL), Olga Kalashnikova, Michael Garay, Larry Di Girolamo, Ralph Kahn, Roger Marchand
- AirMSPI deployed in ER-2 Nose
- Spectral bands (355, 380, 445, 470\*, 555, 660\*, 865\*, 935 nm, \*=polarimetric)
- Gimbal mounting enables multi-angle imaging in two modes: step and stare (10 m sampling) and sweep (25 m sampling)
- 10 km x 11 km swath
- Obtained data over a wide variety of scenes and targets during the PODEX flights
- L1B data and documentations available at LaRC ASDC  
[https://eosweb.larc.nasa.gov/project/airmspi/airmspi\\_table](https://eosweb.larc.nasa.gov/project/airmspi/airmspi_table)

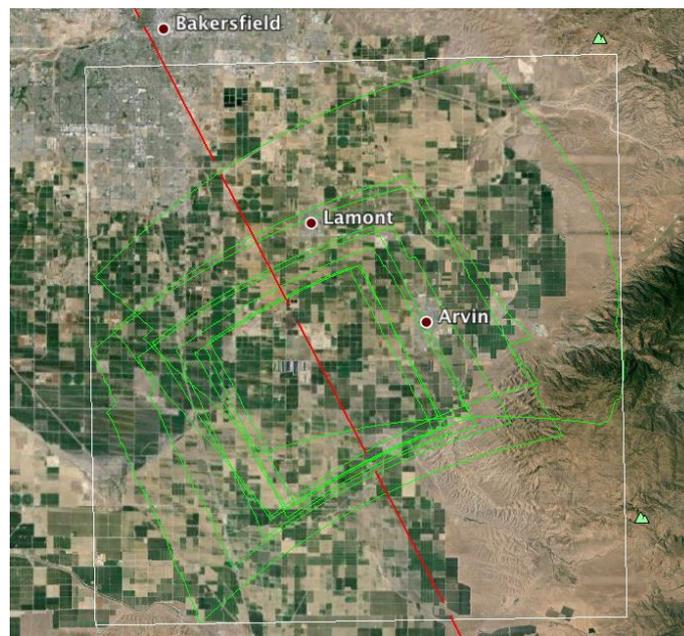
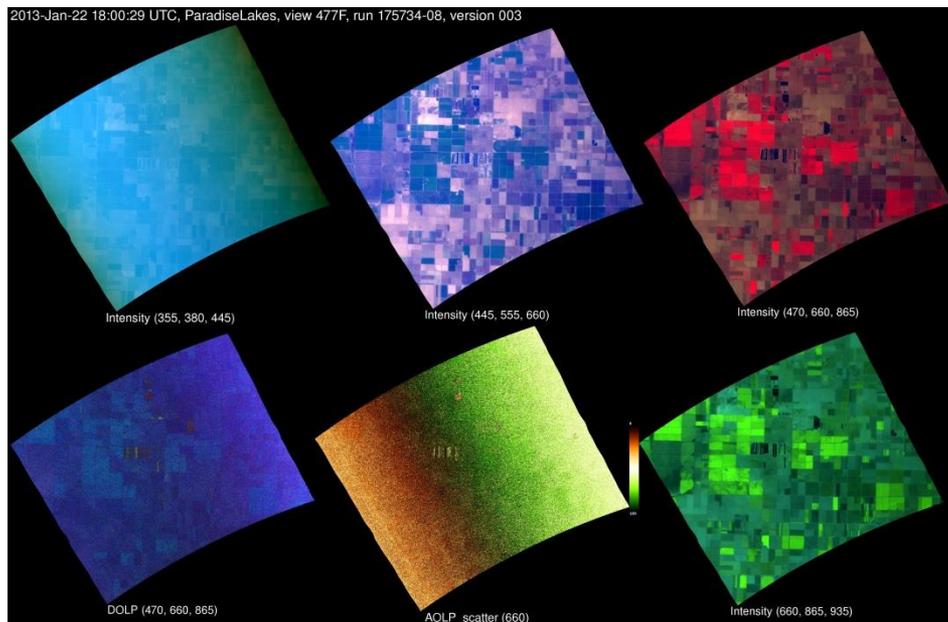
This step and stare image set from 22 January 19:59 UTC over Hanford, CA shows enhanced scattering in the UV and blue, providing sensitivity to aerosol height.



# JPEG browse and kml files are available for every AirMSPI acquisition



Paradise Lakes, 22 Jan 2013



Intensity  
355, 380, 445 nm

Intensity  
445, 555, 660 nm

Intensity  
470, 660, 865 nm

DOLP  
470, 660, 865 nm

AOLP  
660 nm

Intensity  
660, 865, 935 nm

Green outlines show locations of the AirMSPI multiangle images

# AirMSPI calibration pedigree



	Current PODEX (v003)	Current SEAC <sup>4</sup> RS (v004)	Next PODEX upgrade (summer)
Radiometric calibration	Lab integrating sphere + adjustment to MISR July 2012. Uncert. ~ 10% (higher in UV)	Lab integrating sphere with improved UV response + October 2013 vicarious calibration. Uncert. ~ 5%	Similar to SEAC <sup>4</sup> RS but using May 2013 vicarious calibration
Spectral calibration	Center wavelength only	Integrated over spectral response functions	Correction for out of band light
Polarization calibration	Based on 100% polarizer Systematic DOLP uncert. ~ 0.3%	Based on improved polarization state generator with 100% polarizer and verified with partial polarizers. Systematic DOLP uncert. < 0.2%	Same as SEAC <sup>4</sup> RS
Geometric calibration	Camera geometric model + ground control points Subpixel (<10 m) multiangle image co-registration	Same	Same

# AirMSPI PODEX data analysis accomplishments and plans



PODEX products (designated v003) were delivered in 2013. Subsequent PODEX effort has focused on refining radiometric, spectral, geometric, and polarimetric calibration.

Several calibration improvements were made for SEAC<sup>4</sup>RS. Publicly available SEAC<sup>4</sup>RS products are designated v004.

Additional calibration improvements are in progress. An updated PODEX delivery will take place in a few months.

All AirMSPI PODEX data and documentation are available at the LaRC ASDC

[https://eosweb.larc.nasa.gov/project/airmspi/airmspi\\_table](https://eosweb.larc.nasa.gov/project/airmspi/airmspi_table)

	Accomplished so far	2014 – 2015 plans
L1 products	All V003 PODEX products made publicly available	Products with updated radiometric, spectral, and polarimetric calibration released Intercomparisons with RSP and PACS and resolution of any differences
L2 aerosol and cloud products	Retrieval case studies performed	Research code converted to production quality code Develop publicly available L2 products (AOD, size distributions, complex refractive index, cloud-top height, droplet size, and cloud optical depth) Validate/intercompare results with other PODEX measurements



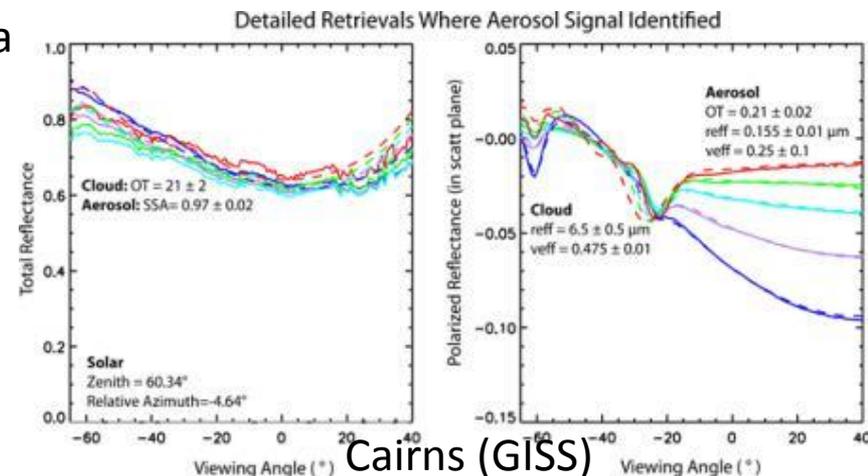
# RSP and PODEX

May 23, 2014

# Research Scanning Polarimeter (RSP)



- Brian Cairns (PI-GISS), Jacek Chowdhary, Matteo Ottaviani, Bastiaan van Diedenhoven, Mikhail Alexandrov, Andrzej Wasilewski
- Prototype for APS sensor on Glory
- 152 viewing angles/scene+dark reference and calibrator on every scan
- 410, 470, 555, 670, 864, 960, 1593, 1880, 2263 nm aerosols/clouds; 960 nm water vapor; 1880 nm cirris
- No swath,  $\pm 60$  deg from nadir
- All RSP L1B PODEX data available at <http://data.giss.nasa.gov/pub/rsp/> along with spreadsheets that indicate aircraft coincidences. L2 water cloud retrievals in Water\_clouds directory.
- Obtained data over a wide variety of scenes and targets during the PODEX flights
- New retrieval capabilities tested using PODEX data
  - New procedure to screen for water clouds above snow
  - Aerosol retrievals above snow, below cirrus, above fog
- RSP lost IR bands on Jan. 28 due to operator error
- Post mission repair and calibration showed that visible bands were unaffected

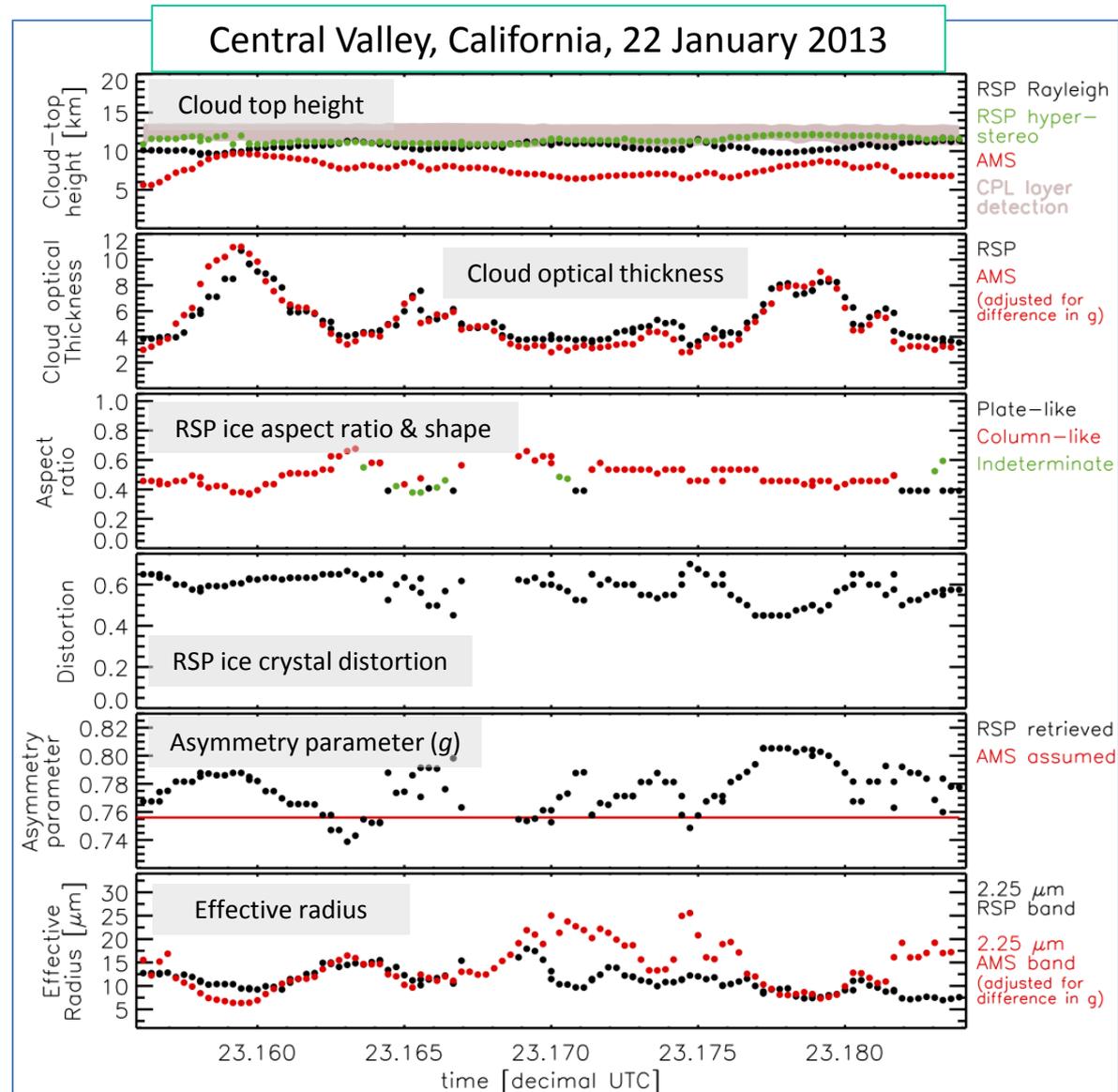


# PODEX ice cloud retrievals – AMS & RSP

Bastiaan van Dierenhoven, Brian Cairns (GISS); Steven Platnick, Tom Arnold (GSFC)



- Particle shape, distortion and asymmetry parameter from RSP multi-directional polarimetry
- RSP cloud top heights (two methods) compare well to CPL lidar heights
- AMS IR cloud top heights underestimated
- RSP vs AMS cloud optical thickness and effective radius compare well
- Suggests good calibration of both instruments
- Retrieved asymmetry parameter a little larger than assumed by AMS
- Small distorted ice crystals with column-like components





# PACS and PODEX

May 23, 2014



# Passive Aerosol and Cloud Suite (PACS)

- V. Martins (PI-UMBC), L. Sparr, R. Fernandez-Borda, L. Munchak, L. Remer
- PACS deployed in left wing pod
- Obtained a wide variety of scenes and targets during the PODEX flights

## PACS configuration for PODEX :

- Ground Resolution = 37m, Swath = 37km
- 470<sup>p</sup>, 550<sup>p</sup>, 670<sup>p</sup>, 766<sup>p</sup>, 870<sup>np</sup>nm
- 65+ angles for all wavelengths
- 130 view angles for 670nm
- 110° FOV cross track, +/- 55° FOV along track

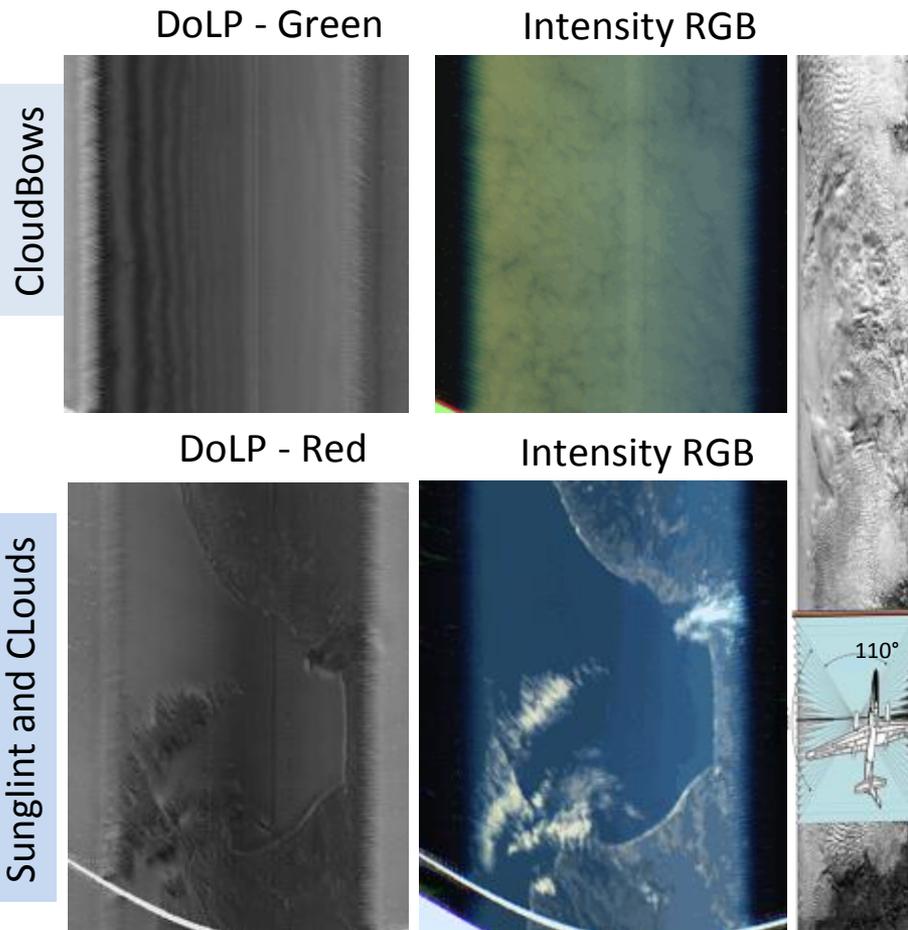
- PACS SWIR components under testing

## Current Status:

- Applied new multi-dimensional calibration, geo-location/geo-referencing
- Level 1 data available in HDF5 (June 2014)
- Cloud algorithm ready for production
- Aerosol algorithm (GRASP) being adapted for PACS

Movies show the information content of hyperangular views in intensity and polarization

Wide FOV hyperangular sampling adds new dimensions to the measurements of aerosol and clouds



Martins (UMBC)





## 1) L1 polarimeter data

### a) Availability

- LACO server at UMBC (June 2014); Transfer to Langley DAAC (TBD/2014)
  - Level 1B data in HDF5, Quick look images, Hyperangular movies

### b) Analyses and comparisons with L1 data

- Radiance comparisons with AMS and MODIS
- Geo-location comparisons with AMS
- Multi-angle geo-registration

### c) Analyses and comparisons to be done with L1 data in 2014

- Radiance and multi-angle polarization comparisons with AirMSPI and RSP

## 2) PACS L2 analysis activities

### a) Aerosols

- Adaptation of the GRASP algorithm for PACS retrievals
- Studies of aerosol retrievals above clouds

### b) Clouds

- Retrievals of cloud droplet distributions
- Retrieval of cloud thermodynamic phase

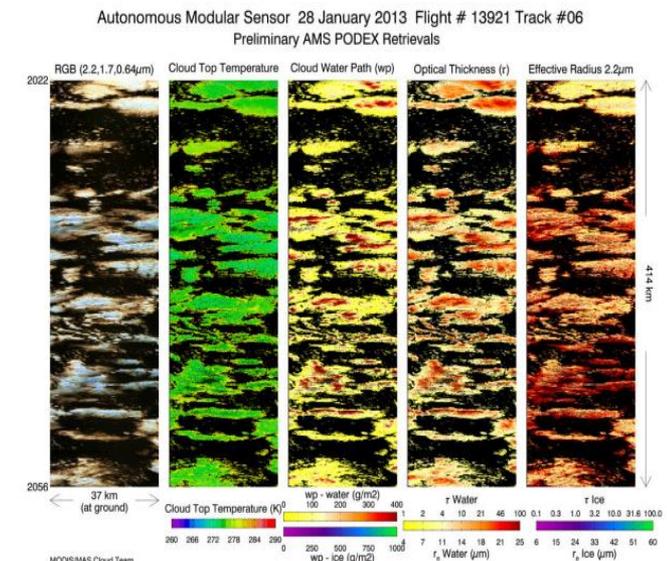
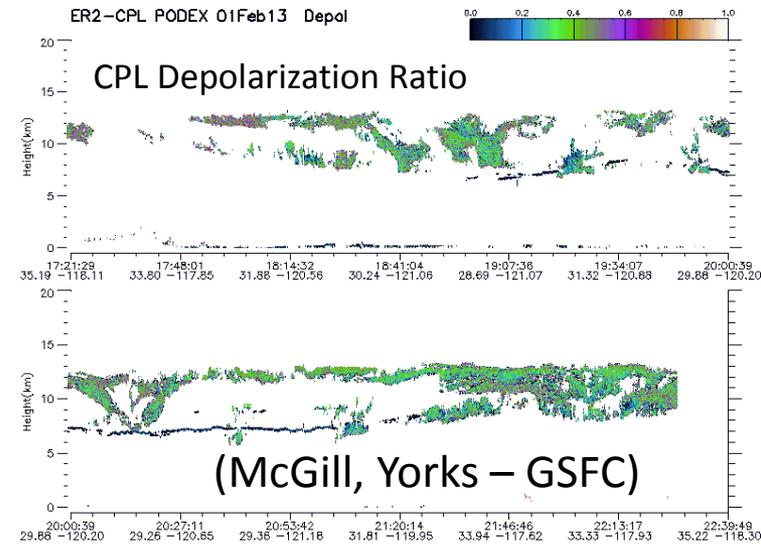


- c) Availability of L2 products
  - L2 products for aerosol and clouds to be produced and made available at the UMBC server
    - Cloud droplet effective radius and effective variance
    - Cloud thermodynamic phase
    - Cloud height
    - Fine and coarse AOD
    - Aerosol microphysics (size parameters on fine and coarse mode, aerosol type)
- d) Use of DISCOVER-AQ data
  - PACS group has run the PI-Neph instrument during DISCOVER-AQ/PODEX and SEAC4RS. This data analysis is about to be completed and will be available for validation and aerosol microphysical characterization
  - PI-Neph + LARGE data set for aerosol retrieval validation of the polarimeter retrievals
- e) Use of other PODEX or related datasets for such analyses (e.g. CPL, AMS, etc.)
  - PI-Neph + LARGE data set for aerosol retrieval validation of the polarimeter retrievals
  - CPL will be used for cloud height validation
- f) Future Plans for data analyses in 2014-2015
  - Apply L2 algorithm to the whole PACS data set from PODEX
  - PI-Neph data set will be used in conjunction with the LARGE aerosol data for validation of the polarimeter retrievals from the ER2 aircraft.

# Additional instruments on the ER-2 for PODEX



- CPL (Cloud Physics Lidar) (McGill, Yorks-GSFC)
  - Provided real-time data and post processed data that located and identify aerosol and cloud layers
  - PODEX images and data are available online
- AMS (Autonomous Modular Sensor) (Platnick-GSFC)
  - ASF group generated L1B calibrated/geolocated HDF4 files for all AMS straight and level observations
  - Browse imagery and L1B data available online
  - Cloud products generated using MODIS algorithms archived on MODIS distribution ftp site (<ftp://ladsweb.nascom.nasa.gov/>)
  - Quantitative aerosol retrievals via MODIS dark target precluded by lack of wavelength bands to screen cirrus and characterize surface (but pretty Google Earth kmz image files available)
- SSFR (Solar Spectral Flux Radiometer) (Schmidt-Univ. Colorado)
  - Tested new leveling platform to provide irradiance measurements largely unaffected by aircraft attitude changes
  - Reconciling cloud/aerosol PODEX remote sensing products with spectrally resolved shortwave irradiance measurements
  - Analyzing spectral information of combined aerosol/cloud scenes, and deriving radiative forcing parameters



(Platnick-GSFC)



# PODEX and DISCOVER-AQ data availability



- DAQ-hosted PODEX data website (<http://www-air.larc.nasa.gov/missions/discover-aq/podex-links.html>)
  - ER-2 Nav data, AMS, CPL, RSP
  - AirMSPI data available via LaRC ASDC [https://eosweb.larc.nasa.gov/project/airmspi/airmspi\\_table](https://eosweb.larc.nasa.gov/project/airmspi/airmspi_table)

Description	URL	Comments
ER2 Nav data	<a href="http://asp-archive.arc.nasa.gov/N809NA/FY2013/">http://asp-archive.arc.nasa.gov/N809NA/FY2013/</a>	
Autonomous Modular Sensor (AMS)	<a href="http://asapdata.arc.nasa.gov/ama/missions.html">http://asapdata.arc.nasa.gov/ama/missions.html</a> --- Level-1B <a href="ftp://asapdata.arc.nasa.gov/outgoing/RDF/PODEX/">ftp://asapdata.arc.nasa.gov/outgoing/RDF/PODEX/</a> --- FTP Download	See flights: 13-925, 13-924, 13-923, 13-922, 13-921, 13-920, 13-918, 13-917
Cloud Physics Lidar (CPL)	<a href="http://cpl.gsfc.nasa.gov/">http://cpl.gsfc.nasa.gov/</a>	Click on PODEX on the left
<b>Research Scanning Polarimeter (RSP)</b>		
PODEX 2013	<a href="http://data.gis.nasa.gov/pub/rsp/PODEX/BL1B/">http://data.gis.nasa.gov/pub/rsp/PODEX/BL1B/</a>	Data associated with flight lines
PODEX 2013 - smaller files	<a href="http://data.gis.nasa.gov/pub/rsp/PODEX/BL1B/small/">http://data.gis.nasa.gov/pub/rsp/PODEX/BL1B/small/</a>	Additional shorter files during maneuvers
RSP Viewer Code	<a href="http://data.gis.nasa.gov/pub/rsp/RSP_Utilites/rsp_viewer.zip">http://data.gis.nasa.gov/pub/rsp/RSP_Utilites/rsp_viewer.zip</a>	
Spreadsheet	<a href="http://data.gis.nasa.gov/pub/rsp/PODEX/PODEX_AircraftEncounters.xls">http://data.gis.nasa.gov/pub/rsp/PODEX/PODEX_AircraftEncounters.xls</a>	Contains when two aircraft get close to one another (B200 within 20 km of ER2, P3B within 20 km of ER2, and P3B within 10 km of B200)
Spreadsheet	<a href="http://data.gis.nasa.gov/pub/rsp/PODEX/PODEX_AircraftGroundtrackCrossings.xls">http://data.gis.nasa.gov/pub/rsp/PODEX/PODEX_AircraftGroundtrackCrossings.xls</a>	Contains all ground track intersections of any two aircraft or even with itself and the time difference in minutes when the aircrafts were over that intersection
All RSP data including PODEXB	<a href="http://data.gis.nasa.gov/pub/rsp/">http://data.gis.nasa.gov/pub/rsp/</a>	PODEXB labelled flights are for January-February 2013.

- DAQ data (P-3B in situ, HSRL-2) available via DAQ website (<http://www-air.larc.nasa.gov/cgi-bin/ArcView/discover-aq.ca-2013>)

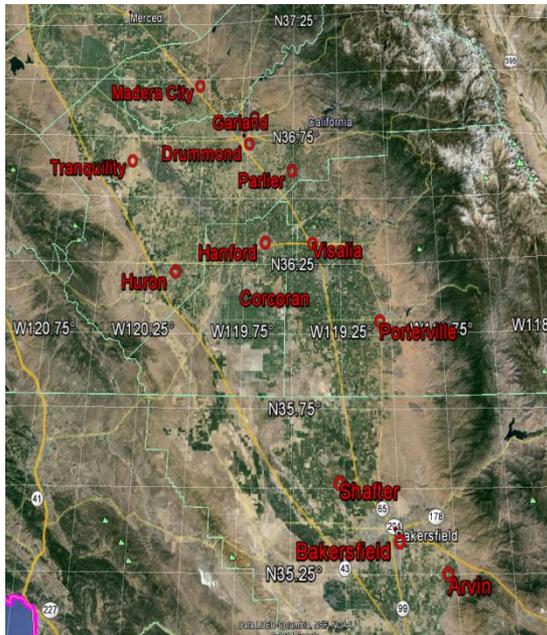
P-3B Aircraft	B200 Aircraft	UC-DAVIS Aircraft	Merges	Model
Analysis	Satellite	Arvin-DiGiorgio *	Bakersfield *	Clovis *
Corcoran *	Fresno *	Hanford *	Huron *	Madera *
Oildale *	Ground-Other	Parlier *	Porterville *	Shafter *
Tranquility *	Visalia Airport *	P-3B Aircraft Videos		

# Coordination with AERONET, MODIS, MISR



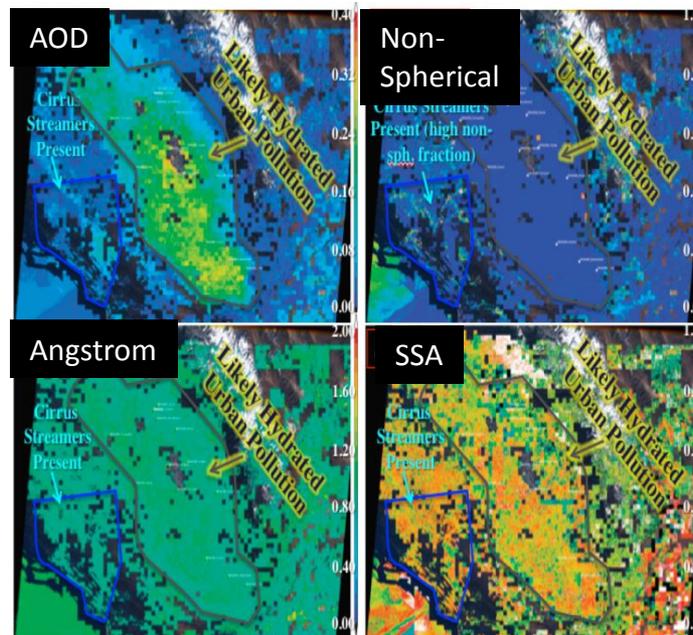
- AERONET (DRAGON) (Holben-GSFC) network deployed in southern California Central Valley to provide column aerosol measurements for aerosol and air pollution studies
- MISR (Kahn-GSFC) standard and research retrievals were performed to help obtain AOD and aerosol types
- MODIS (Munchak, Levy-GSFC) maintained websites of Terra and Aqua AOD maps, prepared cloud forecasts for flight guidance, and retrieved AOD from AMS measurements

## AERONET (DRAGON)



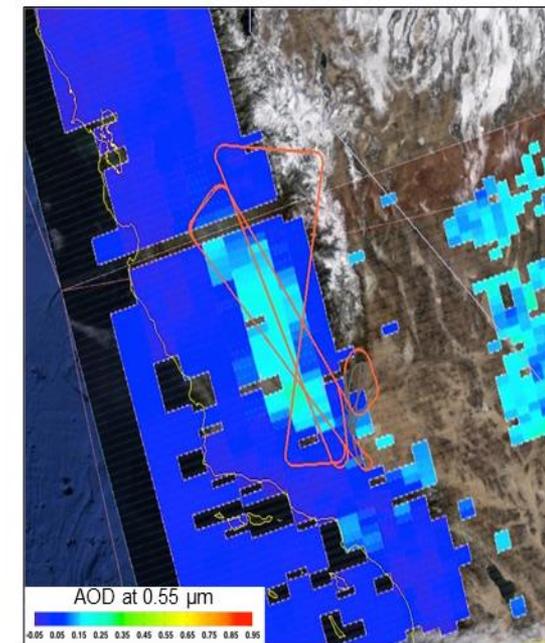
(Holben – GSFC)

## MISR Aerosol Retrievals



(Kahn – GSFC)

## MODIS AOD Retrieval



(Munchak, Levy – GSFC)

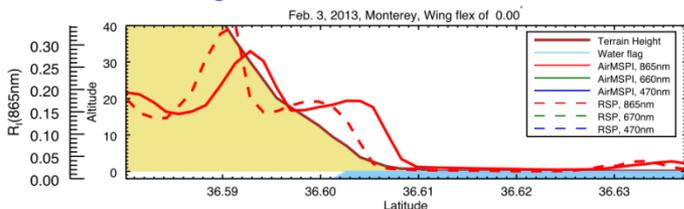
# PODEX Radiometric Comparisons



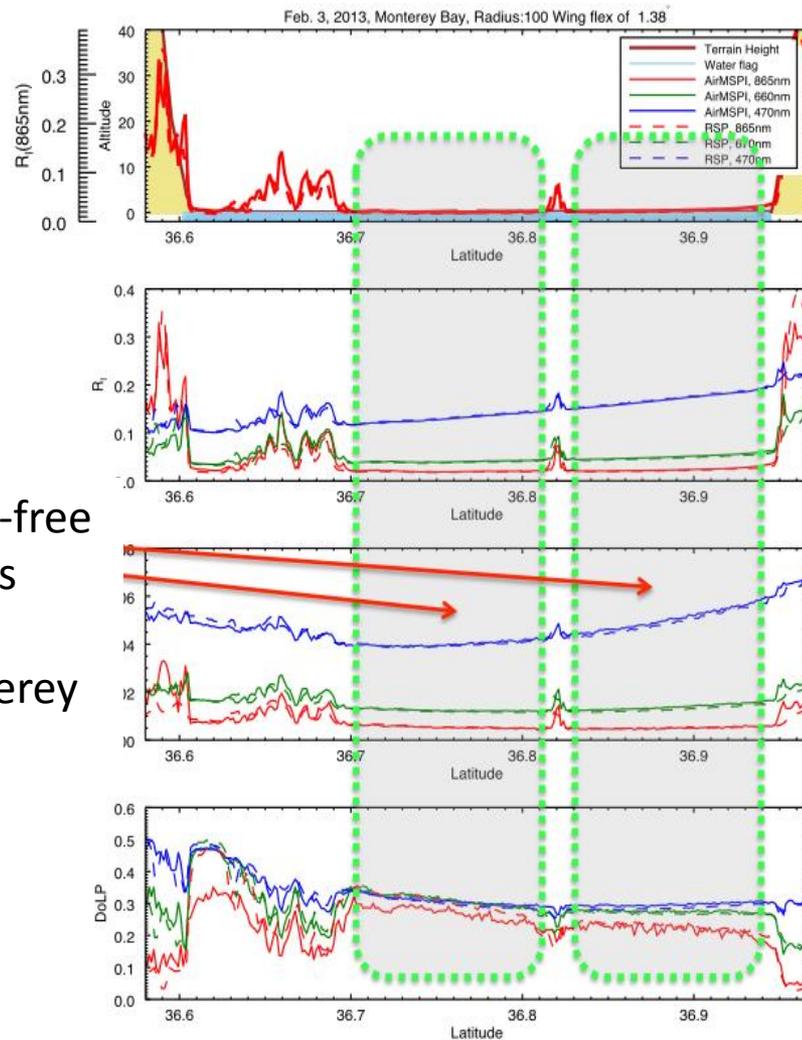
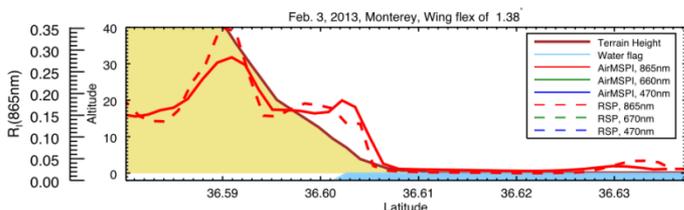
- Radiometric comparison of AirMSPI and RSP measurements from PODEX (Knobelspiesse-Ames)
- Wing 'flex' may roll RSP observations from attitude measurements in the fuselage and complicate direct comparisons with AirMSPI
- RSP geolocation (determined using surface features) was corrected to account for ER-2 wing flex - correction developed based on flight time (i.e. fuel load) developed using SEAC4RS data

Cloud-free scenes over Monterey Bay

Uncorrected for wing flex:



Corrected for wing flex of 1.38°:  
(positive means counter-clockwise for the pilot)



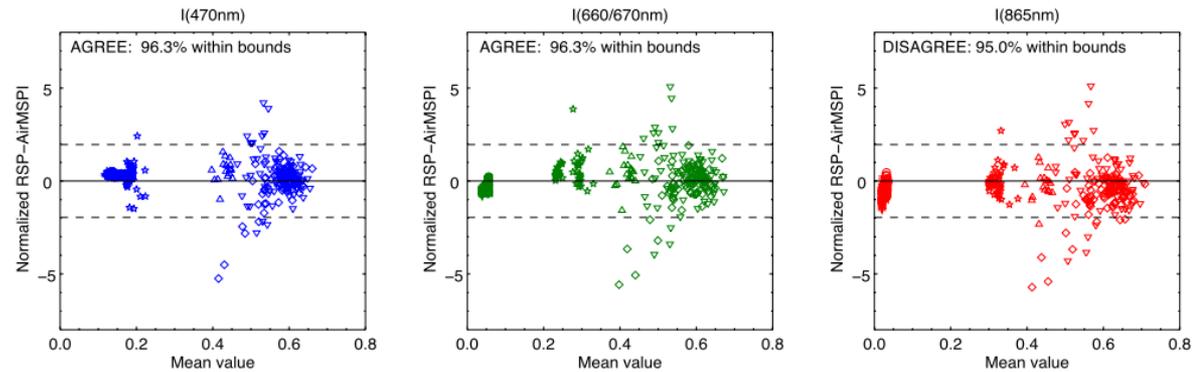
(Knobelspiesse – Ames)

# AirMSPI and RSP Comparisons

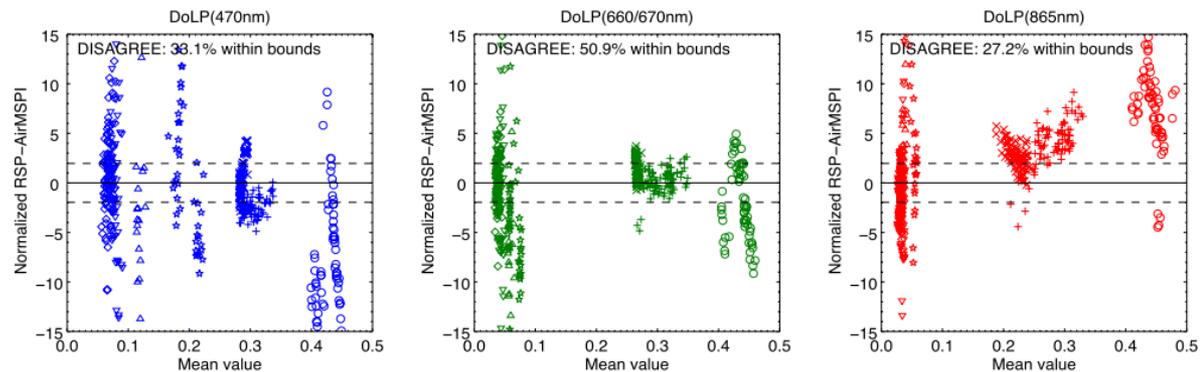


- **Comparisons of scenes over water (dark radiance, moderate polarization)**
  - Reflectances agree within uncertainties (comparison needs repeated for bright scene)
  - Degree of linear polarization results do not agree within expected uncertainties
- **Additional studies required:**
  - Inclusion of PACS measurements
  - Comparisons of other scenes
  - Discussion of polarimetric calibration techniques
  - Cross-calibration

(see presentation by Kirk Knobelspiesse)



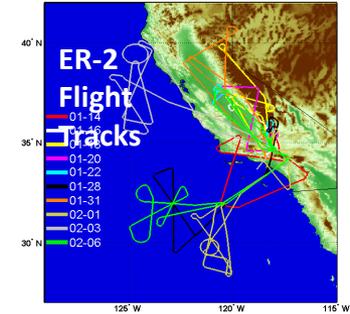
(Knobelspiesse – Ames)



# Summary



- Experiment conducted during Jan-Feb 2013 from DAOF (Palmdale)
  - 10 flights (49 flight hours)
  - Observations include:
    - Bright (snow) and dark (ocean) targets
    - Aerosols over various surfaces, above and under clouds
    - Clouds – Fog, Stratus, Stratocumulus, Cirrus
  - Additional ER-2 instruments, DISCOVER-AQ, DRAGON AERONET provided valuable data for evaluation of aerosol and cloud retrievals
  - SEAC4RS provides additional aerosol and cloud cases not observed during PODEX
- Polarimeter Data Status
  - RSP and AirMSPI L1B data available on line now
  - PACS L1B data to become available in June
  - Some initial L2 retrievals of clouds and aerosols produced but not publicly available
- Preliminary intercomparisons of RSP and AirMSPI measurements
  - ER-2 wing flex complicates geolocation, surface features used to geolocate data
  - Preliminary radiometric comparisons show AirMSPI and RSP agree in reflectances and disagree in degree of linear depolarization
- Further work
  - Examine data, calibration, and instrument uncertainties
  - Continue polarimeter comparisons (including PACS)
  - Develop and distribution L2 products
  - Comparison with PODEX and SEAC4RS measurements





**EXTRA**

# AirMSPI data acquisitions during PODEX

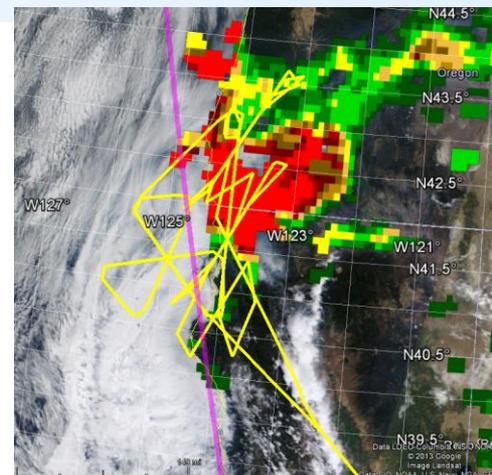


Date	Locations
1/14	La Jolla AERONET, Pacific Ocean
1/16	Hanford
1/18	Bakersfield, Hanford
1/22	Bakersfield, Fresno, Hanford, Huron, Paradise Lakes, Porterville
1/28	Palmdale, Pacific Ocean
1/31	Bakersfield, Boca Stampede, Clovis, Folsom, Fresno, Galt, Gridley, Groveland, Hanford, Huron, Pioneer, Plumas Forest, Porterville, Rosamond, Snelling, Tracy
2/1	Camp Pendleton, Catalina, Lake Elsinore, Long Beach, San Diego, Santa Monica, Simi Valley, USC SeaPRISM AERONET, Pacific Ocean
2/3	Big Sur, Boulder Creek, Monterey, Nicasio, Soledad, Sonoma, Yorkville, Pacific Ocean
2/6	Bakersfield, Fresno, Hanford, Huntington Beach, Huron, Porterville, USC SeaPRISM AERONET, Pacific Ocean

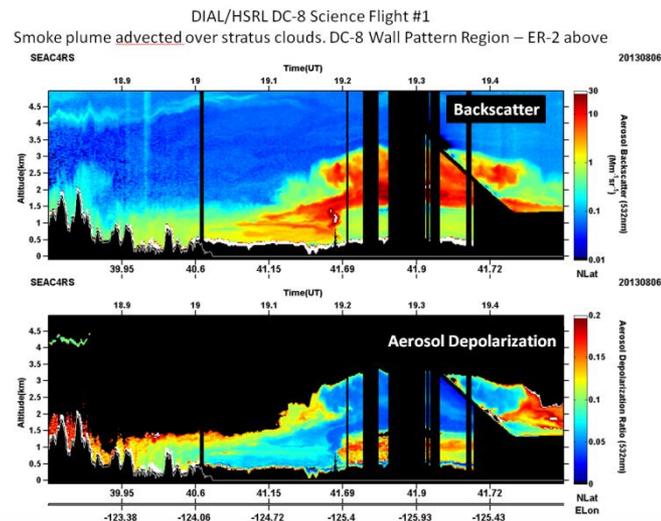
- Clear ocean with visible wave structure, sunlint patterns
- Farmland, foothills, mountains, rivers, lakes, urban areas, snow fields, desert
- Pollution aerosols
- Fog, broken stratus, stratocumulus, scattered cumulus, and cirrus
- Glories, supernumerary bows, cloudbows
- Calibration target: Rosamond Dry Lake

# PODEX Related Studies Continued During SEAC4RS

- PODEX did not have the opportunity to measure some desired targets:
  - Very high aerosol loadings (e.g. smoke)
  - Significant dust
  - Aerosol above clouds
  - Cirrus
- SEAC4RS (Studies of Emissions and Atmospheric Composition, Clouds and Climate Coupling by Regional Surveys) conducted during Aug-Sep 2013 has provided:
  - Opportunity to collect these desired conditions with two polarimeters (AirMSPI, RSP) on ER-2
  - Additional aircraft (DC-8, LearJet) to acquire detailed correlative aerosol and cloud measurements
- SEAC4RS has so far provided measurements of:
  - Aerosols (dense smoke) above stratus clouds off Oregon coast
  - Saharan dust along Gulf coast
  - Dense forest fire smoke over land
  - Convective cirrus over Southeastern U.S.



Aqua MODIS imagery at ~21:30 UT on Aug. 6 showing AOT (color), ER-2 track (yellow), and CALIPOS track (purple).



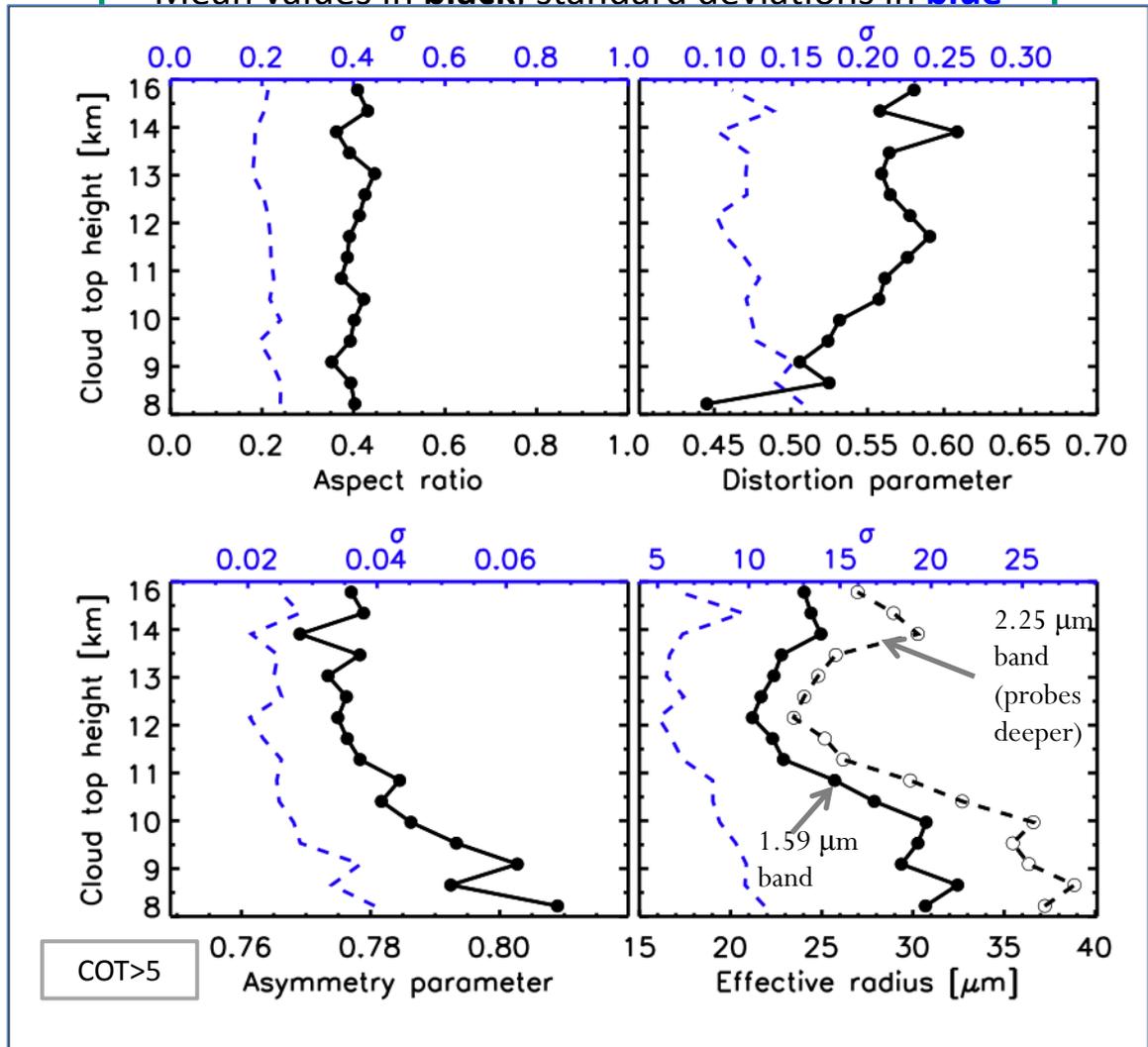
Coincident (preliminary) DIAL/HSRL data from DC-8 showing aerosol backscatter and depolarization measurements of smoke over stratus below ER-2 on August 6 (Hair – LaRC)

# SEAC<sup>4</sup>RS RSP ice cloud retrieval statistics (Nine days with thick ice clouds)



- RSP VIS-SWIR multi-directional polarization + reflectance allow retrieval of
  - Cloud top height
  - Cloud optical thickness
  - Ice crystal effective radius
  - Ice crystal aspect ratio
  - Crystal distortion/roughening
  - Asymmetry parameter
  
- Retrieval data available in archive
  
- SEAC<sup>4</sup>RS statistics reveal
  - Systematic variation among cloud types
  - Variation with top heights
  - Interesting increase in mean  $R_{\text{eff}}$  near Tropopause

Mean values in **black**, standard deviations in **blue**



# All AirMSPI PODEX data and documentation are available at the LaRC ASDC



Atmospheric Science Data Center

Processing, archiving and distributing Earth science data at the NASA Langley Research Center

Home Data Descriptions Order Data Citing ASDC Data Help & Resources

Extended Maintenance June 2-9... details

## AirMSPI PODEX Ellipsoid-projected Georegistered Radiance Data

L1B2 Ellipsoid-Projected Georectified Radiance and Polarimetry Data

Project Title: AirMSPI Reverb: [Order Data](#)

Discipline: Clouds Quality Summary: AirMSPI Data Quality Summary, V003 Products

Field Campaigns: Aerosols

Level: L1

Platform: NASA ER-2

Instrument: AirMSPI

Spatial Coverage: California

Spatial Resolution: Swath about 15km by 10km

Temporal Coverage: 01/14/2013 - 02/15/2013

Temporal Resolution: Variable

File Format: HDF-EOS

Browse Images by Date	Browse Images by Target	Parameters	Order Data	Documentation
<ul style="list-style-type: none"><li>2013-01-14</li><li>2013-01-28</li><li>2013-02-06</li></ul>	<ul style="list-style-type: none"><li>2013-01-16</li><li>2013-01-31</li></ul>	<ul style="list-style-type: none"><li>2013-01-18</li><li>2013-02-01</li></ul>	<ul style="list-style-type: none"><li>2013-01-22</li><li>2013-02-03</li></ul>	

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Atmospheric Science Data Center

Processing, archiving and distributing Earth science data at the NASA Langley Research Center

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Extended Maintenance June 2-9... details

## AirMSPI PODEX Ellipsoid-projected Georegistered Radiance Data

L1B2 Ellipsoid-Projected Georectified Radiance and Polarimetry Data

Project Title: AirMSPI Reverb: [Order Data](#)

Discipline: Clouds Quality Summary: AirMSPI Data Quality Summary, V003 Products

Field Campaigns: Aerosols

Level: L1

Platform: NASA ER-2

Instrument: AirMSPI

Spatial Coverage: California

Spatial Resolution: Swath about 15km by 10km

Temporal Coverage: 01/14/2013 - 02/15/2013

Temporal Resolution: Variable

File Format: HDF-EOS

Browse Images by Date	Browse Images by Target	Parameters	Order Data	Documentation
<ul style="list-style-type: none"><li>Bakersfield</li><li>Catalina</li><li>Galt</li><li>HuntingtonBeach</li><li>LongBeach</li><li>Palmdale</li><li>Porterville</li><li>SimiValley</li><li>Tracy</li></ul>	<ul style="list-style-type: none"><li>BigSur</li><li>Clovis</li><li>Gridley</li><li>Huron</li><li>Monterey</li><li>ParadiseLakes</li><li>Rosamond</li><li>Snelling</li><li>Yorkville</li></ul>	<ul style="list-style-type: none"><li>BocaStampede</li><li>Folsom</li><li>Groveland</li><li>LaJolla</li><li>Nicasio</li><li>Pioneer</li><li>SanDiego</li><li>Soledad</li></ul>	<ul style="list-style-type: none"><li>BoulderCreek</li><li>Fresno</li><li>Hanford</li><li>LakeElsinore</li><li>Pacific</li><li>PlumasForest</li><li>SantaMonica</li><li>Sonoma</li></ul>	

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PODEX products (designated v003) were delivered in 2013. Subsequent PODEX effort has focused on refining radiometric, spectral, geometric, and polarimetric calibration.

Several calibration improvements were made for SEAC<sup>4</sup>RS. Publicly available SEAC<sup>4</sup>RS products are designated v004.

Additional calibration improvements are in progress. An updated PODEX delivery will take place in a few months.

[https://eosweb.larc.nasa.gov/project/airmspi/airmspi\\_table](https://eosweb.larc.nasa.gov/project/airmspi/airmspi_table)

# AirMSPI PODEX data analysis accomplishments and plans



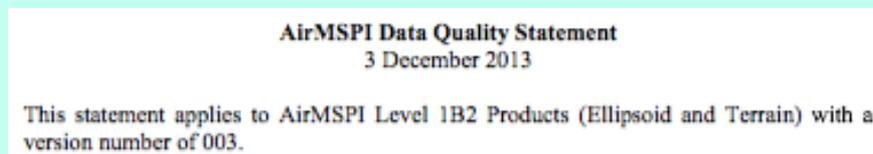
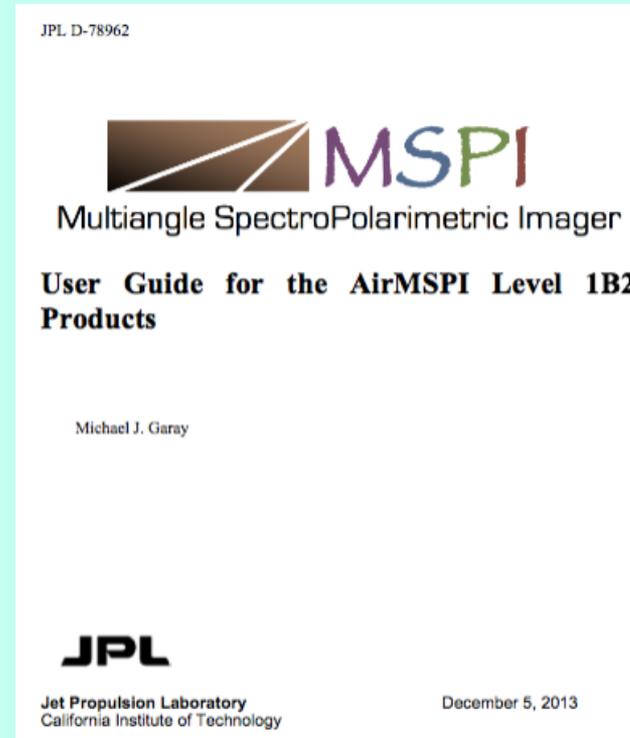
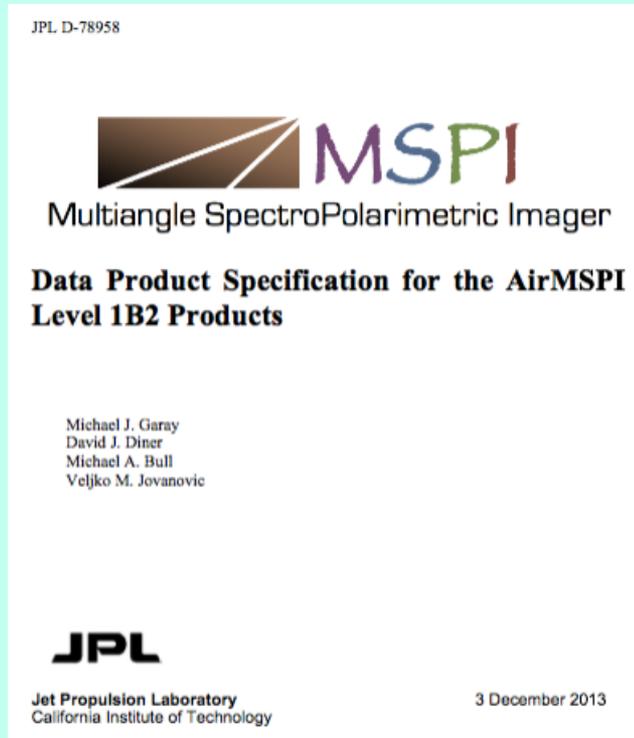
	Accomplished so far	2014 – 2015 plans
L1 products	All V003 PODEX products made publicly available	Products with updated radiometric, spectral, and polarimetric calibration released Intercomparisons with RSP and PACS and resolution of any differences
L2 aerosol and cloud products	Retrieval case studies performed	Research code converted to production quality code Generate publicly available L2 products (AOD, size distributions, complex refractive index, cloud-top height, droplet size, and cloud optical depth) Validate/intercompare results with other PODEX measurements

# AirMSPI data acquisitions during PODEX



Date	Locations	Targets
1/14	La Jolla AERONET site, Pacific Ocean	Clear ocean with visible wave structure (step and stare), and cumulus clouds, sunglint, principal plane (sweep mode).
1/16	Hanford	Clear skies, with some sunglint from lakes and ponds.
1/18	Bakersfield, Hanford	Clear views of agricultural and urban scenes.
1/22	Bakersfield, Fresno, Hanford, Huron, Paradise Lakes, Porterville	Cirrus over farmland and urban targets increasing in thickness as the day progressed.
1/28	Palmdale, Pacific Ocean	GroundMSPI acquisition in Palmdale. Broken stratus/cumulus clouds over the Pacific Ocean.
1/31	Bakersfield, Boca Stampede, Clovis, Folsom, Fresno, Galt, Gridley, Groveland, Hanford, Huron, Pioneer, Plumas Forest, Porterville, Rosamond, Snelling, Tracy	Hazy scenes over farmland, foothills, mountains, rivers, lakes, urban areas, snow fields, and desert. Rosamond Dry Lake calibration target was imaged, with simultaneous GroundMSPI observations.
2/1	Camp Pendleton, Catalina Island, Lake Elsinore, Long Beach, San Diego, Santa Monica, Simi Valley, USC SeaPRISM AERONET site, Pacific Ocean	Ocean scenes with cirrus over lower level clouds, sunglint, and ocean waves. Glories, supernumerary bows, and cloudbows are visible in many acquisitions. Subsun (reflection of solar disk from cirrus) observed.
2/3	Big Sur, Boulder Creek, Monterey, Nicasio, Soledad, Sonoma, Yorkville, Pacific Ocean	Ocean scenes with many different cloud types, with and without overlying cirrus. Glories and bows observed.
2/6	Bakersfield, Fresno, Hanford, Huntington Beach, Huron, Porterville, USC SeaPRISM AERONET site, Pacific Ocean	Many different scenes over land include fog, scattered clouds, and haze. Broken clouds over ocean, ocean waves, and sunglint off the coast.

# AirMSPI publicly available documentation



- Data Product Specification
- User Guide
- Quality Statement

[https://eosweb.larc.nasa.gov/project/airmspi/airmspi\\_table](https://eosweb.larc.nasa.gov/project/airmspi/airmspi_table)