CONTRAST Operations (Strawman)

- Flight Operation Time Table
- Op Center Schedule
- Forecast and Chemical forecast
- Staffing
- Flight Scenarios
- Flight planning

Flight Frequency Considerations

- Total of 12-16 flights 6-8 hours each
- Nominally 3 flights a week for daytime flights, 2 flights per week if any dawn/dusk flights are planned
- 3-4 dawn/dusk flights are considered at the moment, adjust pending results
- Nominal daytime flight takeoff 10 am local for a 6-8 hr flight
- Nominal dusk flight takeoff 3 pm local for a 6-8 hr flight
- Nominal dawn flight takeoff 4 am local for a 6 hr flight

Operation Schedule – day prior to flight

- 9 am Flight planning meeting
  - MS/SD summary report of the last flight (10 min)
  - GV and Instrument status (10 min)
  - Meteorological briefing and forecast (20 min)
  - Chemical briefing and forecast (15 min)
  - Flight scenarios and flight plan discussion (30 min)
- 10:30 am -11 am science team draft flight plan
- 11 -12 am flight plan iteration with pilots
- ?? Pilots filing flight plan
- SD op plan summary into FC

Operation schedule – flight day

- Takeoff -3 hr:
  - Instrument scientists preflight
  - Meteorologist in op center pre-flight preparation
- Takeoff – 2 hr
  - Pre-flight met briefing for the mission scientist (MS) and the science director (SD)
- Takeoff -1 hr
  - MS/Pilots finalize the flight plan
- Takeoff -0.5 hr
  - Op center staff/nowcasters onsite
- Landing + 0.5 hr
  - Debrief (at the airport facility)

Operation schedule – in case of consecutive flights

- **Consecutive flights are being considered for Lagrangian flights, the intention should be made the day before the 1st flight day**
- **If deep convective system is successfully sampled the 1st flight day, a consecutive day Lagrangian flight is desirable.**
- **Discussions:**
  - **In this case, should the day 1 flight be relatively short, say 6 hours, to minimize crew limit issues**
  - **The 2nd day flight plan should be made when the GV is still in air? Using climatology?**
  - **The 2nd day flight plan should be adjusted at landing based on trajectory calculation/forecast**
  - **When is the latest to file a flight plan?**

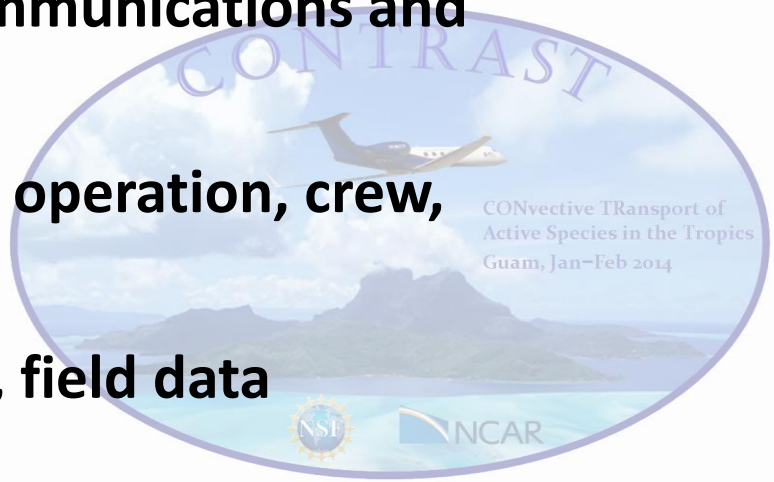
In-Field Science Team Meetings

- To assess the accomplishment/progress of the flights already done
- To iterate flight strategies
- Expect once a week, w contributions from all involved
- More discussions in the joint operation session

Op Center Staffing (1)

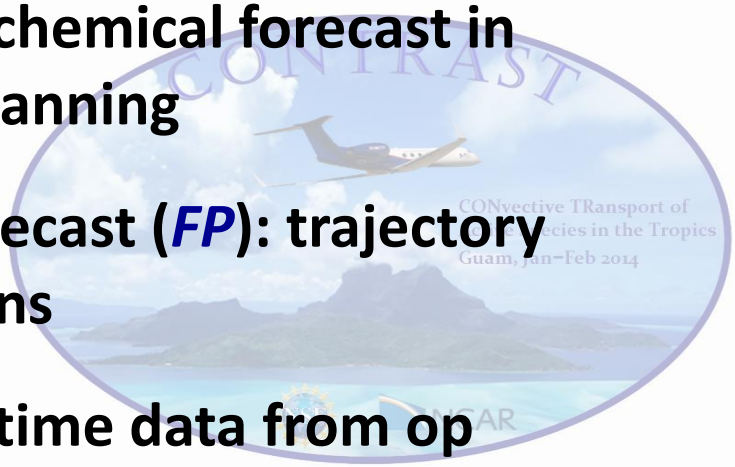
The Op Center is staffed to cover the following tasks (although often require multi-tasking):

- **Science Director (*SD*): lead the Op center operation for the day/week**
- **Mission Scientist (*MS*): lead the final flight plan and direct the flight onboard GV**
- **Project manager (*PM*): EOL FPS manager who will help daily operation meetings and communications and document the experiment.**
- **GV manager (*GM*): manage flight operation, crew, aircraft and instrument status**
- **EOL Field support: system admin, field data management, field catalog**



Op Center Staffing (2)

- Mission Coordinator (*MC*): support MS onboard for meteorological conditions and communication with pilots
- Met. Forecaster (*MF*): daily met briefing and update when needed
- Met. Nowcaster (*MN*): monitor the flight with all latest information and chat with MS/MC
- Chemical forecaster (*CF*): provide chemical forecast in daily op meeting, support flight planning
- Flight planning and Lagrangian forecast (*FP*): trajectory forecast to contribute to flight plans
- Flight monitor (*FM*): monitor real time data from op center



Op Center Staffing (3)

Staff and roles (which can be adjusted as we go):

SD: Elliot Atlas, Ross Salawitch, Laura Pan, Bill Randel, …

MS: Laura Pan, Ross Salawitch, Bill Randel …

PM: Vidal Salazar, Jim Moore

GM: Pavel Romashkin, Louis Lussier

MC: Jorgen Jensen, Jeff Stith

MF/MN: Jim Bresch, Tom Robinson, Owen Shieh, Johnny Luo

CF: Doug Kinnison, Alfonso Saiz-Lopez, Jean-Francois Lamarque

FP/FM: Shawn Honomichl, and all above

***Boulder Op Center*:** Cameron Homeyer (FP/FM, trajectory forecast) and Jiali Luo (chemical forecast)

Flight Scenarios and Modules

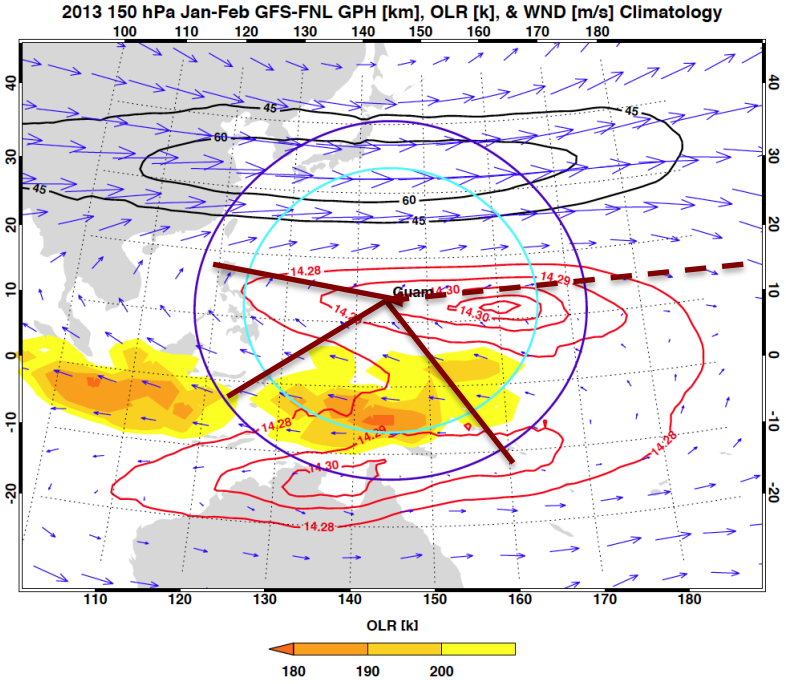
(strawman for discussions)

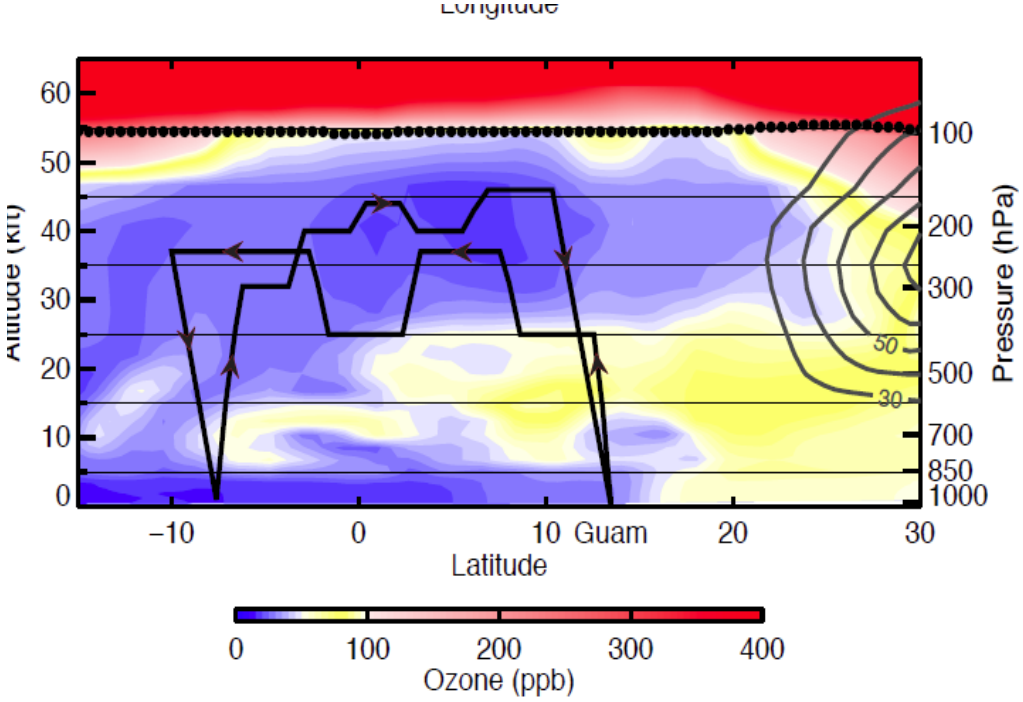
1. **Domain Survey** – 2-3 flights + transit flight and part of other flights
2. **Fresh convective outflow** – main part of 2-3 flights
3. **Lagrangian flight** – 4 flights
4. **Photochemistry evolution (a) Dusk flight** – 2 flights, **(b) Dawn Flight** – 1-2 flights
5. **Contrast flight** – northern domain & jet crossing, 1 flight

Flight Scenarios (1): Southern Domain Survey

Main objective: Investigate the chemical homogeneity, or the lack of, in the domain, using ozone and other tracers

Example of flight patterns

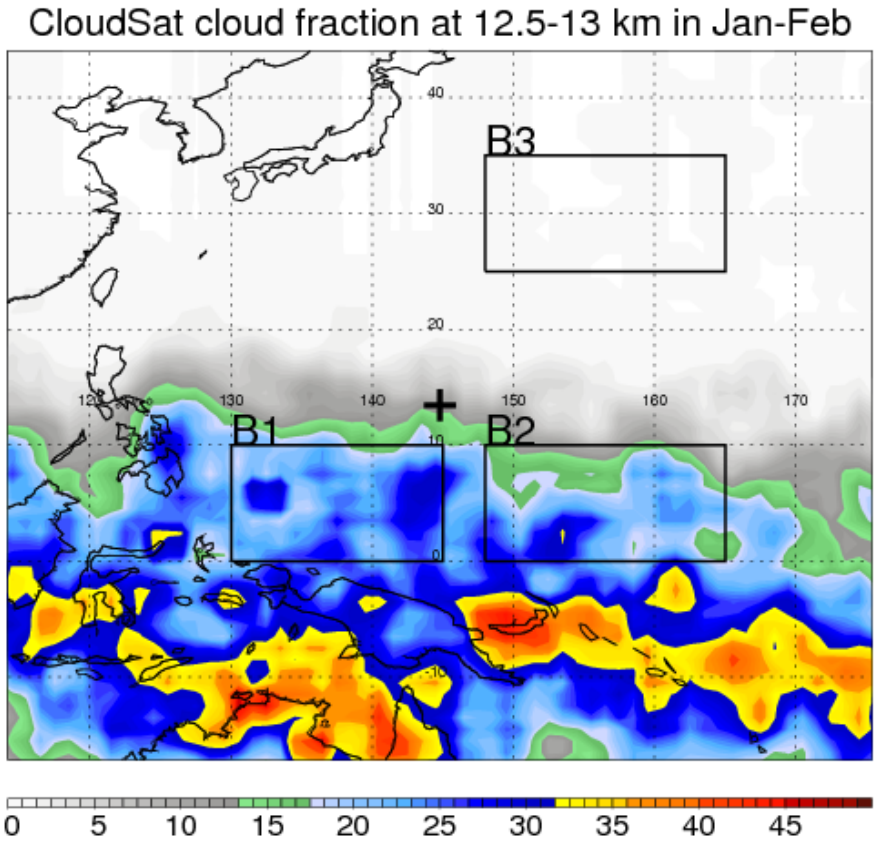


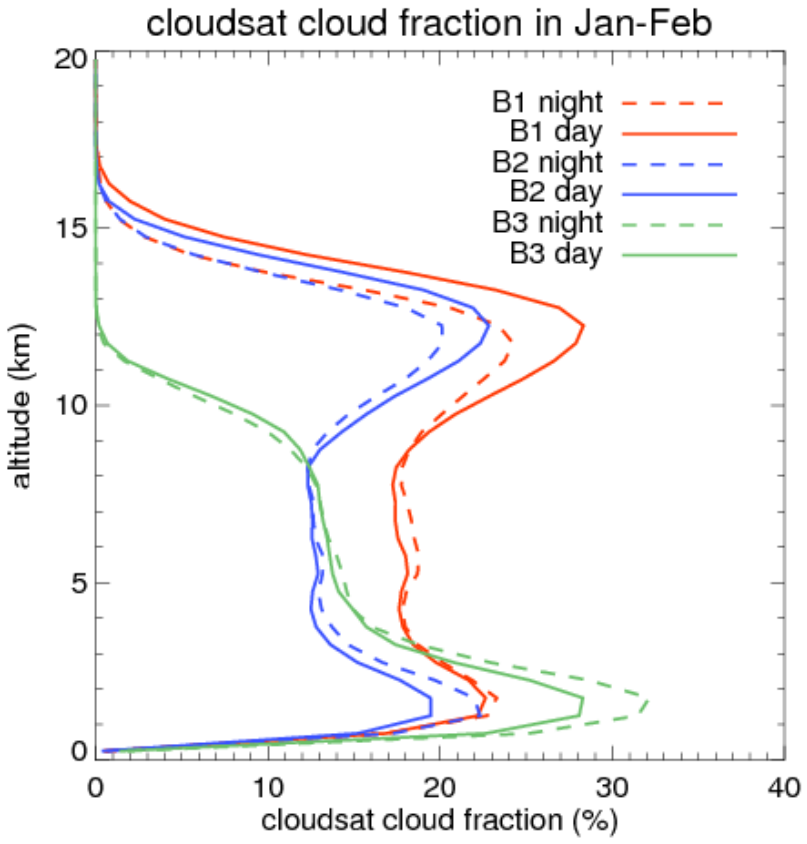


Flight Scenarios (2): Fresh convective outflow

Main objective: sample the newly pumped MBL air

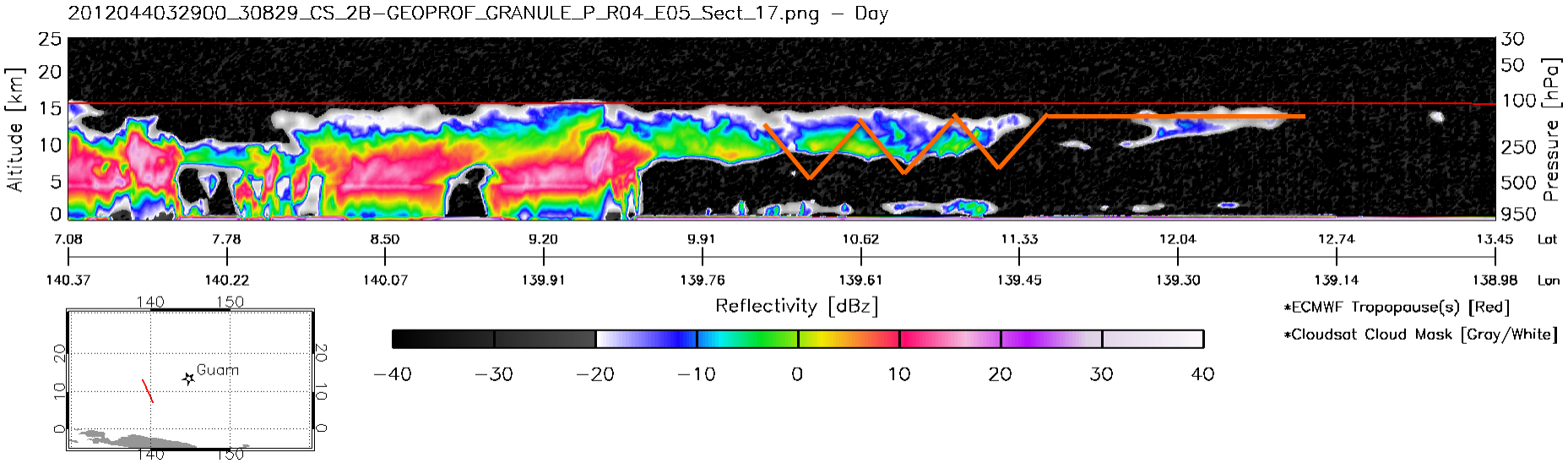
Southern domain flights





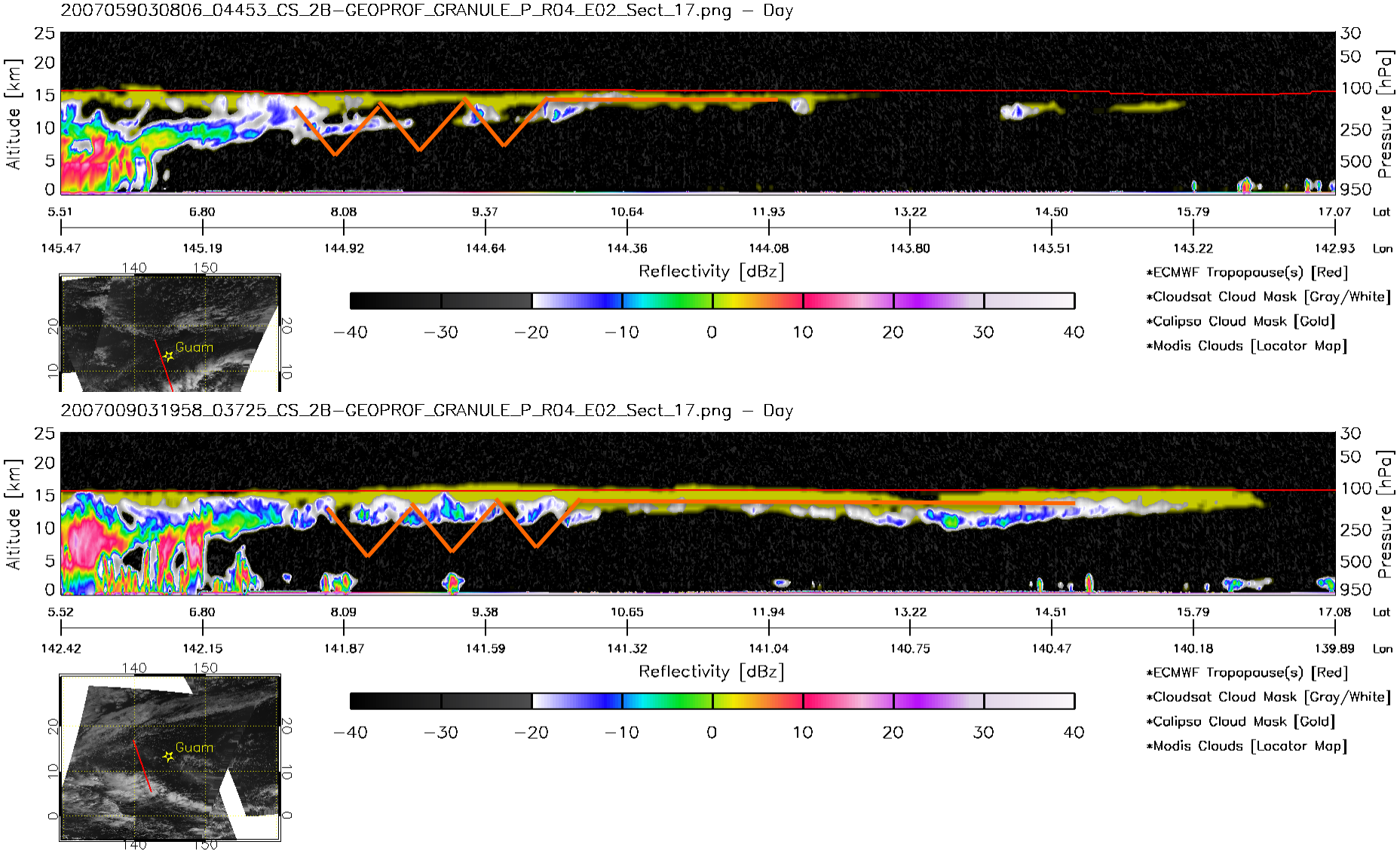
Flight Scenarios (2a): Fresh convective outflow

2a. Targeting outflow region of deep convective system



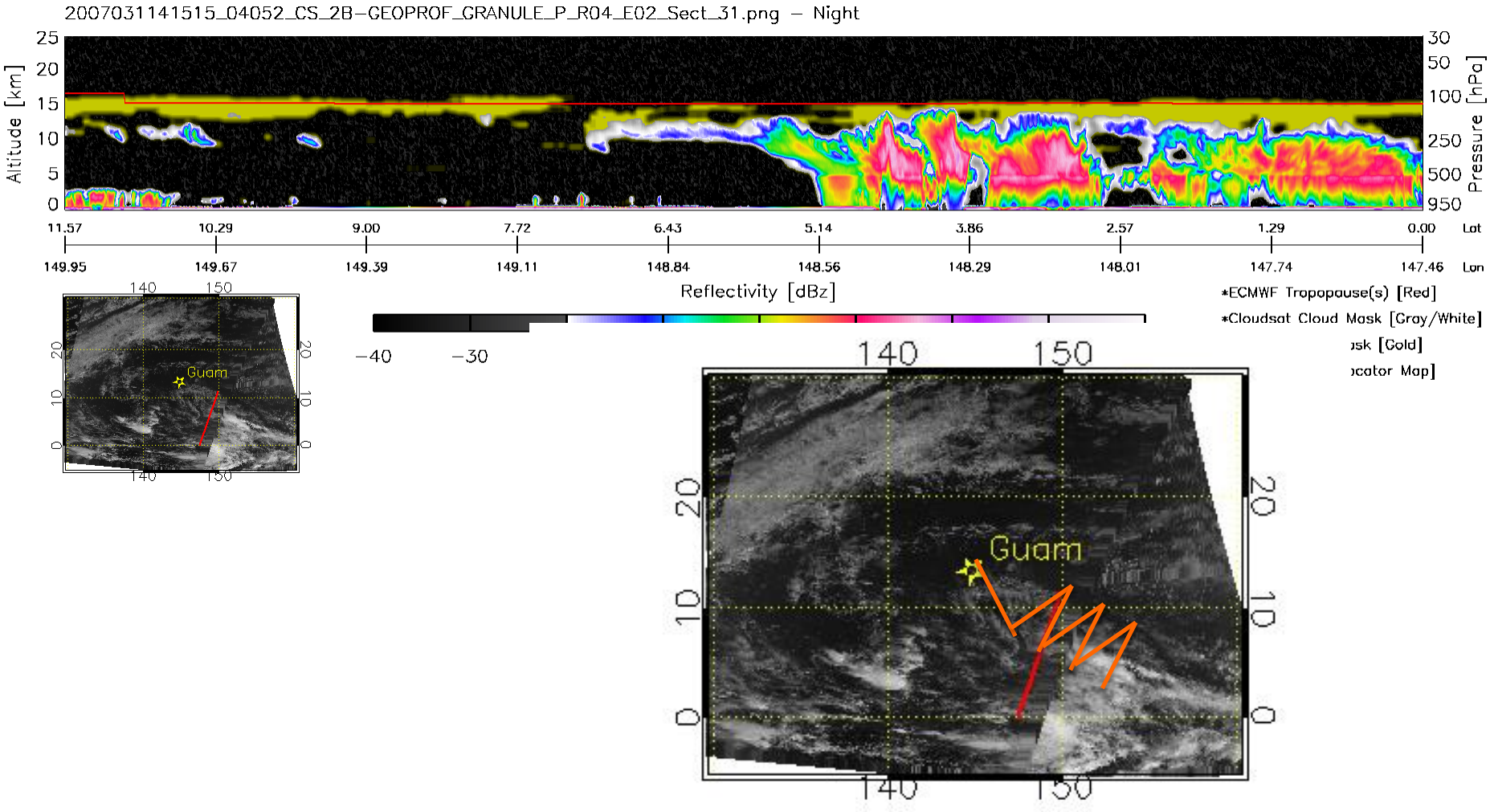
Flight Scenarios (2a): Fresh convective outflow

2a. Targeting outflow region of deep convective system



Flight Scenarios (2b): Fresh convective outflow

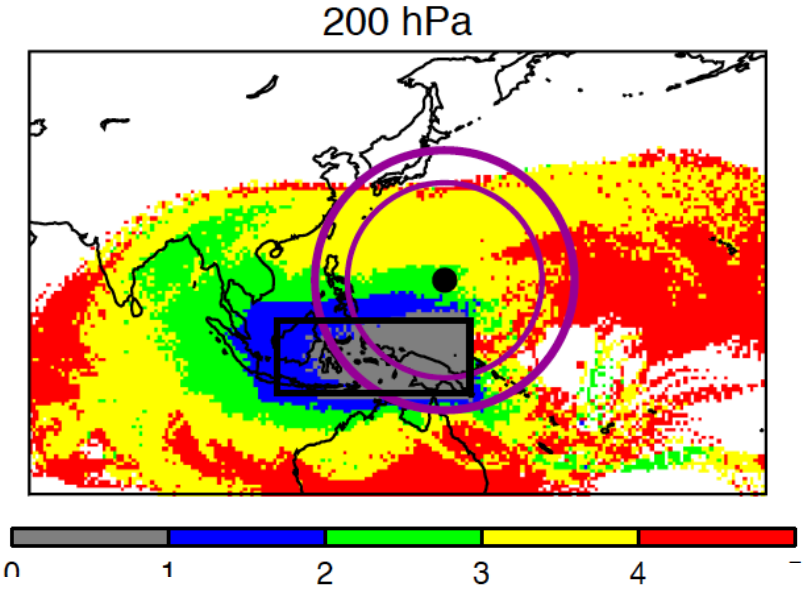
2b. Targeting the region where a night time deep convective system has collapsed



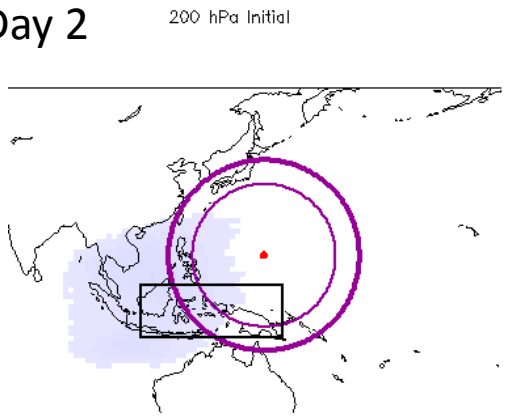
Flight Scenarios (3): Lagrangian flight

Main objectives: Contrast the air mass down wind from the fresh outflow and the background air mass, investigate the chemical fate and aging of the low ozone air mass

Trajectory statistics



Day 2



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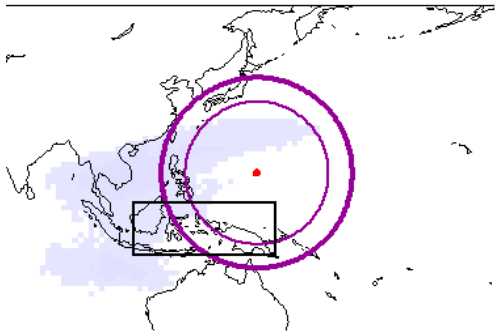
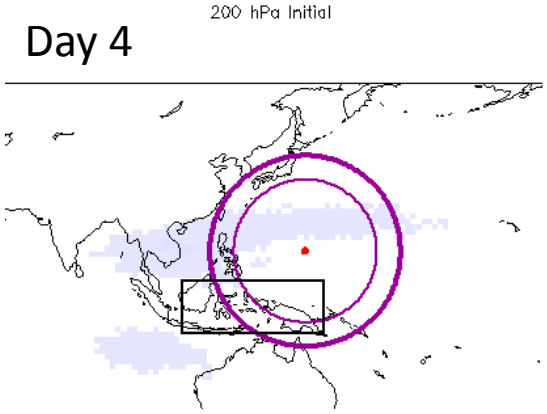


Day 4

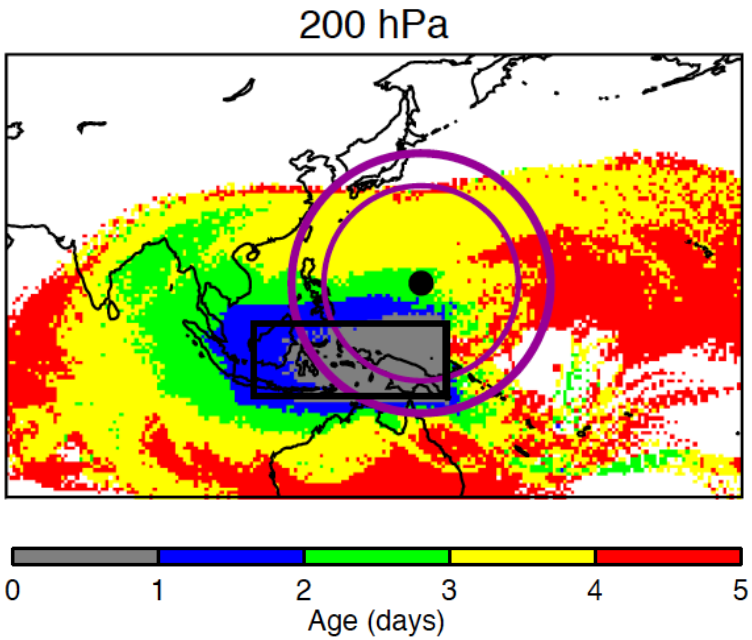


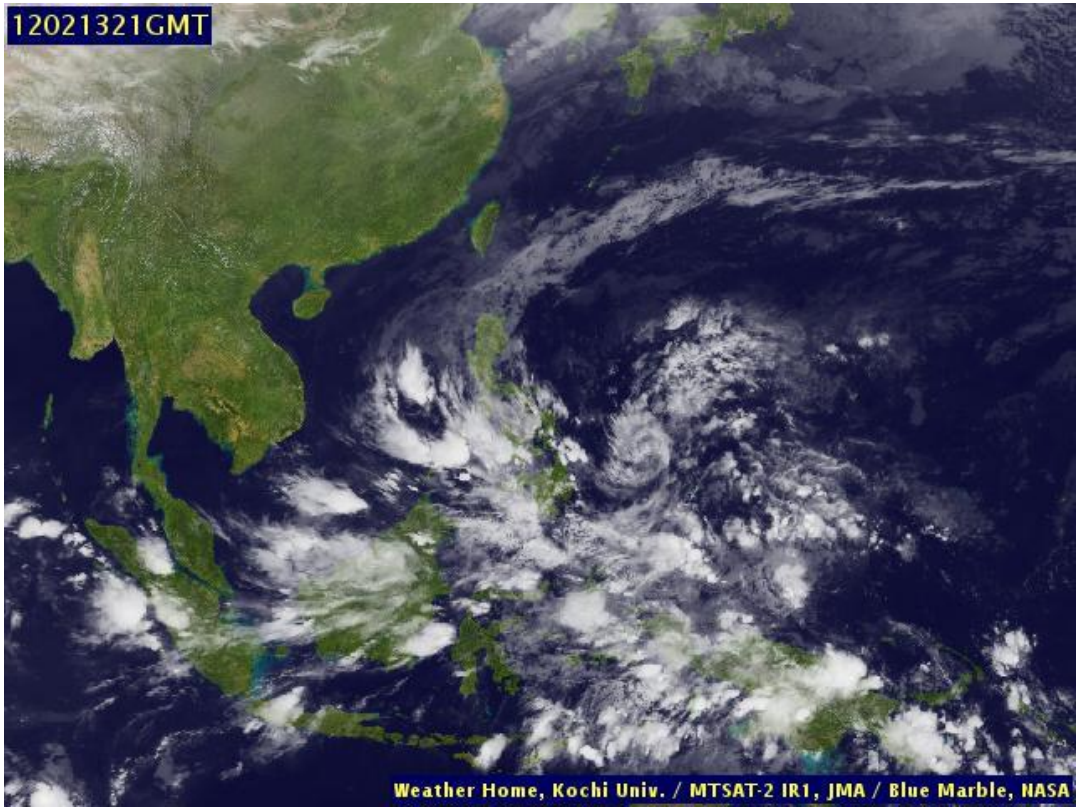
Flight Scenarios (3): Lagrangian Flight

Discussion: single system Lagrangian vs domain Lagrangian

We are likely facing many systems going on simultaneously and continuously.
Single event Lagrangian may not be practical

Trajectory statistics





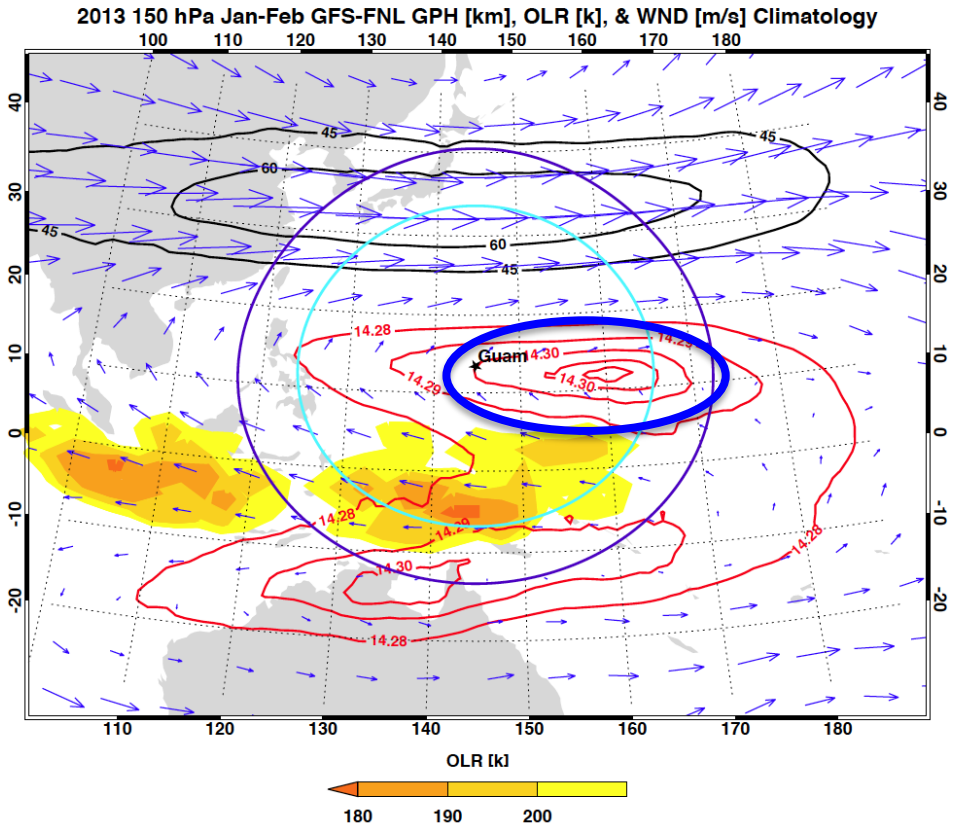
Flight Scenarios (4): Photochemical evolution

4a. dusk flight ; 4b. dawn flight

Main objectives:

1) quantify nighttime reservoirs of inorganic bromine;

2) quantify coupling of BrO & $BrONO_2$ (i.e., J_{BrONO2} and $k_{BrO+NO2+M}$)

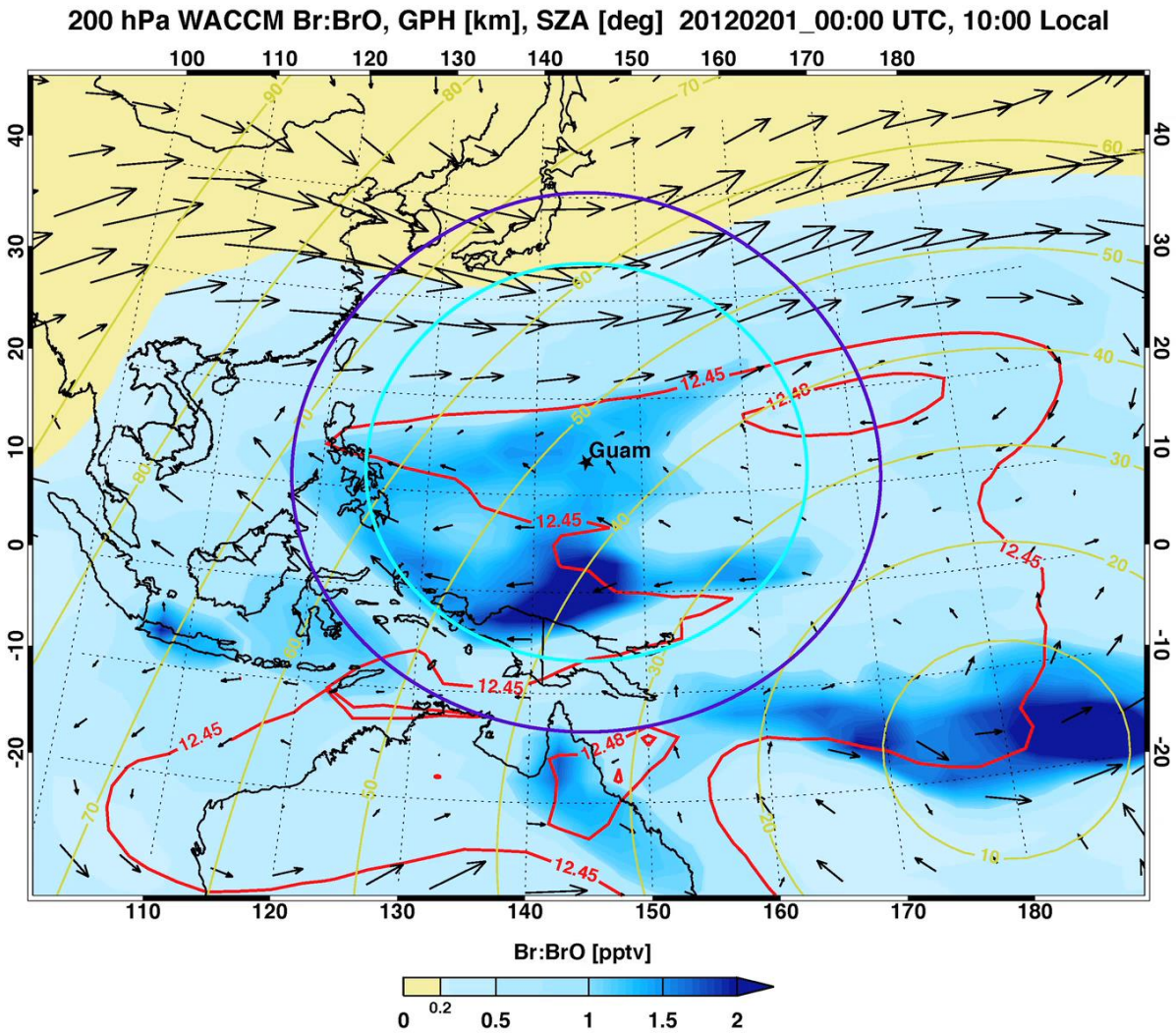


Flight strategy:

1) **identify region of no convection/clear air and good confinement (ideally the region inside the anticyclonic circulation)**
2) **re-sample air mass at different solar zenith angles**

Flight Scenarios (4): Photochemical evolution

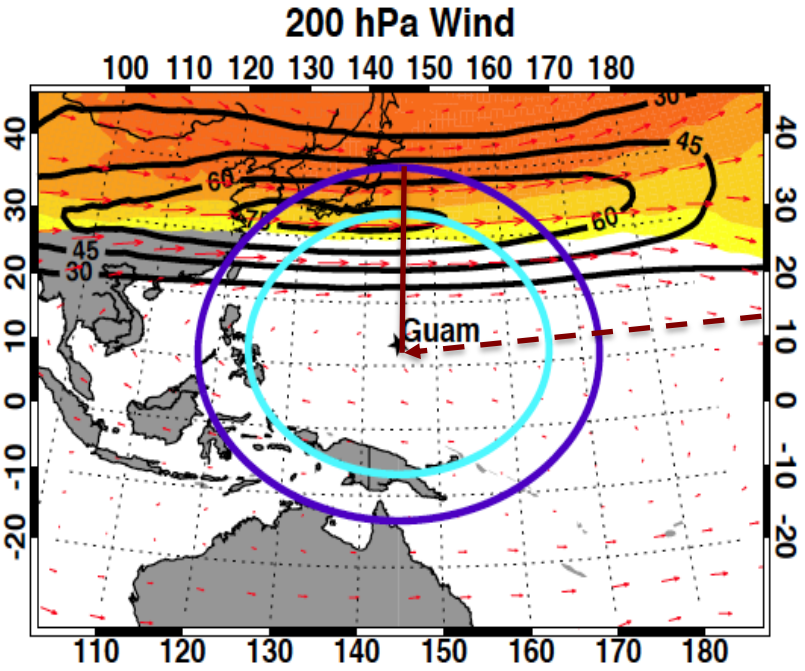
4a. dusk flight ; 4b. dawn flight

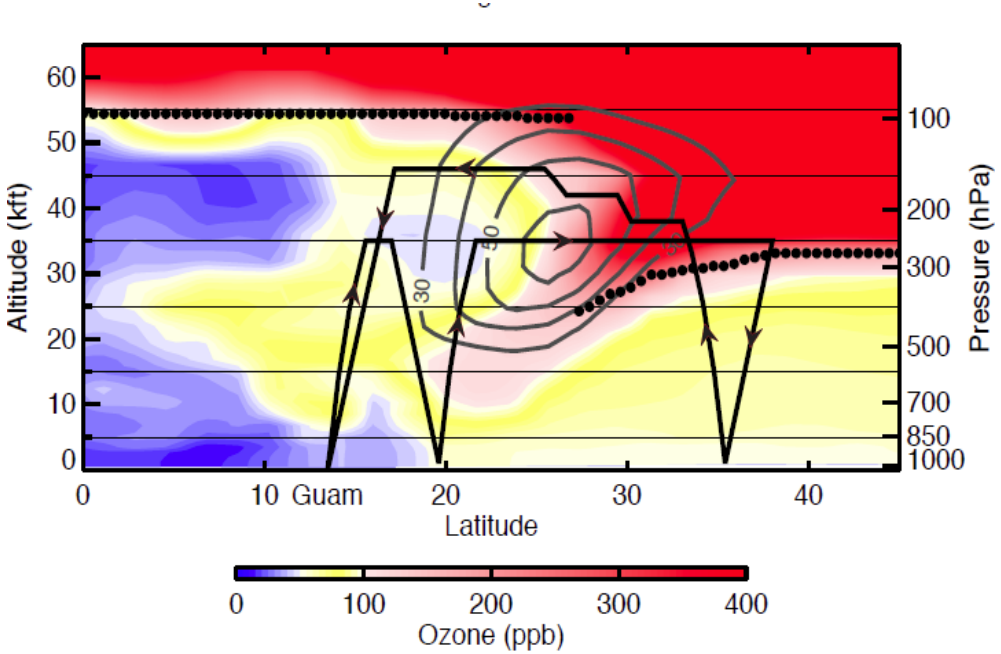


Flight Scenarios (5): Contrast flight

Main objectives: map out the gradient from UT to LS by crossing the jet stream and enter the extratropical lower stratosphere

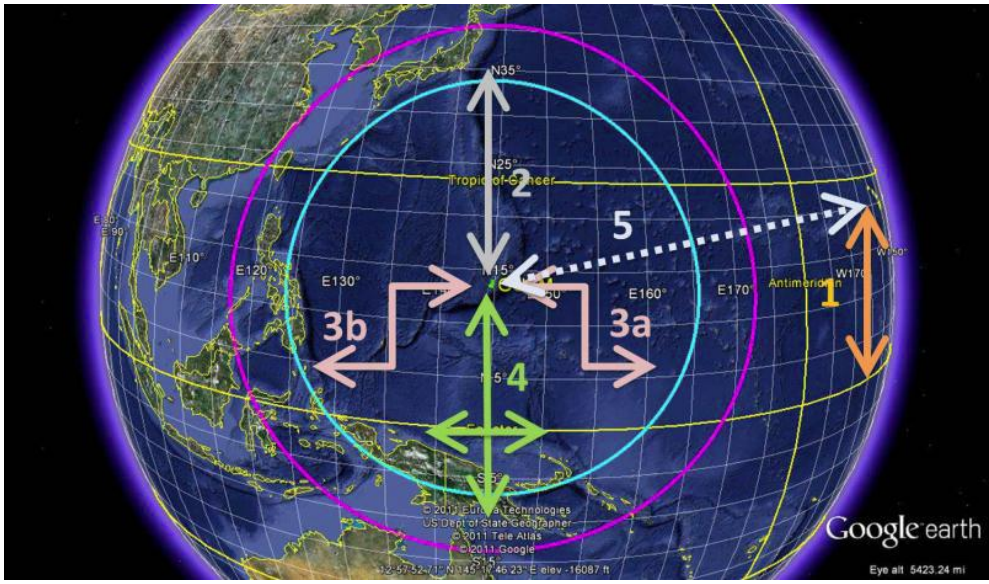
Example of flight patterns



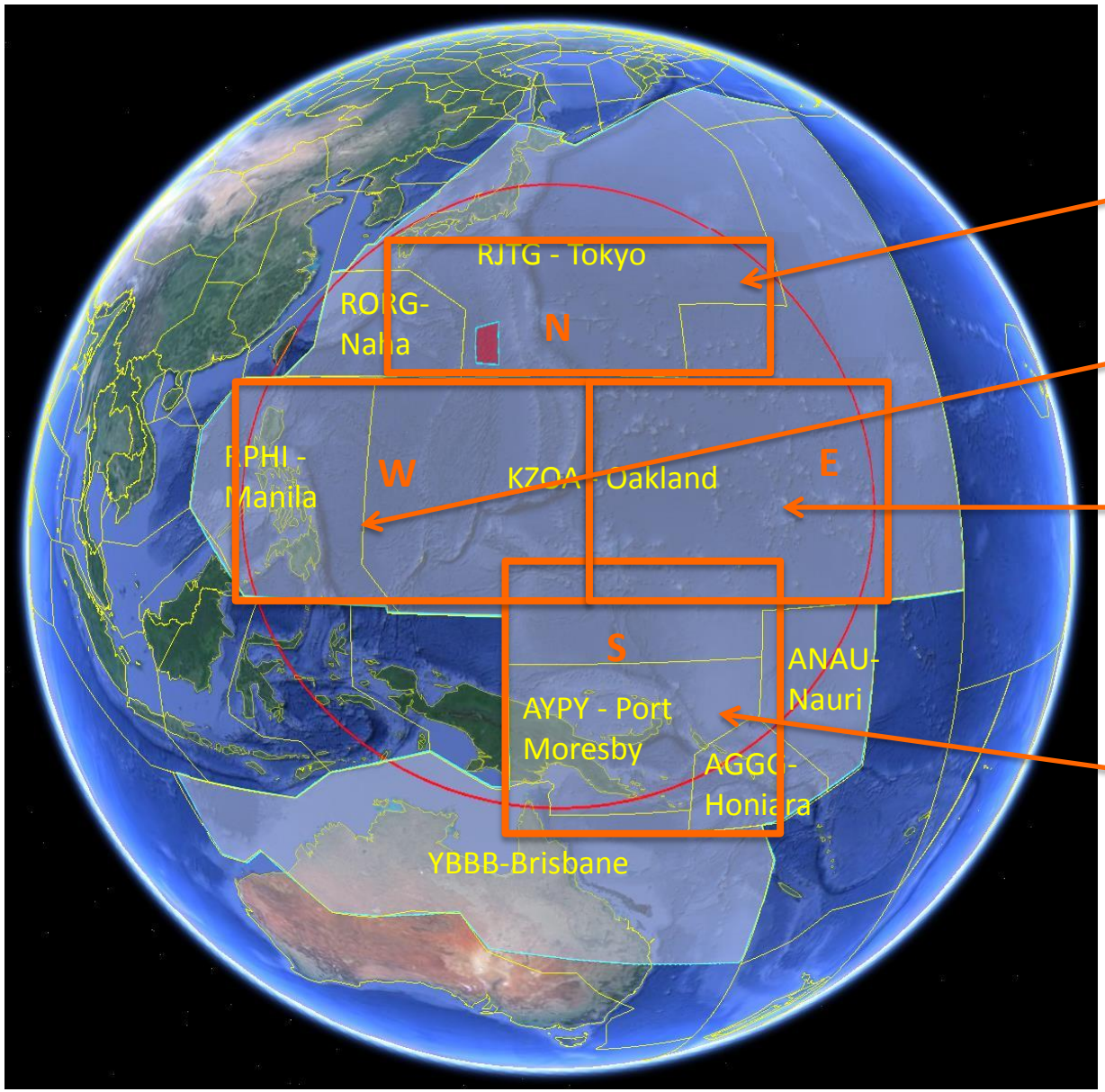


Flight Planning Strategy

- The entire CONTRAST domain may be divide into Northern, Southern, Eastern and Western four subdomains.
- Flight plan each day will choose a sub-domain best fit an intended scenario
- Contingencies will be planned as back up
- Iterate as the campaign progress with the scorecard



The CONTRAST Domain and Airspace Considerations



"jet stream, contrast"

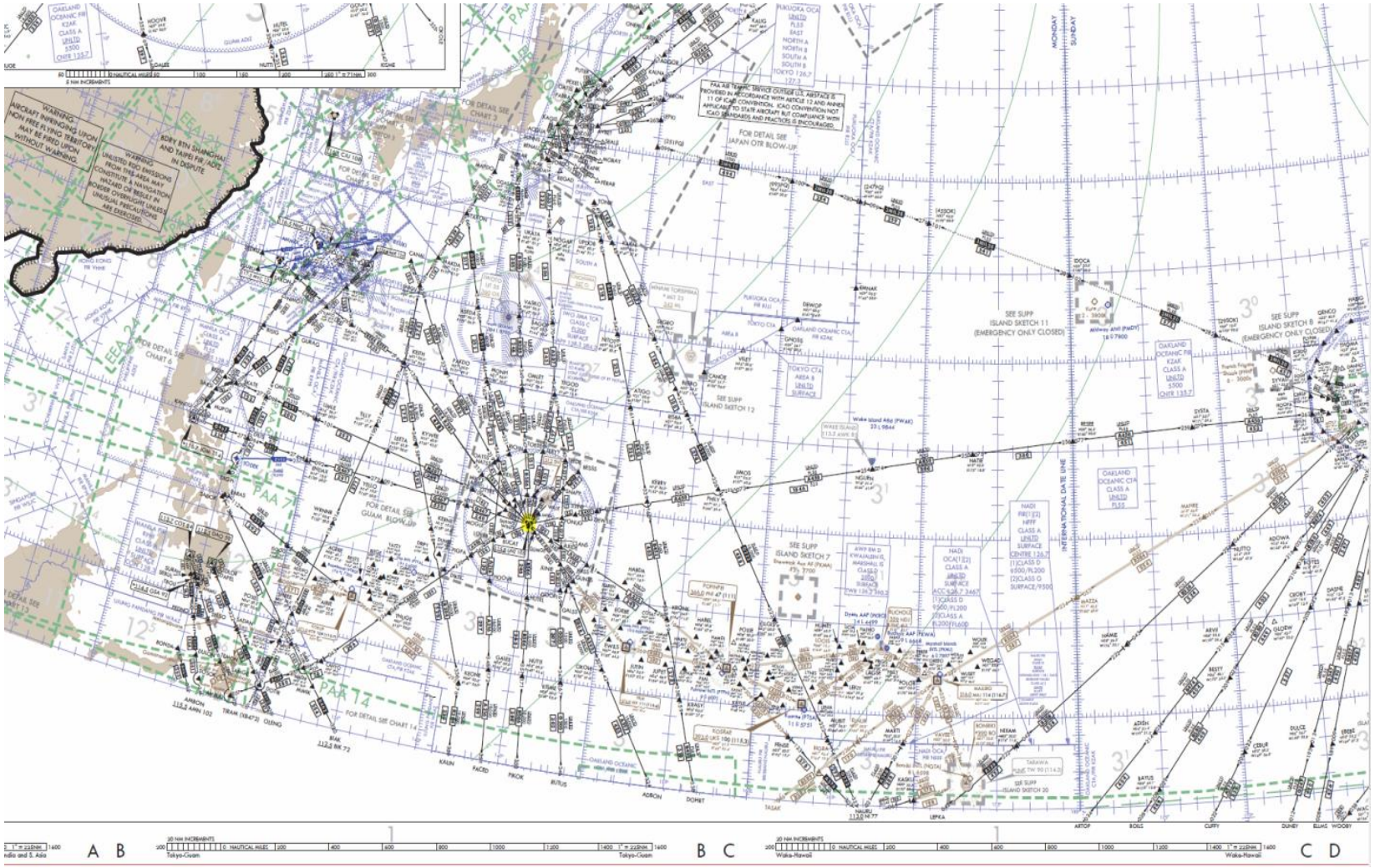
"Lagrangian"

older air for photochemical evolution

"fresh outflow, younger air"

Flight Strategy – air traffic considerations

Traffic corridors we stay at 35 Kft and higher, choose location for complete profiles



Discussions…