

# River ice monitoring (AQUA) via screening-in thin cloud data and its validation

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- I. Introduction
- II. Detecting opt. thick clouds and river ice
- III. Algorithm
- IV. Results and validation (daily)
- V. Results and validation (entire winter)



# River ice and ice jams

#### ≻Purpose

➤Using satellites to obtain frequent river ice observations over a larger region

➤Stakeholders

National Weather Service
National ice center
River forecasting centers
Sus. River Basin Commission
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#### Susquehanna River Basin







# Discharge at Harrisburg, PA

Discharge for the 171 days monitored

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Blue: Median Q Yellow: Estimated Q Black: Observed Q Bars: 25<sup>th</sup> to 75<sup>th</sup> percentile Q





#### Problem statement

Nov 1 to Apr 20 (171 days)
Clouds cover the river (CM)
Especially when it bears ice, 90 d\*
>50% of river CF in only 2/90 d\*
But clouds often are opt. thin!\*

#### ≻Approach:

Develop automated algorithm to extract data when/where clouds are opt. thin first, then check results



Aqua (547, scaled) with cloud masks (1/13/14). White: cloud, Grey: mixed cloud.

NOAACRES



## II. Relevant VIS/NIR bands





## II. Band decomposition (Jan 9, 2014)





# II. Determining where the river is

River masks (AQUA, 500m)
Max. Likelihood for bands 1-4,7
Based on 3 images (Summer 2009)
Keep only those that were classified as river in every scene





### II. Statistical contrast of band 7, river (7r)







#### II. Statistical contrast of band 7, scene (7s)





Aqua (547), 11/1/13.



## II. Statistical contrast of band 7, river (7r)





Aqua (547), 12/22/13.



## II. Statistical contrast of band 7, scene (7s)





Aqua (547), 12/22/13.



## II. Histogram of data that includes ice, snow





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# III. Algorithm

#### Test 1: Informed by time series





#### IV. Results (daily)







N/A Cld Wtr Low Mod High SZA

N/A Cld Wtr Low Mod High SZA

17





	Cloud flag			Algorithm		
Days since 11/01/13	Data	Obs	Rev	Data	Obs	Rev
1-42 (42d, no ice)	9.1	25	4.6	7.8	8	5.4
43-132 (90d, ice)	6.1	37	14.8	23.9	24	3.8
133-171 (39d, no ice)	11	24	3.5	9.92	10	3.9

Data: 1.0 represents 402 pixels, Obs: number of days in which at least one pixel was observed, Rev: effective revisit time (days)



IV. Validation (winter)





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≻ Dr. Bill Rossow

► IDL Coyote

► REU & HIRES Students

Kathy Ammari (2014-15), Damola Ajibola (2014), Steven Persaud (2015), William Rivers (2015)

➢ Recent presentations (2015)

> AMS, NOAA EPP, NOAA Advisory board meeting