CalWater 2015 – Precipitation, Aerosols, and Atmospheric Rivers Experiment

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CalWater 2015

Precipitation, Aerosols, and Pacific Atmospheric Rivers Experiment

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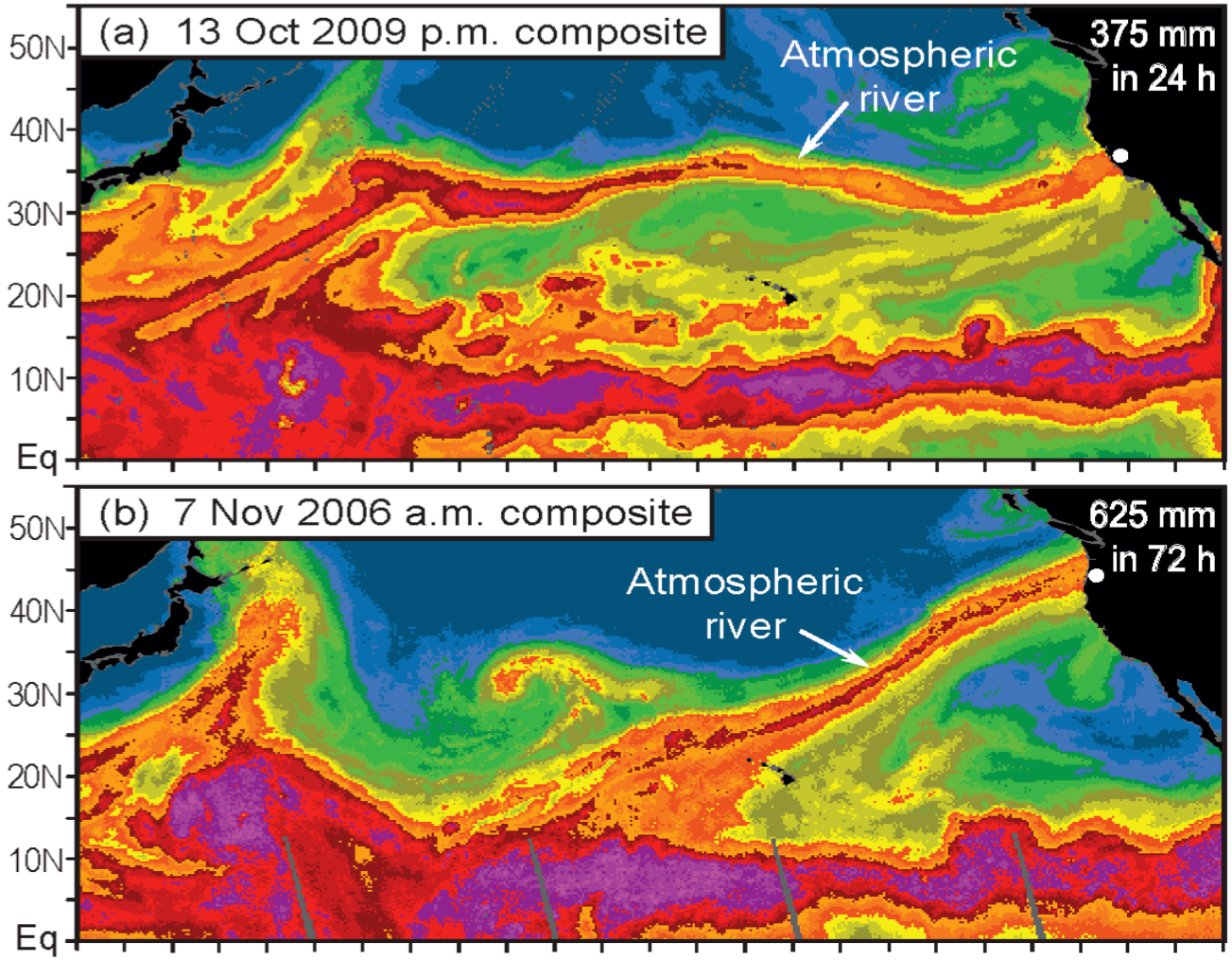
CalWater 2015 Drivers

Societal Relevance

- Variability of water supply
- Incidence of extreme precipitation events

Key Phenomena and Science Gaps

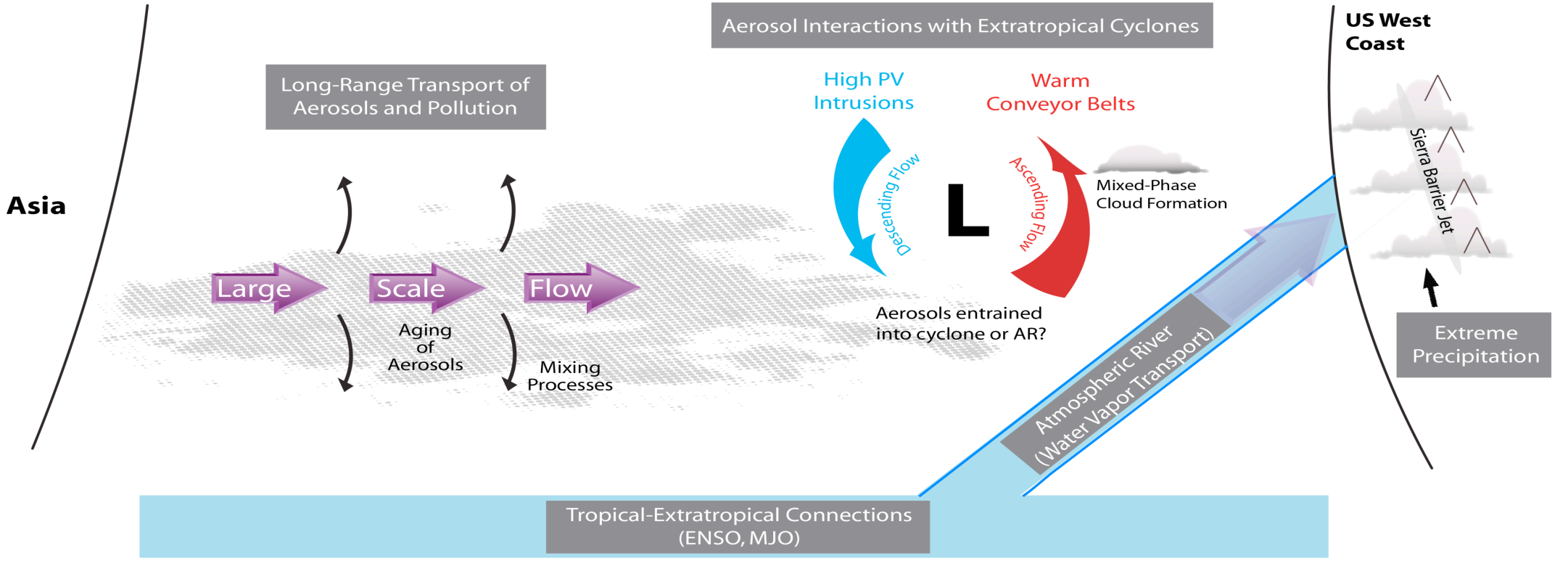
- Impact of atmospheric rivers (ARs) on flooding and drought relief
- Aerosols impacts on precipitation
- Effects of climate variability and change



Atmospheric Rivers: Two examples that produced extreme rainfall and flooding

CalWater 2015 Conceptual Framework

Challenge – Improve the predictive capability for extreme weather events by developing process understanding through the implementation of *integrated* observing strategies that include quantifying aerosol impacts on weather



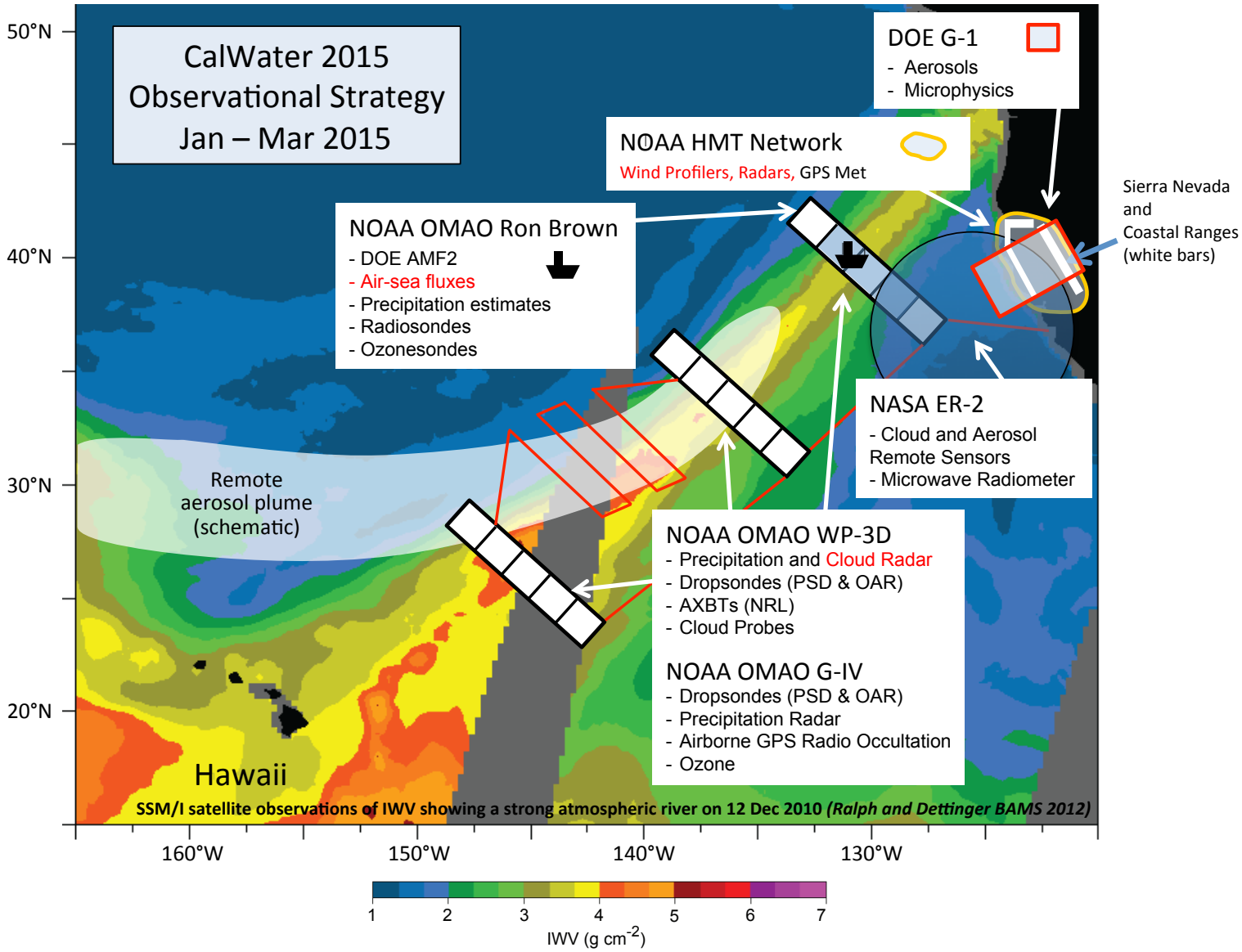
Courtesy of J. R. Spackman, NOAA Earth System Research Laboratory

CalWater 2015 Integrated Observing Strategy

Core Science Goal – Improve predictive capability for extreme weather events

Approach – Implement integrated observing strategies to address science gaps:

- **Atmospheric Rivers** – Water vapor budgets offshore and orographic control of precipitation upon landfall
- **Aerosol impacts on precipitation** – Aerosol composition and microphysical conditions which facilitate nucleation and affect precipitation offshore and at landfall

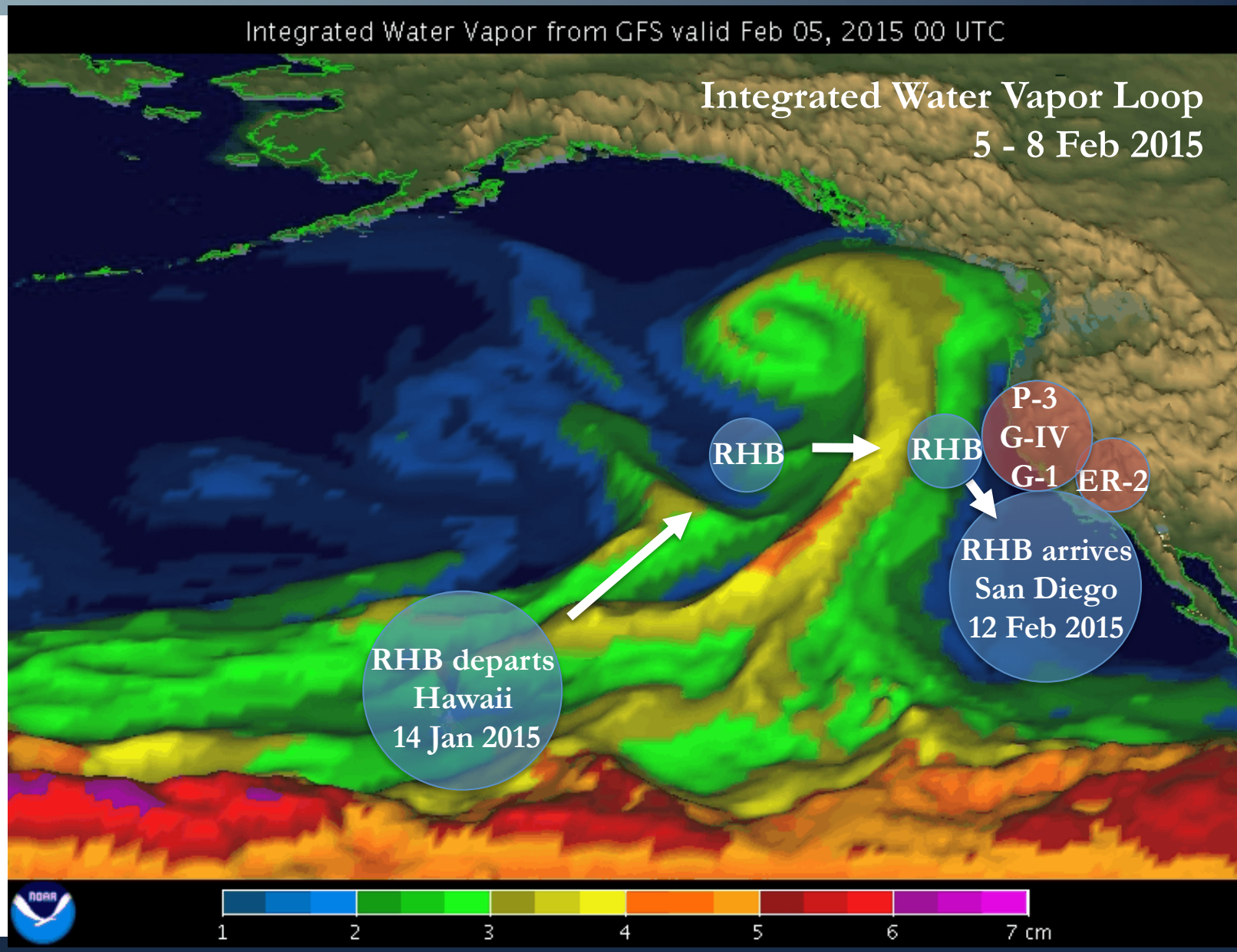


SSM/I satellite observations of IWV showing a strong atmospheric river on 12 Dec 2010 *(Ralph and Dettinger BAMS 2012)*

CalWater 2015 Implementation

Intensive observations for 2 months in Jan-Feb 2015 with unprecedented interrogation of atmospheric rivers and related water vapor transport phenomena:

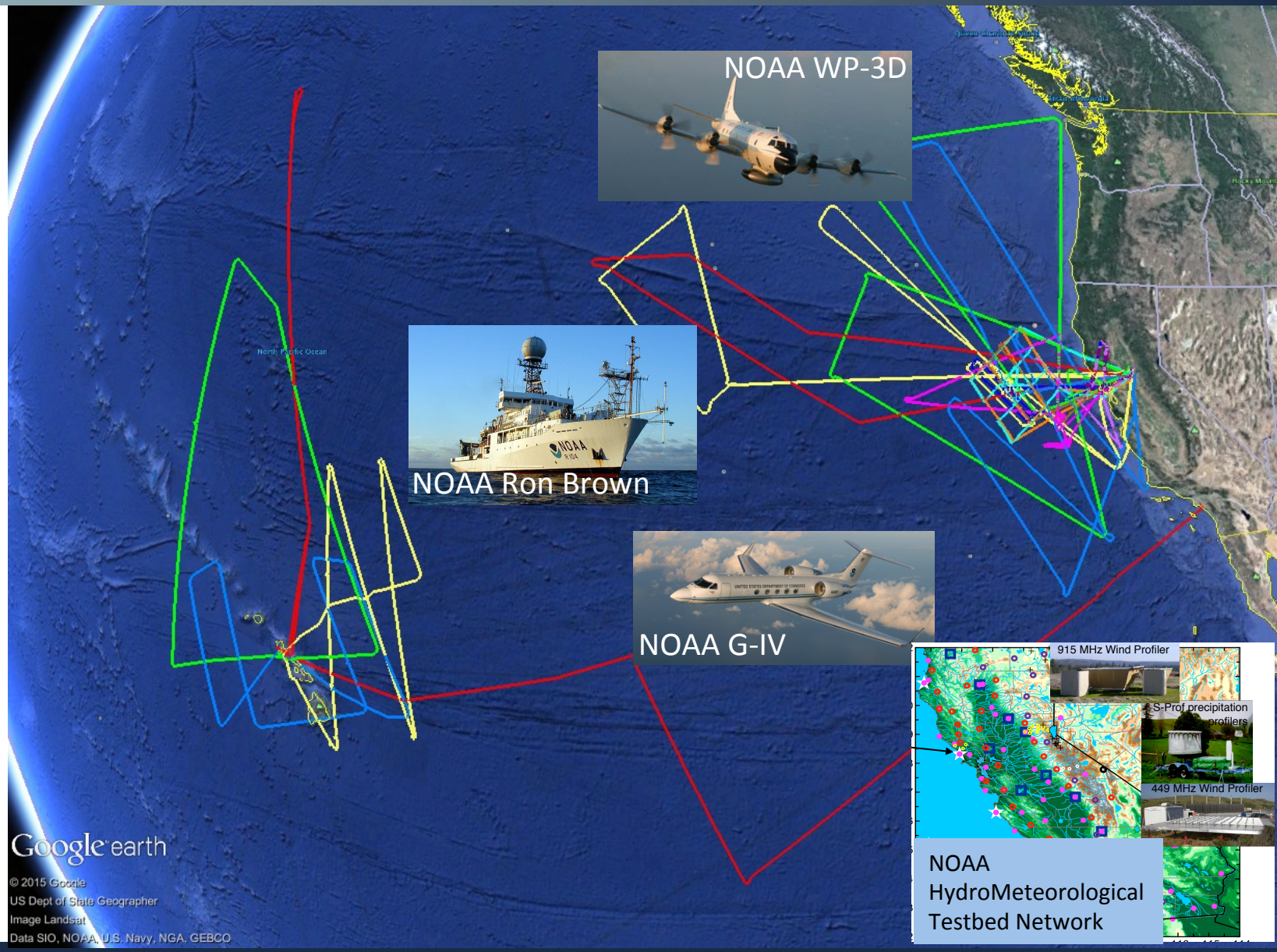
- 57 research flights
- 29 day research cruise
- 33 atmospheric river transects
- 444 dropsondes from P-3 and G-IV
- 300+ ship-based radiosonde launches
- Daily ship-based ozonesonde launches
- Coordination with NOAA HMT network and NSF-funded aerosol supersite observations



Emerging CalWater 2015 Science Results

Several process studies are emerging from the intensive observations to address the CalWater 2015 science goals:

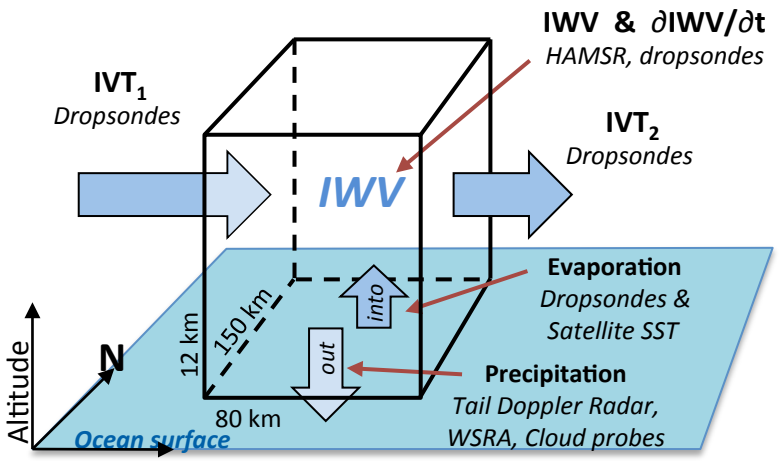
- Water vapor budget of ARs
- Air-sea flux interactions in ARs
- Aerosol-cloud interactions including role of direct and indirect aerosol impacts on precipitation
- Orographic control of precipitation and microphysical and barrier jet processes
- Tropical-extratropical connections
- Data denial/model integration studies with dropsonde observations

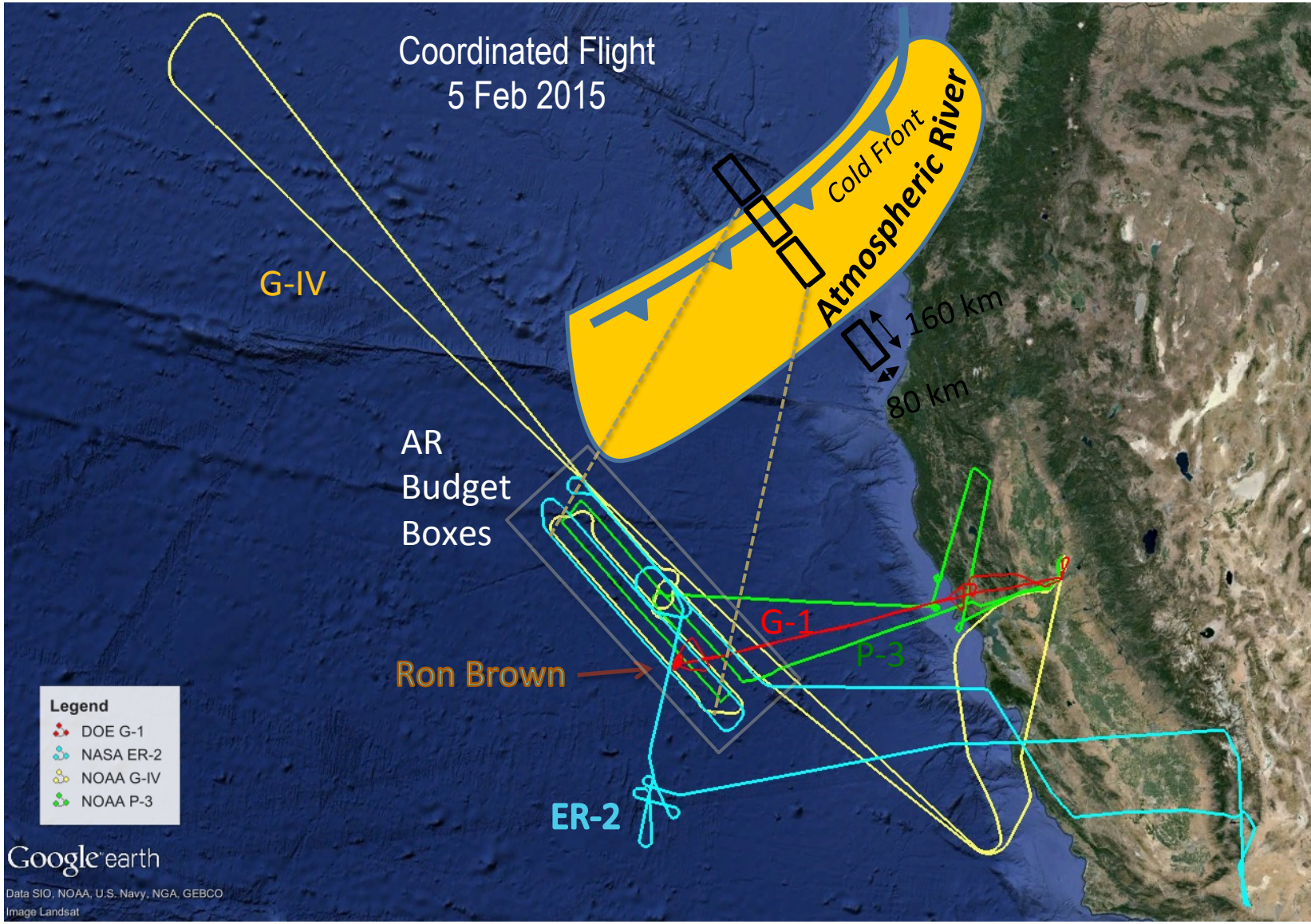


Emerging CalWater 2015 Science Results

Max Mission: Four research aircraft were coordinated with the NOAA Ron Brown during AR activity offshore of Northern California to address the science goal:

- Water vapor budget of ARs





Future CalWater Research Plans

Vision

CalWater 2015 is part of a project with a longer time horizon to develop integrated observing strategies to support process studies to improve weather forecasts and climate predictions including aerosol impacts on precipitation

Strategy

Establish partnerships internally in ESRL and externally with:

- Ball Aerospace to develop airborne wind and aerosol profiling capability and the Chemical Sciences Division to implement airborne integrated observations
- Global Systems Division to improve forecasts of high-impact weather

Plans for Early 2016

PSD has requested the NOAA G-IV to evaluate a Ball Aerospace-developed wind lidar on the NASA WB-57F with dropsondes and tail doppler radar on the G-IV in support of CalWater science objectives providing:

- More detailed vertical coverage of winds in storm environments
- Aerosol burdens in the region of high-impact weather

Supplementary Material

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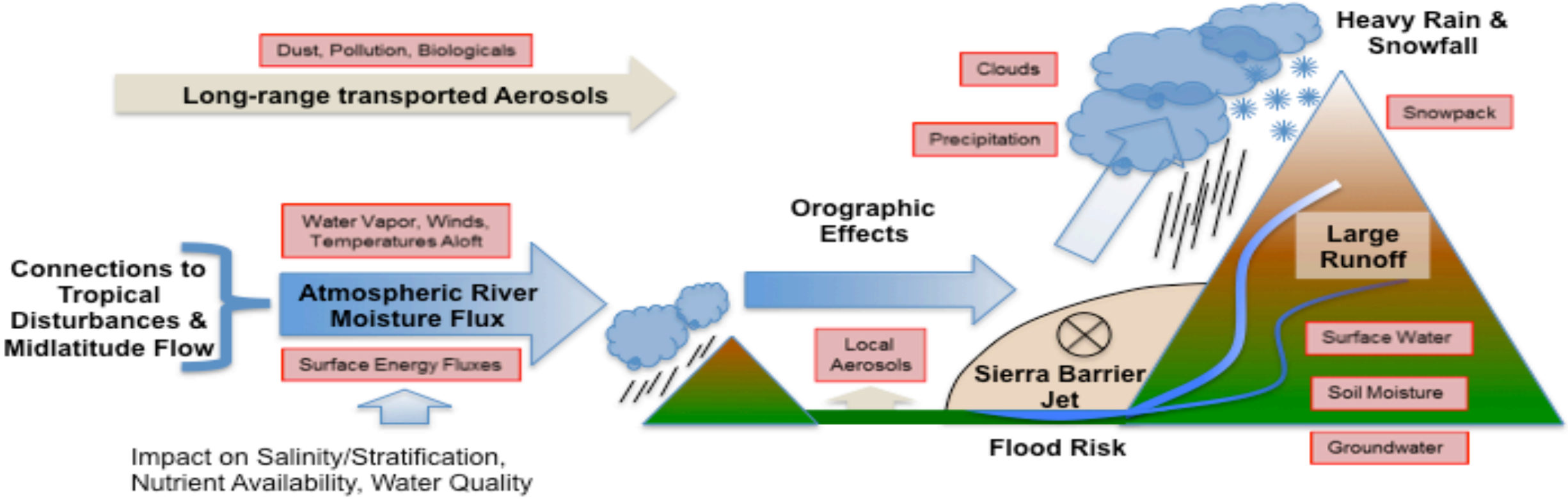
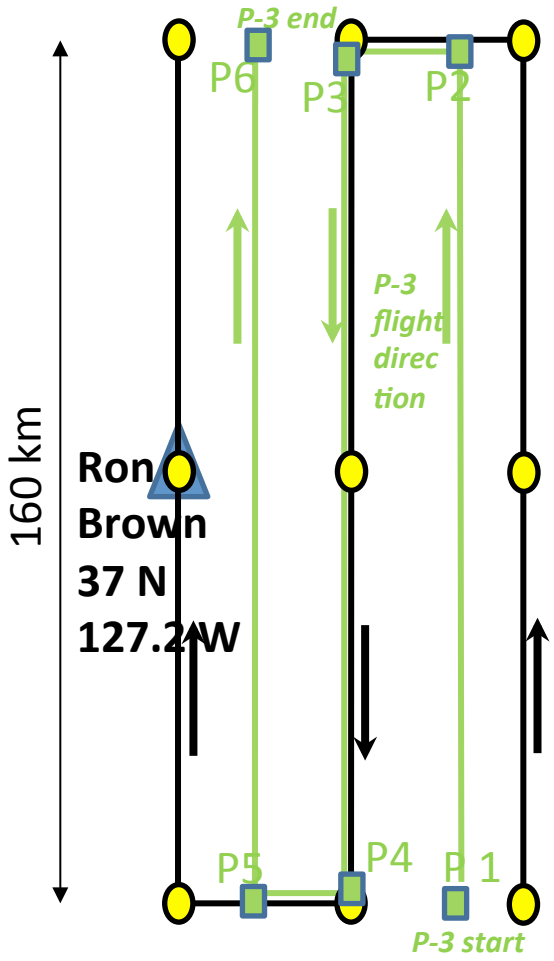
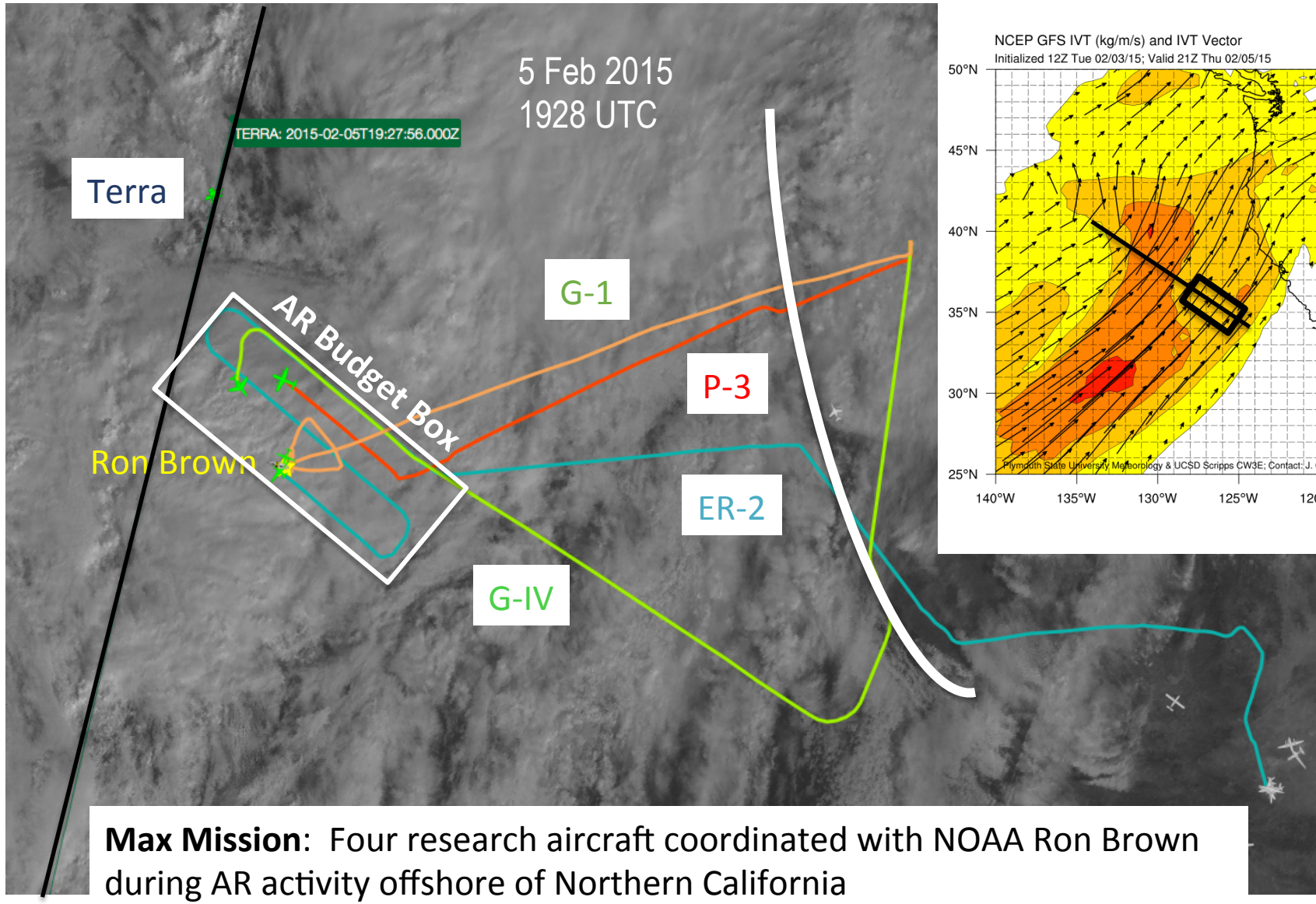


Coordinated Flight 5 Feb 2015





Max Mission: Four research aircraft coordinated with NOAA Ron Brown during AR activity offshore of Northern California