Lagrangian Observations of Interactions of Aerosol, Clouds and Near-Coastal Circulations

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Overview

- We are proposing an NPS Twin Otter flight campaign to ONR

- This talk outlines the general aims and motivation:
  1. Lagrangian sampling upwind of La Jolla to constrain evolution of airmass arriving at AMF site
  2. Is there an aerosol source term due to near-coastal circulations?

NPS Twin Otter

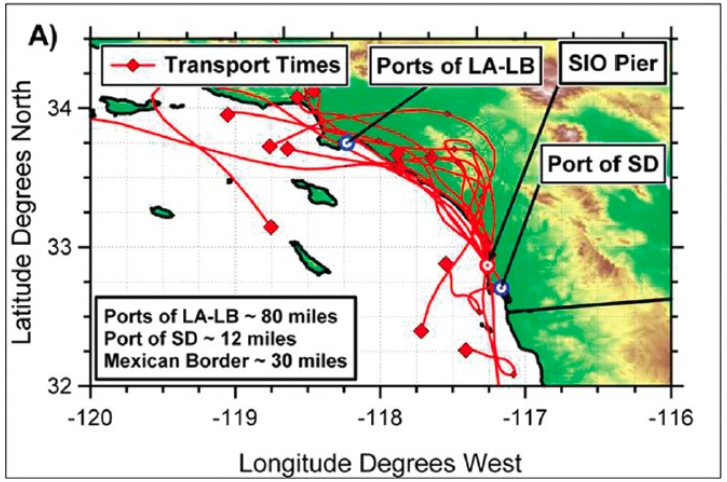
- Formerly CIRPAS, now a “lab” in the NPS Dept. of Meteorology
- Ideally suited to sampling PBL, low clouds
- Basic thermodynamic, turbulence, microphysics, aerosol instrumentation + radiometers

- For this project:
  - Working on additional aerosol probes from NRL colleagues
  - Interested in getting involved? Contact me!

- From the EPCAPE Science Plan:
  - Ports of LA/LB are a major source of air pollution/aerosol
  - Prevailing winds transport “stuff” from LA/LB along the coast to the EPCAPE site at La Jolla pier

- **Aircraft measurements will provide context on airmass evolution en route to AMF site at La Jolla as a function of**:
  1. **Surface fluxes**
  2. **Cloud processes**
  3. **Near-coastal circulations** (specifically, is there aerosol transport across MBL-capping inversion?)

Coastal circulations: aerosol implications



Ault et al. 2009

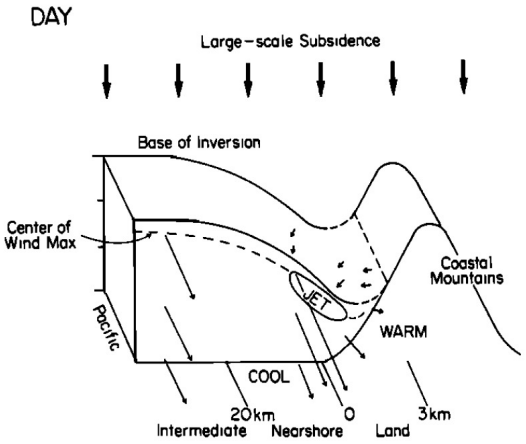
Regional pollution episodes near San Diego are frequently associated with alongshore transport (Ault et al. 2009)

Diurnal cycle of land-sea breeze circulations implies land-sourced aerosol can be advected over the near-shore MBL

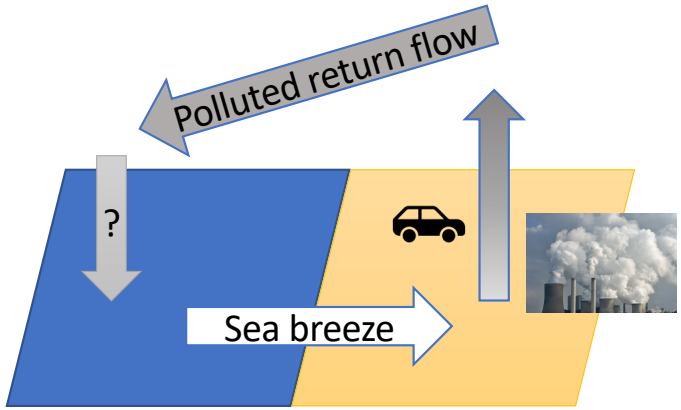
We will quantify transport of aerosol across the MBL-capping inversion

Aerosol transport from free troposphere

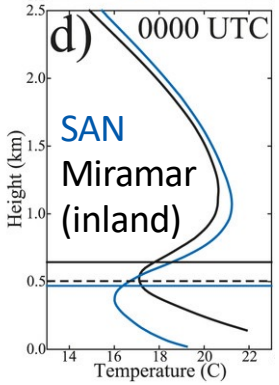
- Evidence for PBL transport from LA Basin from many lab studies, field campaigns
- Few studies on SoCal coastal circulation south of Catalina Eddy
- Diurnal cycle near Orange Co.: enhanced role of sea/land breeze?



Schematic of N. Cal. coastal circulation
Beardsley et al. (1987)



Orange & SD Co. coast has lower topography (<400 m), weaker winds



Average June sounding (2001-14) from Rahn and Mitchell (2016)

Flight planning

- Main idea:
  “Lagrangian” sampling upwind of AMF site
- Target sampling period: April-June ‘23 IOP

- Complicated airspace due to large coastal population, military presence (Camp Pendleton), heavy civilian air and ship traffic
- May be some constraints on how low/high we can sample

Flight planning

- Main idea:
  “Lagrangian” sampling upwind of AMF site

- Horizontal sampling: drift with mean wind across some cross section (say, 30-60 km)
- Vertical sampling: deep sawtooths (surface to free troposphere)

Summary

- Planning underway for NPS Twin Otter campaign during Apr-Jun IOP
- Major goals:
  - Understand airmass evolution between LA/LB pollution source and AMF site
  - Constrain aerosol transport due to near-coastal circulations

- If you want to get involved, please get in touch!
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