

More qualitative research methods:
Use of information by NWS forecasters
and end-users during a meteorological
field experiment

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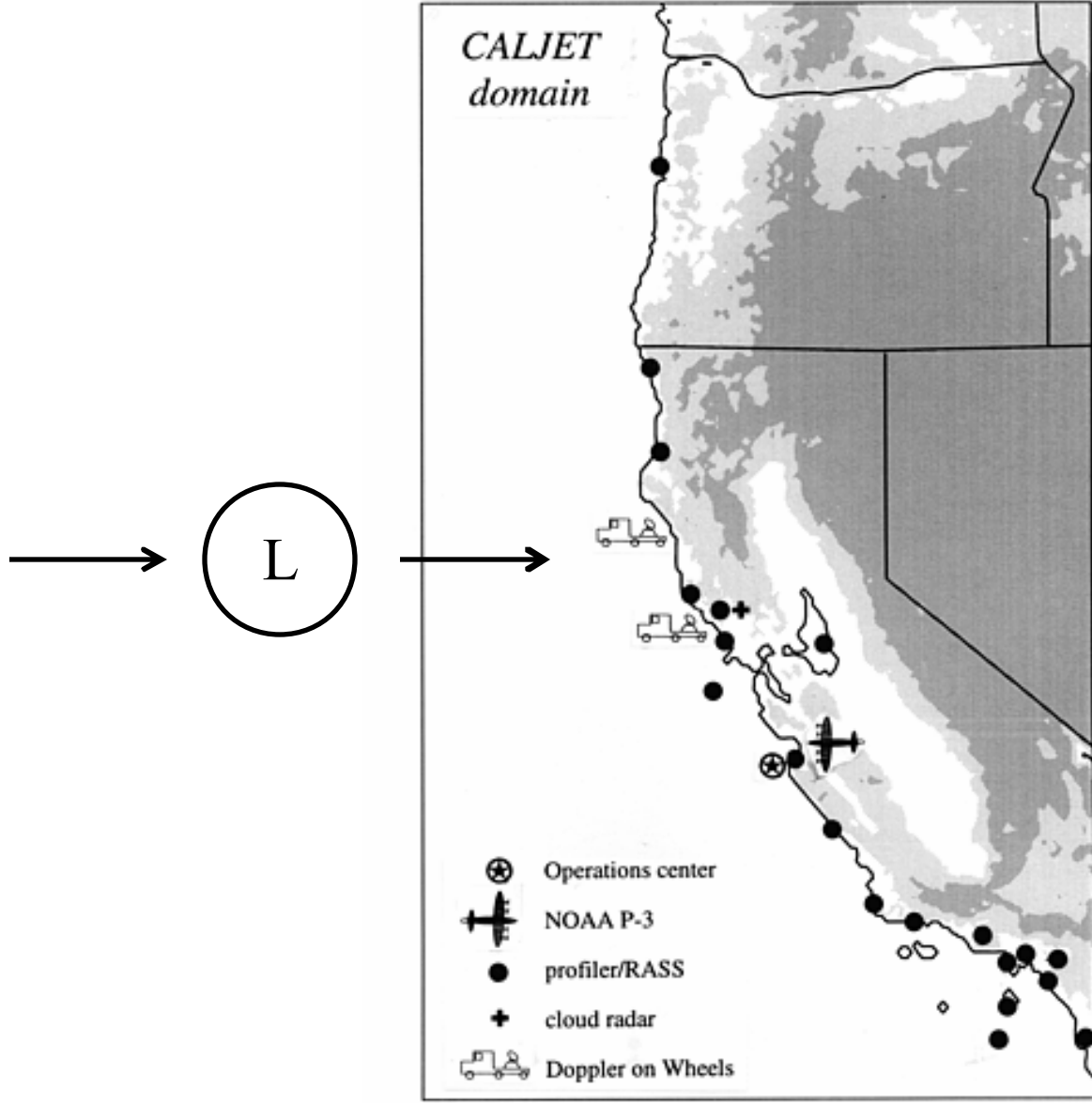
with Marty Ralph

and help from Roger Pielke, Jr. and Kristen Koch

- Background
 - What are CALJET and PACJET? (What is a meteorological field experiment?)
 - Why study use of information by forecasters and end-users?
- Research methods
 - Semi-structured, qualitative interviews
 - Observations of NWS forecasters
 - Data analysis
- Lessons learned / suggestions
- Discussion

Field experiment 1: CALJET

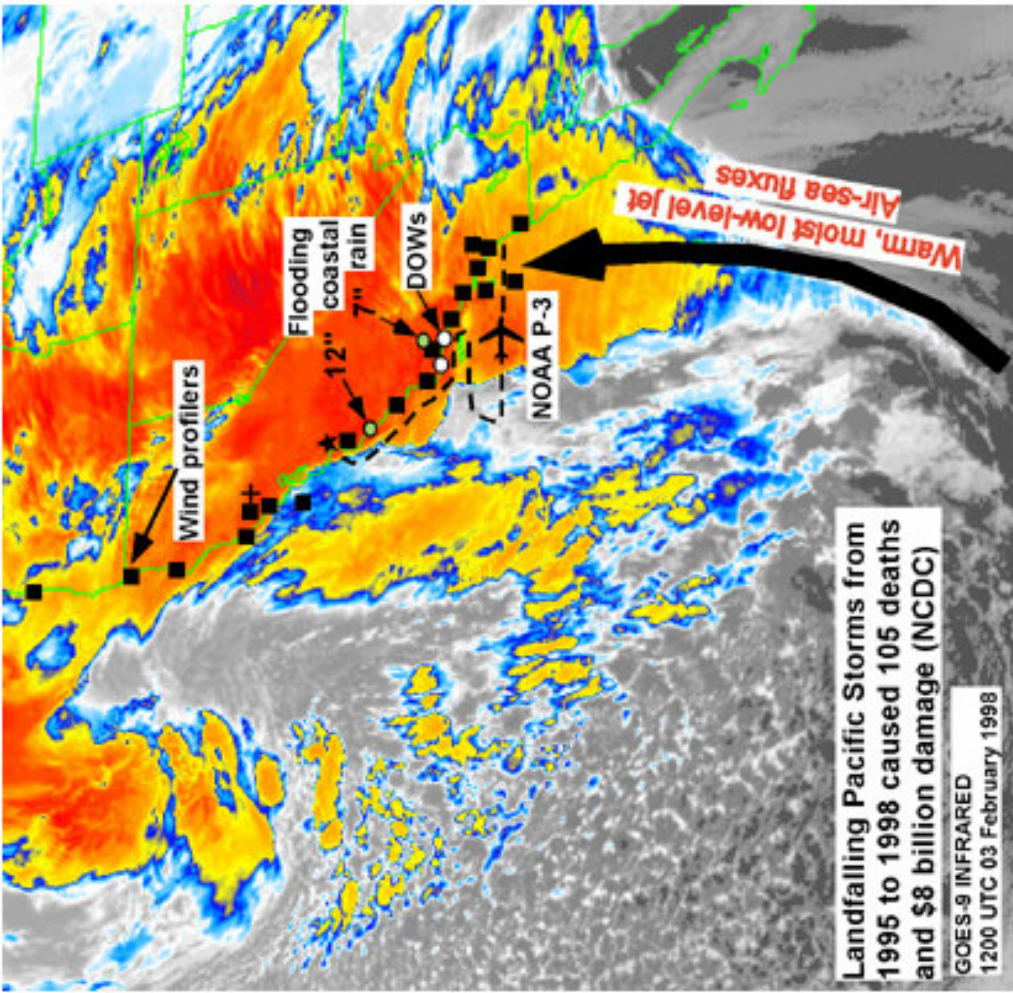
- CALJET = California Land-falling Jets Experiment
- Goal: Take observations in landfalling winter storms, focusing on the prefrontal low-level jet, to improve scientific understanding and forecasts
- Dec 1997 – Mar 1998 — a strong El Nino, heavy rainfall and severe flooding in California
- NWS forecasters and California emergency managers found extra information so valuable that they requested (and funded) project extension



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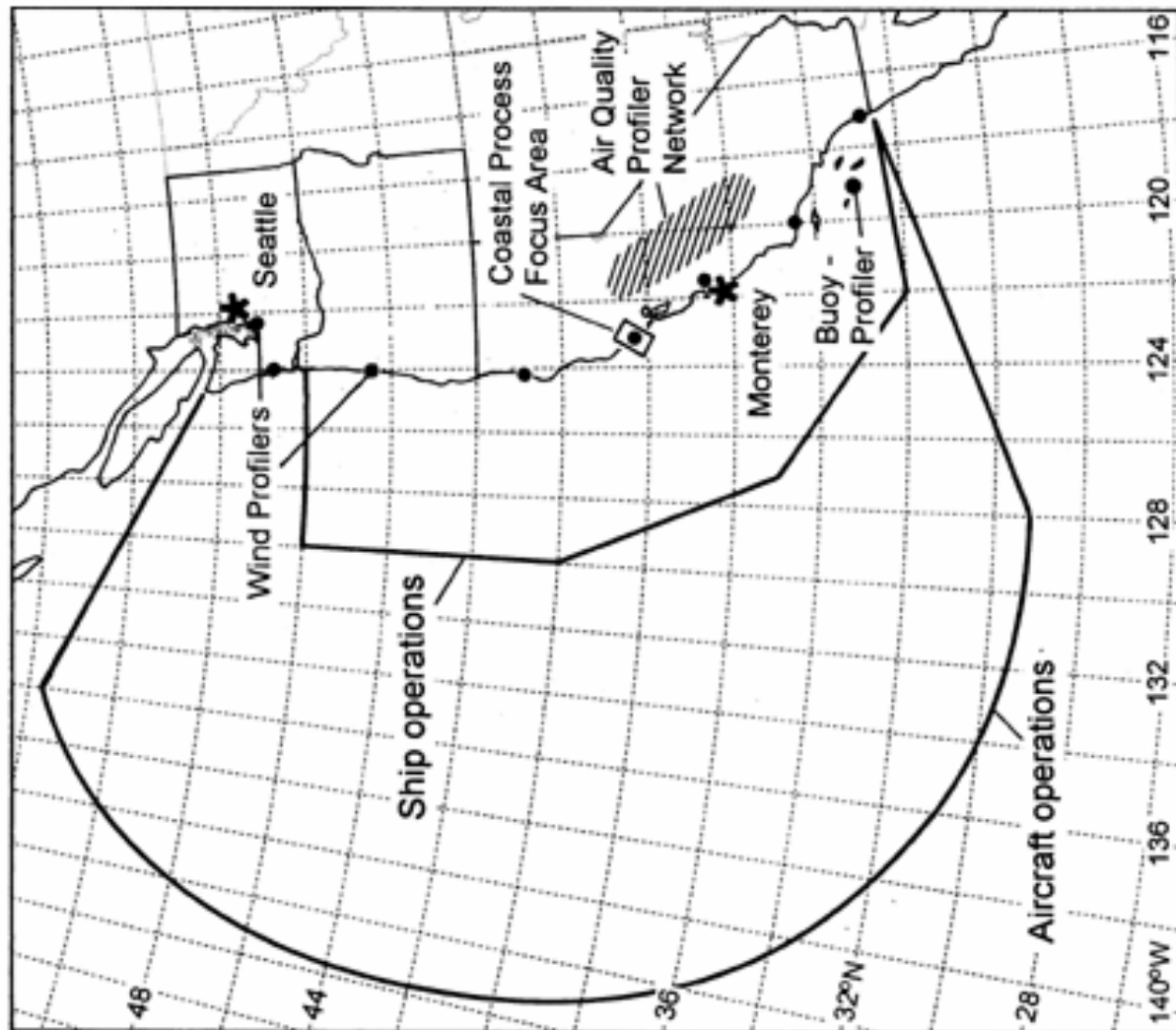
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Landfalling Pacific storms caused 105 deaths and \$8 billion in damage from 1995 to 1998.



Field experiment 2: PACJET-2001

- PACJET = Pacific Land-falling Jets Experiment
- Goal: Similar to CALJET
 - With increased emphasis on interactions with NWS forecasters and end-users
 - Extended north to U.S. West Coast and west into Pacific
- Jan – Mar 2001
- PACJET continued, in different forms, in 2002 and beyond



PACJET Domain

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Focus of research

- How did NWS forecasters and end-users (particularly emergency managers) use additional information provided by CALJET and PACJET?
- Because understanding use of additional information requires understanding context:
How do NWS forecasters and emergency managers use information in general?
(focusing on precipitation in California)

Research methods

- Previous work: Anecdotes from and discussions with forecasters and end-users
- My work:
 - During PACJET-2001 (Feb–Mar 2001):
 - Interviewed forecasters, researchers, and end-users about CALJET and PACJET, etc.
 - Observed NWS forecasters' use of information
- Later work: Web log and survey of forecasters' use of PACJET observations in 2002, 2003

Interviews

- Qualitative, semi-structured interviews with
 - NWS forecasters
 - NWS personnel (primarily managers)
 - CALJET/PACJET researchers
 - Emergency managers and water resource managers
- Followed an interview guide with relatively open-ended questions, allowing for flexibility
- Interview questions evolved as data collection progressed and research grew more focused
- (Other more focused interview methods)

Observational methods

A continuum:

Quantitative, structured observations

-
-
-

Qualitative, unobtrusive observations

-
-
-

Participant-observation

Observations of forecasters

- Qualitative participant-observation of NWS forecasters at different locations, including 2 Weather Forecast Offices in California
 - Observed forecasters conducting their regular job duties
 - Asked forecasters to explain what they were doing and why
 - Interspersed questions and discussion
- Sessions during ordinary operating periods and landfalling winter storms

More data collection and recording

- Additional data collected from:
 - Informal interviews and discussions with NWS personnel, NWS forecasters, CALJET/PACJET participants, and end-users
 - Written documents, including forecast products (no formal textual analysis)
- All data recorded by handwriting notes and typing up afterwards
(No tape or video recording, to limit intrusiveness)

Why these methods?

- Study was “exploratory”
(In other words, we did not know what specific questions to ask using more structured or quantitative methods)
- Wanted to understand, in detail, how and why people used different types of information in different situations
- Wanted the “real”, “inside” view
- Wanted to understand use of information during hazardous weather situations: small sample of events, forecasters are busy

Data analysis

- Read data to identify initial themes (codes)
- Cycle of:
 - Coding data
 - Reorganizing data by code
 - Rereading data
 - Modifying and refining codes
 - (Using Microsoft Excel)
- Additional analysis by diagramming concepts and relationships
- Revisited analysis cycle during writing

Sampling

- Many different types of sampling for this type of research, ranging from sampling for representativeness to sampling for diversity
- In this study:
 - Sample of forecasters was not representative (was biased towards certain types of forecasters)
 - Sample of end users was small, based on recommendations (“snowball” method)
 - Samples not large enough to draw generalizable conclusions, but still provide interesting knowledge

Validity and reliability in qualitative research

- Many definitions of “quality” in qualitative research, depending on research tradition
- Qualitative research can be high-quality
- Many techniques to improve validity and reliability of (and reduce bias in) qualitative research, e.g.,
 - Limit assumptions as much as possible: when designing study, collecting data, and analyzing data
 - Record data systematically
 - Analyze data systematically, check ideas against data
 - Collect data from different sources and “triangulate”
 - Check results with key sources
 - Question assumptions and check them against data

Qualitative and quantitative research

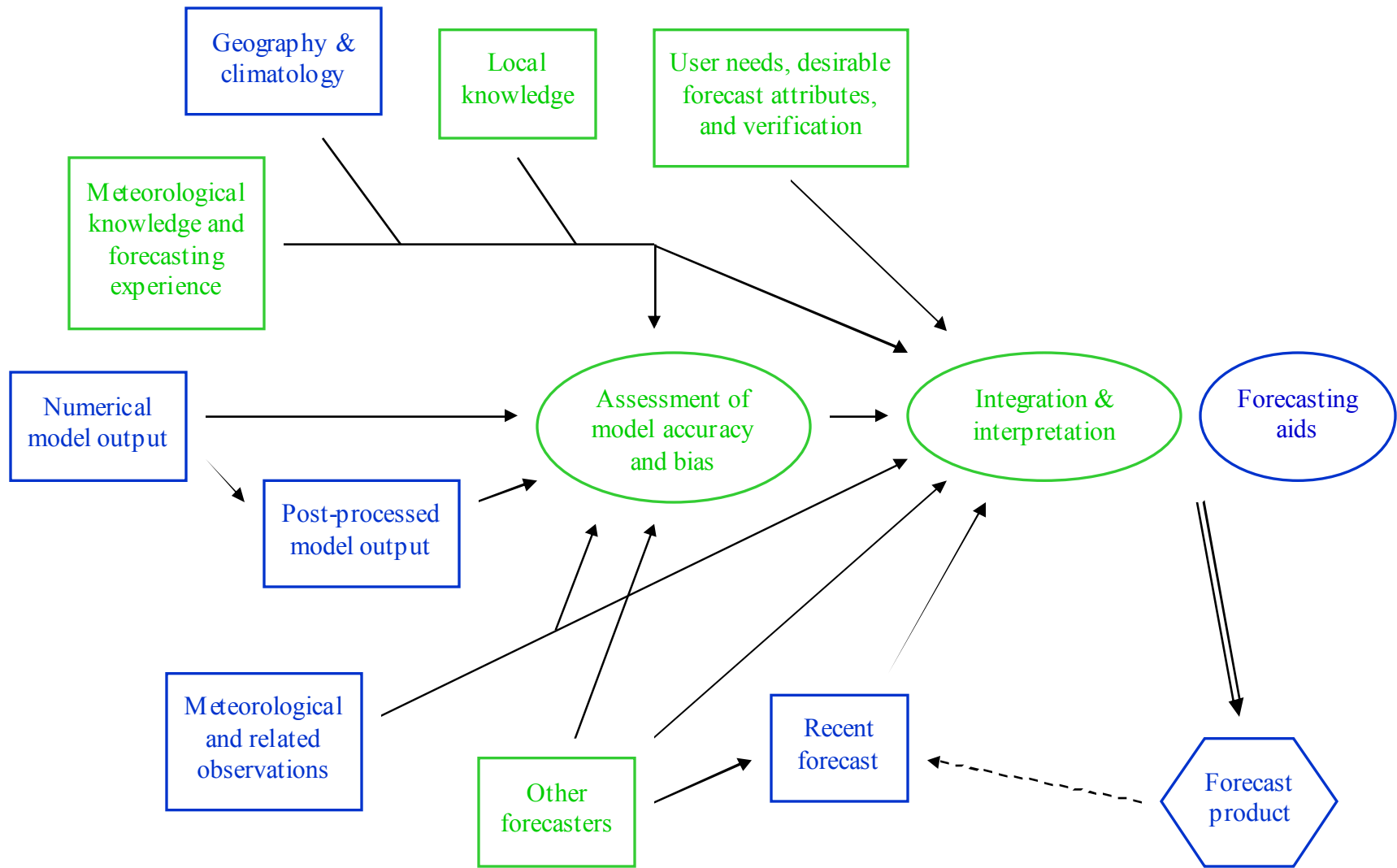
- One view
 - Use qualitative methods for exploratory research and theory development
 - Use quantitative methods for confirmatory research and theory testing / confirmation
- Another view
 - Use quantitative methods to identify representative relationships
 - Use qualitative methods to understand why those relationships exist, how they work, what they do, how they came about, what they mean to people
- And many more views ...

Lessons learned / suggestions

- Identify clear, manageable research questions that can be investigated using desired methods within intended time period
 - ... but be open to new questions as research develops!
- Keep clear, consistent records of everything
- Develop a sampling strategy based on what you want to accomplish
- Allow time for data analysis
- Limit assumptions as much as possible

Results of study

- Document different types of information that NWS forecasters use and how they combine that information to generate forecasts
- Describe how NWS forecasters used additional CALJET/PACJET observations in potentially hazardous weather situations
- Identify several of CALJET/PACJET's challenges and reasons for success
- Discuss how weather forecasts are incorporated into emergency management decision-making



Questions
and
discussion