Floods in Queensland

Key Topics:

- flood [2]
- forecasting [3]
- remote sensing [4]

Improving flood forecast skill using remote sensing data [5]

This project investigated the use of remote sensing data to improve modelled flood forecast skill and value. It developed optimal ways to constrain and update hydrologic flood models using remotely sensed soil moisture data. The project also proposed an algorithm for the monitoring of floods under vegetation, and investigated optimal ways to use remote sensing-derived inundation extent and level to implement and calibrate the hydraulic model. The results of this project enable improved predictions of flow depth, extent and velocity in the floodplain.

Project: detail Notabs

Research team

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Description

Floods are among the most damaging natural disasters in Australia. Over the last 40 years, the average annual cost of floods was estimated to be $377 million per year. The 2010-2011 floods in Brisbane and South-East Queensland alone resulted in 35 confirmed deaths and $2.38 billion damage. The floods in June 2016 in Queensland, New South Wales, and Tasmania, resulted in five confirmed casualties. The floods in North Queensland in January-February 2019 resulted in four confirmed fatalities and an estimated total direct cost of 1.3 billion dollars. In order to limit the personal and economic damage caused by floods, operational water and emergency managers rely on flood forecasting systems.

These systems consist of a hydrologic and a hydraulic model to predict the extent and level of floods. Using observed and predicted rainfall, the hydrologic model calculates the amount of water that is flowing through the river network, while the hydraulic model computes water depth and velocity in the river and in the floodplain. In recent decades, the accuracy and reliability of these flood forecasting systems has significantly improved. However, it remains difficult to provide accurate and precise flood warnings. This is a result of errors and/or uncertainties in model structures, model parameters, input data, and/or meteorological forcing (mainly rainfall). The hypothesis of this project is that remote sensing data can be used to improve modelled flood forecast skill and value.

More specifically, this project developed optimal ways to constrain and update the hydrologic model using remotely sensed soil moisture data. The significance of soil moisture is its direct impact on the partitioning of rainfall into surface runoff and infiltration. Second, this project proposed an algorithm for the monitoring of floods under vegetation. Finally, the research team investigated optimal ways to use remote sensing-derived inundation extent and level to implement and calibrate the hydraulic model. The results of this project enable improved predictions of flow depth, extent and velocity in the floodplain.

Read the final report here. [20]

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COMMUNITIES, EMERGENCY MANAGEMENT

[25]

09 MAY 2016

Remote sensing flood data is filling the gaps

FLOOD, FORECASTING

[26]

12 FEB 2016

River bed mapping to help flood forecasting

FLOOD, FORECASTING

[27]

Publications

Year	Type	Citation
2020	Journal Article	Grimaldi, S. [9], Xu, J. [28], Li, Y. [29] & Walker, J. [8] **Flood mapping under vegetation using single SAR acquisitions** [30]. *Remote Sensing of Environment* **237,** (2020). DOI [31] Google Scholar [3
2020	Report	Pauwels, V. [6], Walker, J. [8], Grimaldi, S. [9], Wright, A. [10] & Li, Y. [29] **Improving flood forecast skill using remote sensing data – final project report** [20]. (Bushfire and Natural Hazards CRC, 2
2020	Report	Pauwels, V. [6], Walker, J. [8], Grimaldi, S. [9], Wright, A. [10] & Li, Y. [29] **Guidelines on the optimal use of remote sensing data to improve the accuracy of hydrologic and hydraulic models** [38
2019	Conference Paper	Wright, A. [10], Grimaldi, S. [9], Li, Y. [29], Walker, J. [8] & Pauwels, V. [6] **Improving flood forecasting skill using remotely sensed data** [42]. *Bushfire and Natural Hazards CRC Research Day AFA*
2019	Journal Article	Grimaldi, S. [9], Schumann, G. [47], Shokri, A. [48], Walker, J. [8] & Pauwels, V. [6] **Challenges, Opportunities, and Pitfalls for Global Coupled Hydrologic Hydraulic Modeling of Floods** [49]. *Wat*
2019	Journal Article	Hilton, J. [54] *et al.* **River reconstruction using a conformal mapping method** [55]. *Environmental Modelling & Software* **119,** 197-213 (2019). DOI [56] Google Scholar [57] BibTeX [58] EndNote XML
2019	Report	Pauwels, V. [6], Walker, J. [8], Grimaldi, S. [9], Wright, A. [10] & Li, Y. [29] **Improving flood forecast using remote sensing data - annual report 2018-2019** [60]. (Bushfire and Natural Hazards CRC,
2018	Conference Paper	Wang, A. [64] *et al.* **Evaluation of TanDEM-X and DEM-H digital elevation models over the Condamine-Balonne catchment** [65]. *Hydrology and Water Resources Symposium (HWRS 2018): Wate*
2018	Journal Article	Li, Y. [29], Grimaldi, S. [9], Pauwels, R. N. [70] & Walker, J. [8] **Hydrologic model calibration using remotely sensed soil moisture and discharge measurements: The impact on predictions at g**
2018	Journal Article	Grimaldi, S. [9], Li, Y. [29], Walker, J. [8] & Pauwels, V. [6] **Effective Representation of River Geometry in Hydraulic Flood Forecast Models** [75]. *Water Resources Research* **54,** (2018). DOI [76] G
2018	Journal Article	Liu, S. [80], Li, Y. [29], Pauwels, V. [6] & Walker, J. [8] **Impact of rain gauge quality control and interpolation on streamflow simulation: an application to the Warwick Catchment, Australia** [81]
2018	Journal Article	Wright, A. [10], Walker, J. [8] & Pauwels, V. [6] **Identification of hydrologic models, optimized parameteres, and rainfall inputs consistent with in situ streamflow and rainfall and remotely sens**
2017	Conference Paper	Rumsewicz, M. [91] **Research proceedings from the 2017 Bushfire and Natural Hazards CRC and AFAC Conference** [92]. *Bushfire and Natural Hazards CRC & AFAC annual conference 2017* (Bu
2017	Conference Paper	Li, Y. [29], Grimaldi, S. [9], Wright, A. [10], Walker, J. [8] & Pauwels, V. [6] **Improving flood forecast skill using remote sensing data** [96]. *AFAC17* (Bushfire and Natural Hazards CRC, 2017). Google
2017	Journal Article	Wright, A. [10], Walker, J. [8] & Pauwels, V. [6] **A comparison of the discrete cosine and wavelet transforms for hydrologic model input data reduction** [100]. *Hydrology and Earth System Scienc*
2017	Journal Article	Wright, A. [10], Walker, J. [8] & Pauwels, V. [6] **Estimating rainfall time series and model parameter distributions using model data reduction and inversion techniques** [105]. *AGU* (2017). at <ht
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2016	Conference Paper	Li, Y. [29], Grimaldi, S. [9], Wright, A. [10], Walker, J. [8] & Pauwels, V. [6] **Improving flood forecast skill using remote sensing data** [114]. *AFAC16* (Bushfire and Natural Hazards CRC, 2016). Goog
2016	Journal Article	Grimaldi, S. [9], Li, Y. [29], Pauwels, V. [6] & Walker, J. [8] **Remote Sensing-Derived Water Extent and Level to Constrain Hydraulic Flood Forecasting Models: Opportunities and Challenges** [1
2016	Journal Article	Li, Y. [29], Grimaldi, S. [9], Walker, J. [8] & Pauwels, V. [6] **Application of Remote Sensing Data to Constrain Operational Rainfall-Driven Flood Forecasting: A Review** [122]. *Remote Sensing* **8,** (
2016	Magazine Article	Jones, F. [127] **Remote-sensing flood data is filling the gaps** [128]. *The Australian Journal of Emergency Management* **31,** (2016). Google Scholar [129] BibTeX [130] EndNote XML [131]
2016	Report	Pauwels, V. [6], Walker, J. [8], Li, Y. [29], Grimaldi, S. [9] & Wright, A. [10] **Improving flood forecast skill using remote sensing: Annual project report 2015-2016** [132]. (Bushfire and Natural Hazar
2015	Conference Paper	Li, Y. [29], Grimaldi, S. [9], Pauwels, V. [6], Walker, J. [8] & Wright, A. [10] **Combining hydrologic and hydraulic models for real time flood forecasting - non peer reviewed extended abstract** [13
2015	Report	Pauwels, V. [6], Walker, J. [8], Li, Y. [29], Grimaldi, S. [9] & Wright, A. [10] **Improving flood forecast skill using remote sensing data: Annual project report 2014-2015** [140]. (Bushfire and Natural H
2015	Report	Pauwels, V. [6] **Improving Flood Forecast Skill Using Remote Sensing Data Annual Report 2014** [144]. (2015). Google Scholar [145] BibTeX [146] EndNote XML [147]

Presentations & Resources

DATE [148]	TITLE [149]	DOWNLOAD	KEY TOPICS
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30 Aug 2016	Improving flood forecast skill using remote sensing data - Stefania Grimaldi [161]	5.05 MB [162] (5.05 MB)	engineering [163], flood [2], remote sensing [4]
17 May 2017	Remote sensing offers better forecasting of riverine floods [164]	277.44 KB [165] (277.44 KB)	flood [2], hydrology [166], remote sensing [4]
07 Jul 2017	Water, water everywhere: living with flood and coastal threats [167]	3.98 MB [168] (3.98 MB)	flood [2], severe weather [169], storm surge [170]
07 Sep 2017	Observationally-constrained flood forecasting [171]	1.64 MB [172] (1.64 MB)	flood [2], forecasting [3], remote sensing [4]
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27 Aug 2019	Improving flood forecast skill using remote sensing data [175]	3.83 MB [176] (3.83 MB)	remote sensing [4]

Posters

[177]

Improving flood forecasting skill using remote sensing data

[177]

Accurate, timely and precise Forecast precipitation is the "holy grail" of flood forecasting; this project...

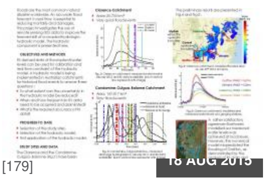
[178]

Improving flood forecasting skills using remote sensing data: precipitation retrieval

[178]

FLOOD [2], FORECASTING [3]

Accurate, timely and precise forecast precipitation is the "Holy Grail" of flood forecasting; this project...



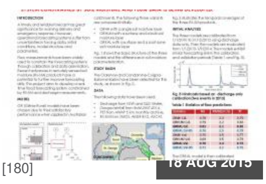
[179]

Improving Flood Forecast Skill Using Remote Sensing Data - Hydraulic Component

[179]

FLOOD [2], FORECASTING [3]

Accurate flood forecast is essential to save lives and reduce damages.How far can we get using remote sensing...



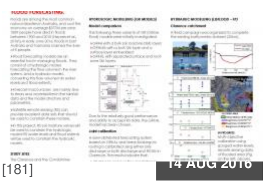
[180]

Improving Flood Forecasting Skill Using Remote Sensing Data - Hydrological Component

[180]

FLOOD [2], FORECASTING [3]

Flood forecasts suffer from various SOURCES of uncertainties. This project investigates the benefit of using...



[181]

Improving flood forecast skill using remote sensing data

[181]

FLOOD [2], REMOTE SENSING [4]

The use of remote sensing data in operational flood forecasting is currently receiving increasing attention.

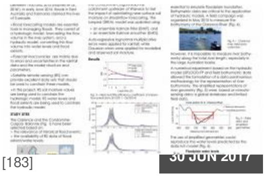
[182]

Improving flood forecasting skill using remote sensing data: rainfall estimation

[182]

FLOOD [2], HYDROLOGY [166]

This project aims to use hydrologic models and data assimilation theory to estimate catchment wide rainfall.



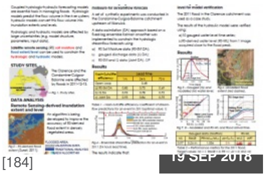
[183]

Improving flood forecast skill using remote sensing data: model/remote sensing data fusion

[183]

FLOOD [2], HYDROLOGY [166]

This project investigates the use of remotely sensed soil moisture data and flood extent/level to improve...



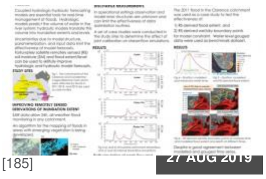
[184]

Improving flood forecast skill using Remote Sensing data

[184]

FLOOD [2], FORECASTING [3]

"The outcomes from this research will provide information for us to use remotely sensed data to improve our...



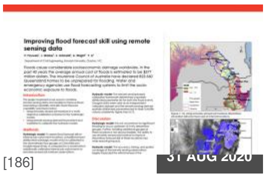
[185]

Improving flood forecast skill using remote sensing data

[185]

FLOOD [2], REMOTE SENSING [4]

This project investigates the use of remotely sensed soil moisture and inundation extent to improve the...



[186]

Improving flood forecast skill using remote sensing data

[186]

FLOOD [2], FORECASTING [3]

Key findings: Remotely sensed data can improve flood forecasting capability in poorly gauged catchments

Linked Projects

Resilience to clustered disaster events on the coast - storm surge [187]

FLOOD AND COASTAL MANAGEMENT [188]

Dr Scott Nichol
Geoscience Australia [15]

[15]

Developing better predictions for extreme water levels [189]

FLOOD AND COASTAL MANAGEMENT [188]

Prof Charitha Pattiaratchi
University of Western Australia [190]

[190]

Improving flood forecast skill using remote sensing data

[5]

FLOOD AND COASTAL MANAGEMENT [188]

A/Prof Valentijn Pauwels
Monash University [7]

[7]

Mapping bushfire hazard and impacts [191]

BUSHFIRE PREDICTIVE SERVICES [192]

A/Prof Marta Yebra
Australian National University [193]

[193]

Fire surveillance and hazard mapping [194]

BUSHFIRE PREDICTIVE SERVICES [192]

Prof Simon Jones
RMIT University [195]

[195]

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[1] https://www.bnhcrc.com.au/files/istock000019955974webjpg [2] https://www.bnhcrc.com.au/research/topics/flood [3] https://www.bnhcrc.com.au/research/topics/forecasting [4] https://www.bnhcrc.com.au/research/topics/remote-sensing [5] https://www.bnhcrc.com.au/research/floodforecasting [6] https://www.bnhcrc.com.au/people/vpauwels [7] https://www.bnhcrc.com.au/organisations/monash [8] https://www.bnhcrc.com.au/people/jwalker [9] https://www.bnhcrc.com.au/people/sgrimaldi [10] https://www.bnhcrc.com.au/people/awright [11] https://www.bnhcrc.com.au/people/chrisleahy [12] https://www.bnhcrc.com.au/people/chris.leahy [13] https://www.bnhcrc.com.au/organisations/bom [14] https://www.bnhcrc.com.au/people/nmueller [15] https://www.bnhcrc.com.au/organisations/ga [16] https://www.bnhcrc.com.au/people/fang-yuan [17] https://www.bnhcrc.com.au/people/Fang-Yuan [18] https://www.bnhcrc.com.au/people/esimmons [19] https://www.bnhcrc.com.au/organisations/nswses [20] https://www.bnhcrc.com.au/publications/biblio/bnh-7694 [21] https://www.bnhcrc.com.au/news/2020/new-online-december-2020 [22] https://www.bnhcrc.com.au/news/2020/new-online-august-2020 [23] https://www.bnhcrc.com.au/news/2019/special-edition-monographs-share-afac19-science-0 [24] https://www.bnhcrc.com.au/news/2019/new-online-august-2019 [25] https://www.bnhcrc.com.au/news/2019/new-online-june-2019 [26] https://www.bnhcrc.com.au/news/2016/remote-sensing-flood-data-filling-gaps [27] https://www.bnhcrc.com.au/news/2016/river-bed-mapping-help-flood-forecasting [28] https://www.bnhcrc.com.au/publications/biblio?f%5Bauthor%5D=1750 [29] https://www.bnhcrc.com.au/people/yli [30] https://www.bnhcrc.com.au/publications/biblio/bnh-6266 [31] http://dx.doi.org/10.1016/j.rse.2019.111582 [32] http://scholar.google.com/scholar?btnG=Search%2BScholar&as_q=%22Flood%2Bmapping%2Bunder%2Bvegetation%2Busing%2Bsingle%2BSAR%2Bacquisitions%22&as_sauthors=Grimaldi&as_occt=any&as_epq=&as_oq=&as_eq=&
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