Challenges of Operational River Forecasters

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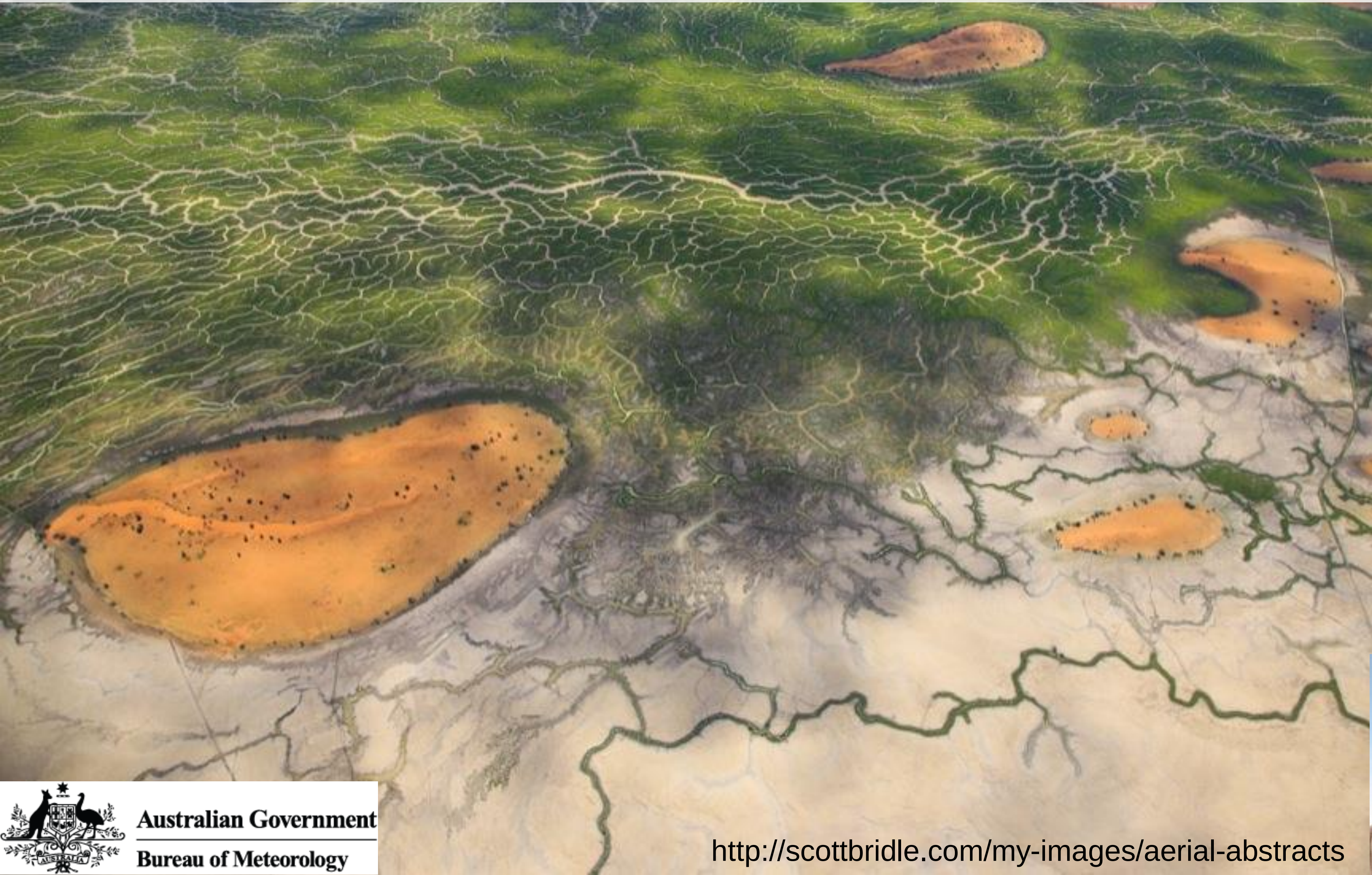

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http://scottbridle.com/my-images/aerial-abstracts http://journals.ametsoc.org/doi/pdf/10.1175/JHM-D-13-0188.1

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Findings based on experience of 11 authors and
16 months of travel through 24 countries.

The Four Great Challenges Faced by Operational River Forecasters

1. Making the most of data

2. Getting the numbers right (modeling and forecasting)

3. Turning the forecasts into effective warnings (products)

4. Administering an operational service (institutions)

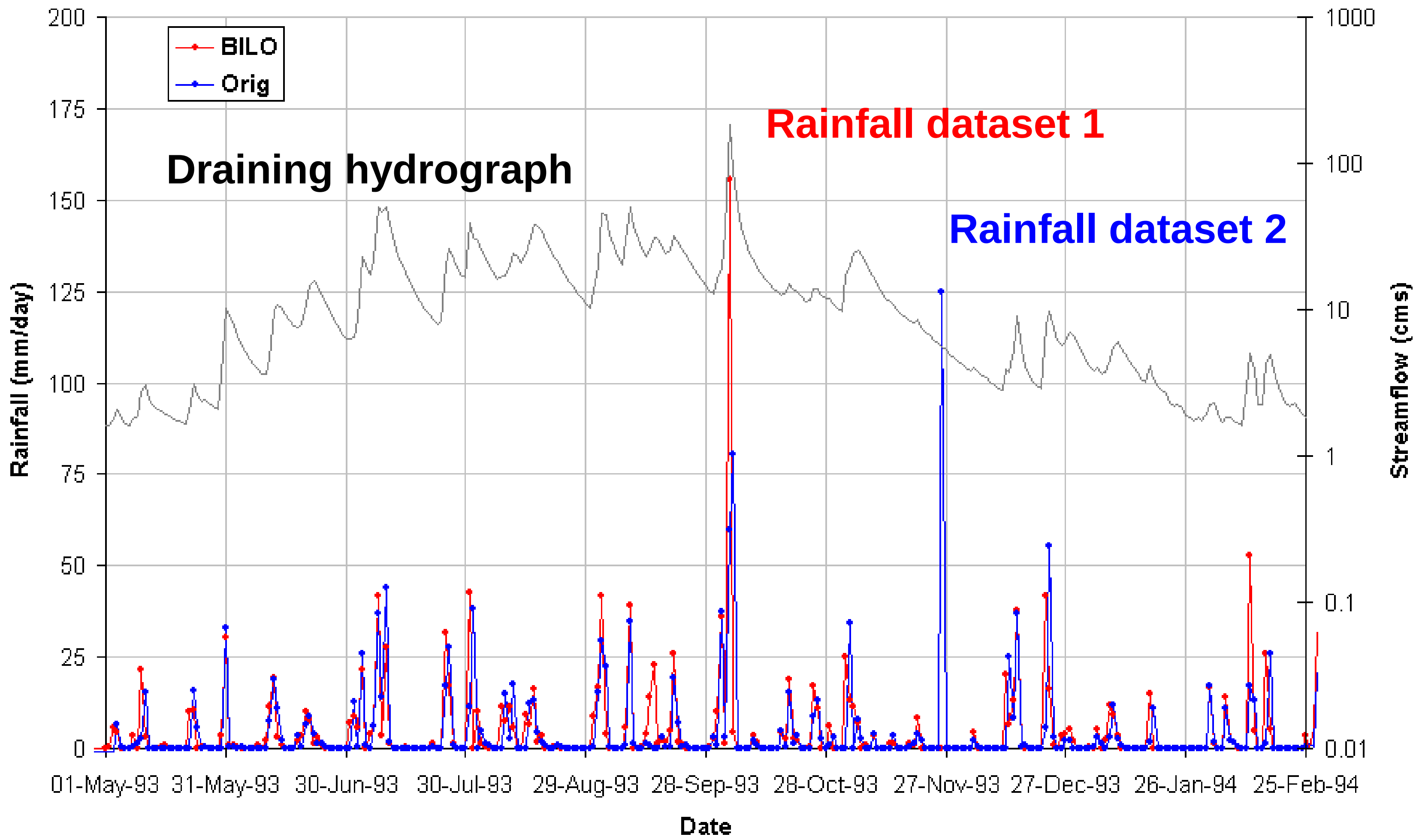
Everyone has data problems

Too much, too little, not the right coverage or quality.

Trouble fetching, cleaning, infilling,
using, archiving, versioning, visualizing, redistributing…

Until 2008, Australian water data managed by 200 entities.

Not all data outliers are bad…
Using multiple sources to triangulate problems.



Reflections on data

How good is our automated data quality control and infilling?

How can we make use of short records?

Can we perform data assimilation
without cutting out forecaster expertise?

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Which of these is more "useful"?

Should there be shame in the vintage and relative simplicity of operational hydrology models?

Researchers rarely demonstrate quantitative improvements in forecast skill using new science in operationally realistic environments.

Therefore system upgrades are more often to the forecasting interface and visualization, how to manage data, generate products, and automate workflows.

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Example:

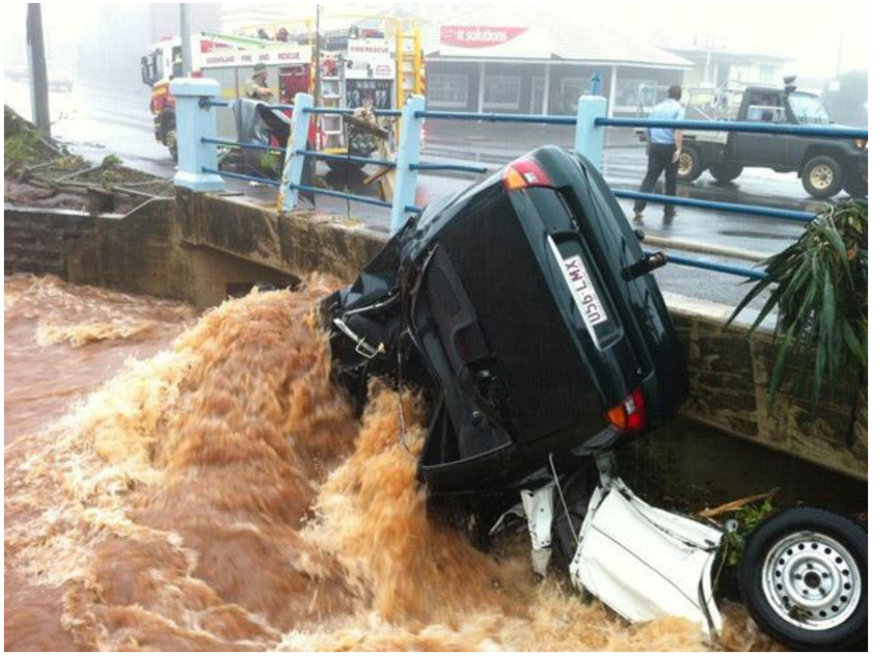
US National Weather Service River Forecast System (in 2000):
400,000 lines of computer code

Sacramento model (the “physics”, unchanged since 1970):
400 lines

Bureau operational forecasting method (event models + Muskingum routing) is 1930s hydrology

Many (important?) hydrologic processes are not modelled or can't be modelled

World's dirtiest river (Indonesia)



Toowoomba, Australia

http://tompagano.blogspot.com/2011/09/manggarai-gate-garbage-part-22.html

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Effective warnings require local context and knowledge of community vulnerability

Are there efficient and scalable methods for the collection of local flood intelligence (i.e. metadata about structures and communities at risk)?

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Bureau of meteorology flood classes

Minor – causes inconvenience, low bridges may submerged
Moderate – small-scale evacuations may be required
Major – extensive flooding, significant disruptions

13.5% of Bureau flood levels are integers differing by 1 (e.g. 4,5,6 metres).

Qualities of good forecast messaging

Clear and easy to understand
Complete yet brief and to the point
Communicates confidence/uncertainty clearly
Consistent message content (if different from last forecast, provide justification)
Conveys something that people can visualize (i.e. physical realism)
Meaningful units/Expressed in the user's terms
Has personal meaning for those at risk
Relevant and specific to user vulnerabilities (e.g. locations, flood thresholds)
Provides options for action

Are operational forecasters being served by/paying attention to scientists in this field?

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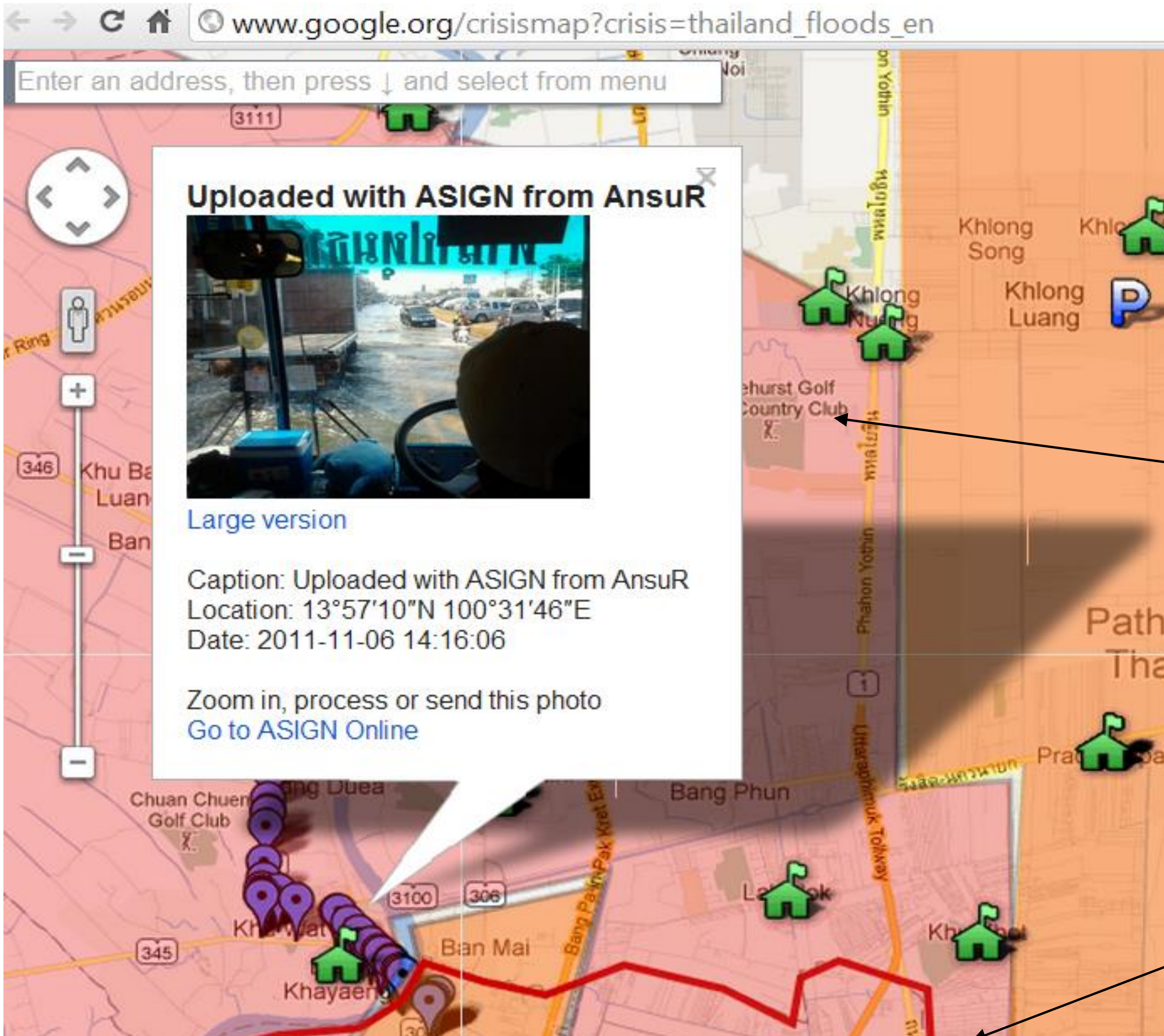
Are operational agencies keeping pace with social technology?

Google Crisis Response



Shelters

Parking

Risk areas

Water barrier

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Forecasters are reluctant to take risks for fear of liability.
Floods can be controversial because rivers are managed by people.
There is a lack of standards in training hydrologists.
With increasing automation, the role of human forecasters is evolving.

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Research question:
How can scientists field test experimental techniques under the supervision and on the terms of operational agencies, yet avoid the potential liability associated with forecasts that affect lives and property?

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Australian rules around "Local Time"

Every state follows a different daylight savings rule.
Rules have changed twice in last six years.

A cross-country train has its own time zone.
One town is offset 0:45 from its neighbors.

The 2000 Olympics had a special daylight savings but not everyone observed it.

Australia's Antarctica bases have their own time.
But the generators run at 60.1Hz so some clocks are fast and need to be set back 5 minutes every couple days.