Global Flood Monitoring System (GFMS)

Using Satellite Rainfall and Hydrological Models to Estimate Flooding across the Globe

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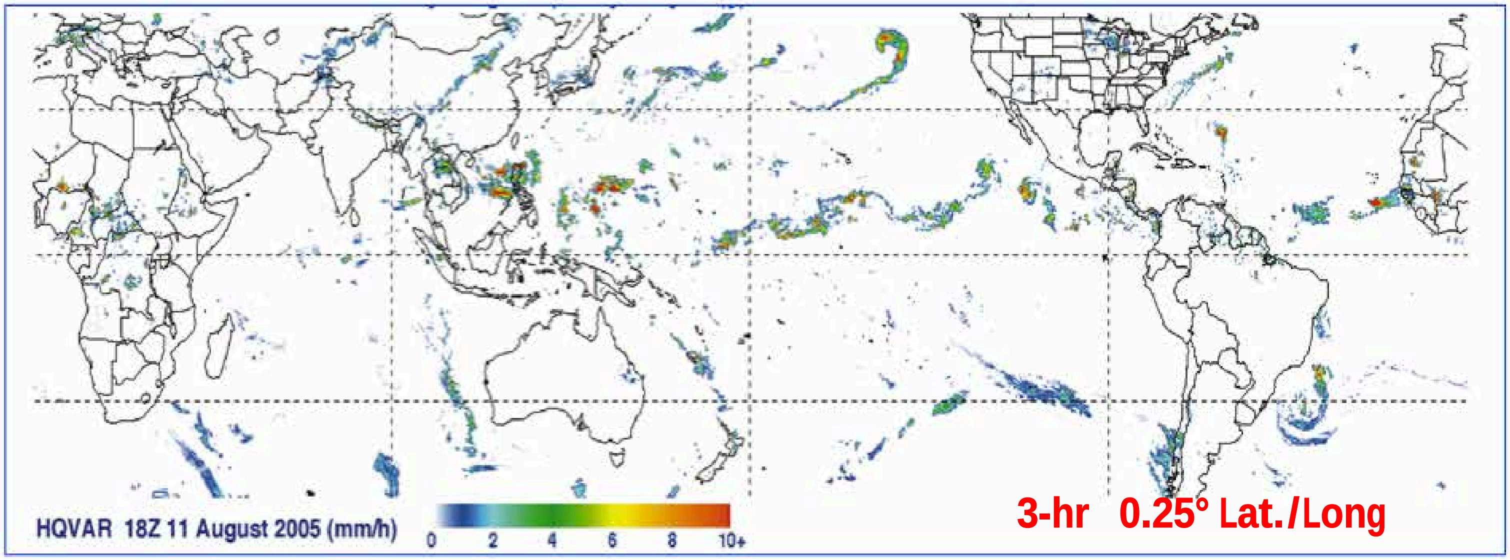
Wu, H., R. F. Adler, Y. Tian, G. J. Huffman, H. Li, and J. Wang (2014), Real-time global flood estimation using satellite-based precipitation and a coupled land surface and routing model, Water Resour. Res., 50, doi:10.1002/2013WR014710.

Global Flood Calculations Using Satellite Rainfall and Hydrological Model

Rainfall input from satellite information---Currently using <u>TRMM Multi-satellite Precipitation Analysis [TMPA/3B42]</u>

<u>(TRMM data used to adjust rain estimates from polar orbit PMW)</u>



- ***Other available candidate rainfall products, e.g., CMORPH (NWS/CPC), GSMaP***
- ***Getting ready for <u>Global Precipitation Measurement (GPM)</u> IMERG multi-satellite product—automatic re-processing to beginning of TRMM era (1998) for consistent long record***
- ***Also using global <u>NWP output</u> to extend flood predictions out to 5 days or beyond***

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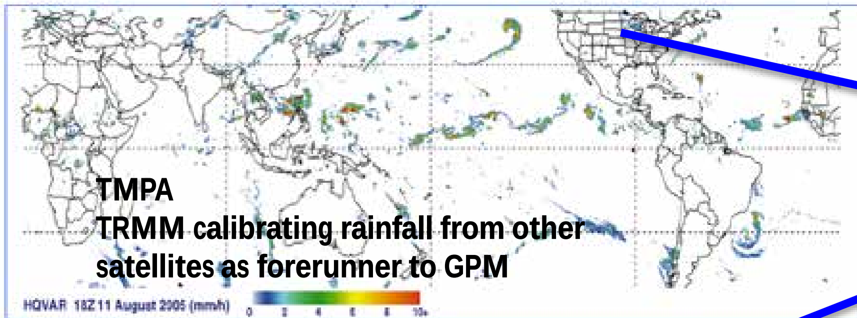
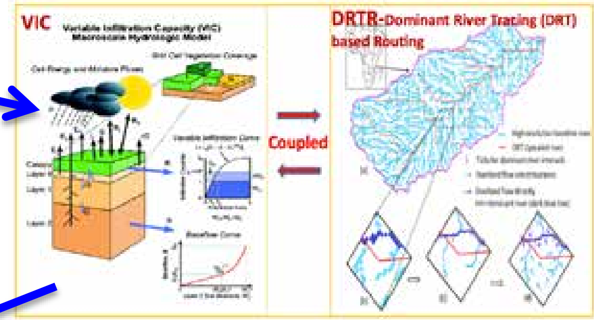
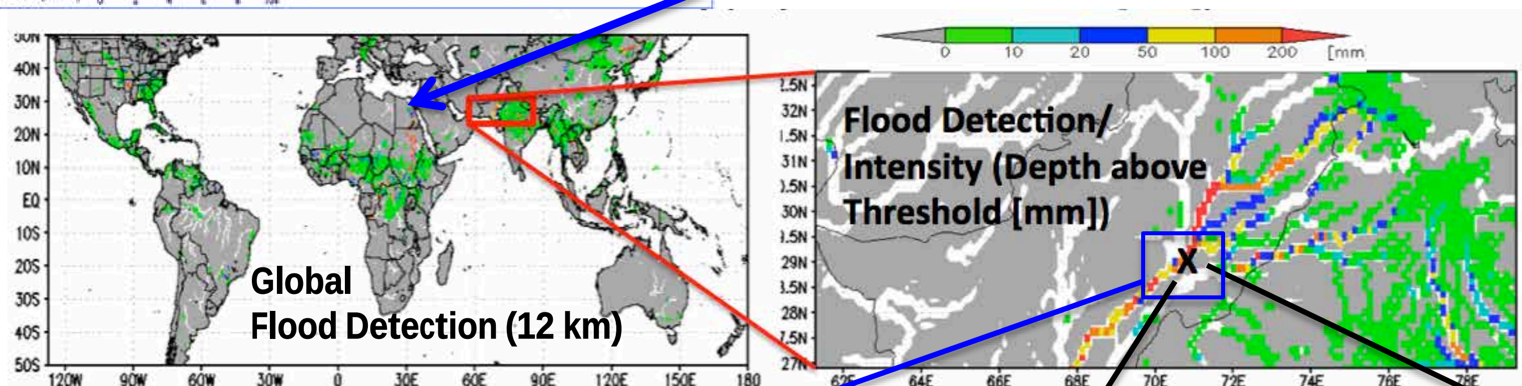
Global Real-time Flood Calculations Using Satellite Rainfall and Hydrological Model

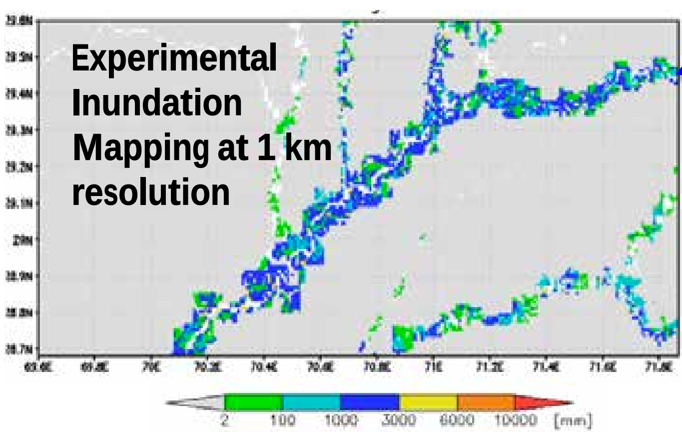


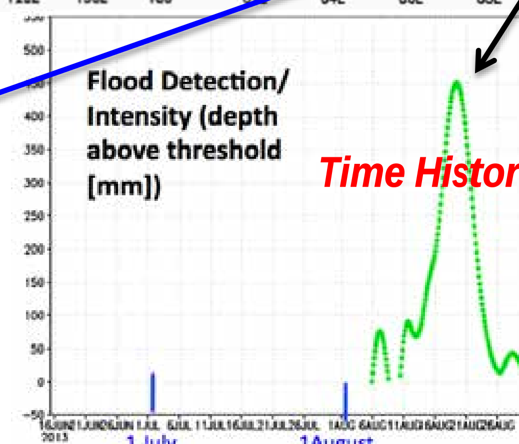


TRMM/GPM rainfall into land surface and routing models for water depth and stream flow calculations compared to flood thresholds

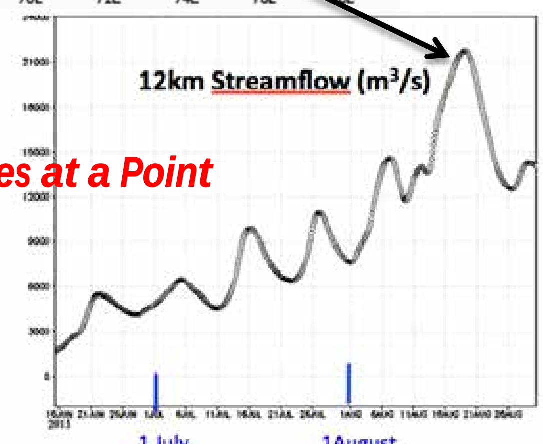


Indus River basin Aug. 20 2013





Time Histories at a Point



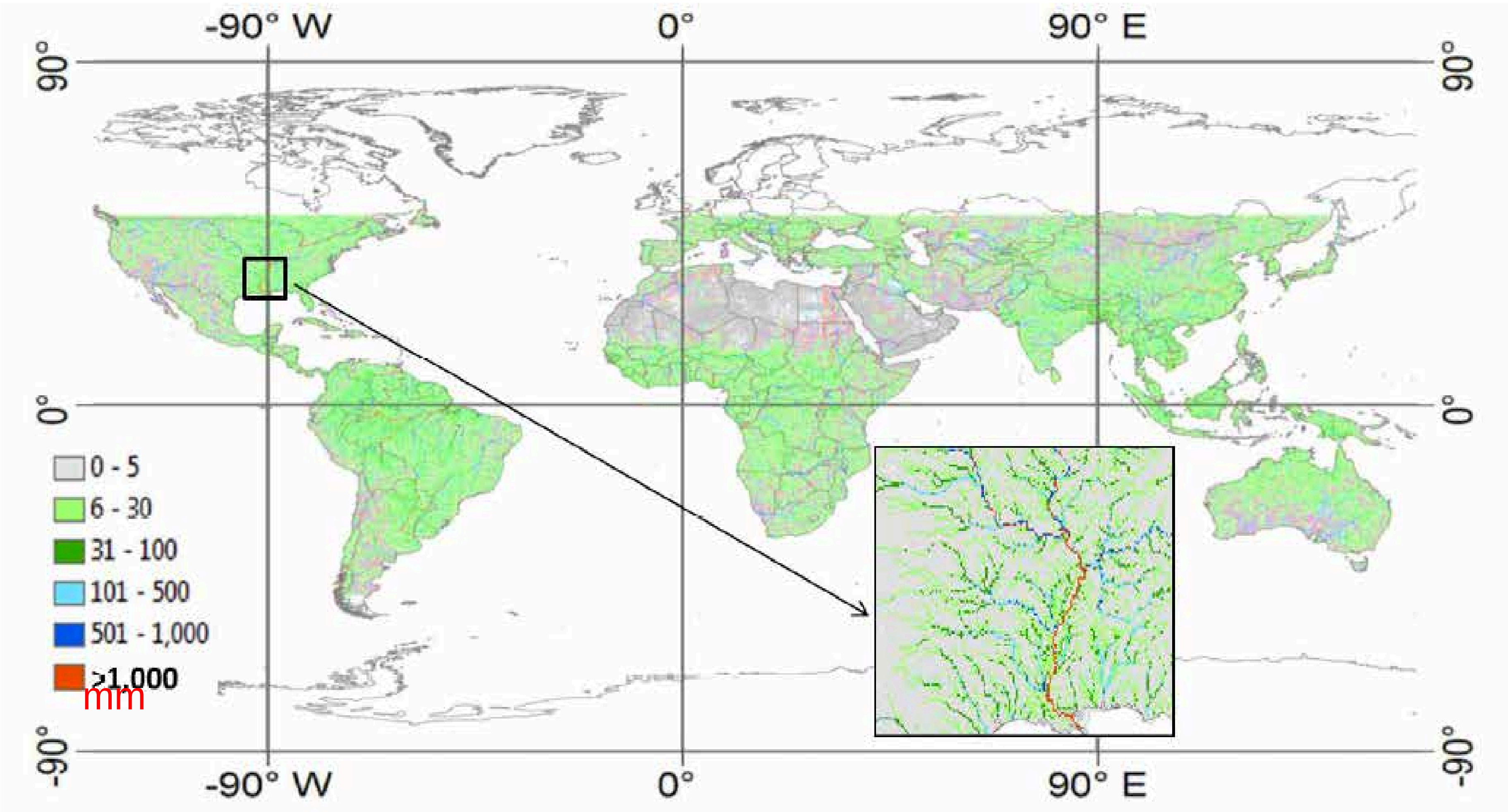
GFMS Features and Capabilities

- Global views of precipitation, streamflow and flood parameters at 12 km resolution
- Zoom, roam on individual fields and switch from parameter to parameter
- Examine forecasts of all the parameters out to ~ 5 days
- Time history plots for current and historical events
- Zoom in to examine 1 km resolution streamflow and inundation estimates (no forecasts at 1 km resolution; one month revolving archive)

Flood Threshold Map for Flood Detection/Intensity Parameter

Routed Runoff (RR) > $RR_{95th\ Percentile}$ + δ and Q (streamflow) > 10 m^3/s,
where δ is temporal standard deviation of RR.

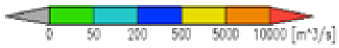
<u>REFERENCE LEVEL</u> at each grid calculated from <u>15-year global hydrology model run using satellite rainfall data</u>

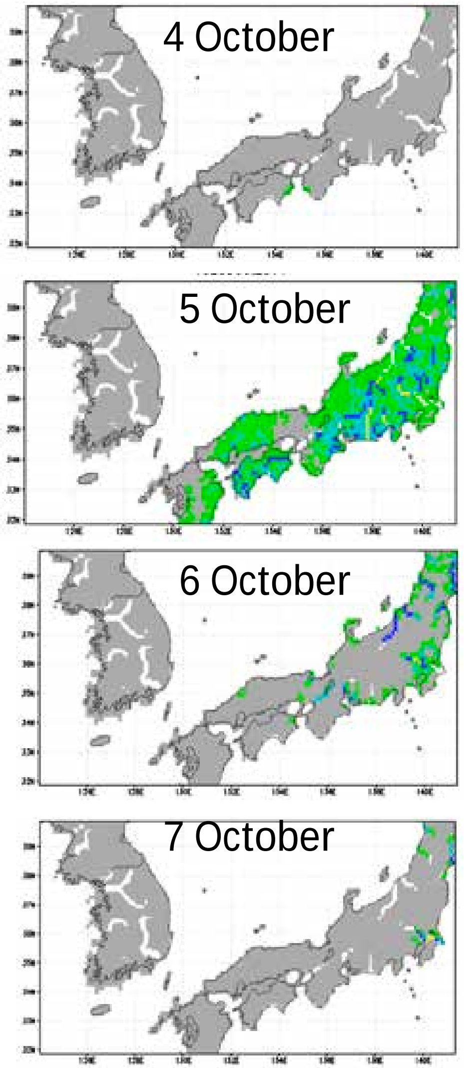


Same Approach is Used for Streamflow

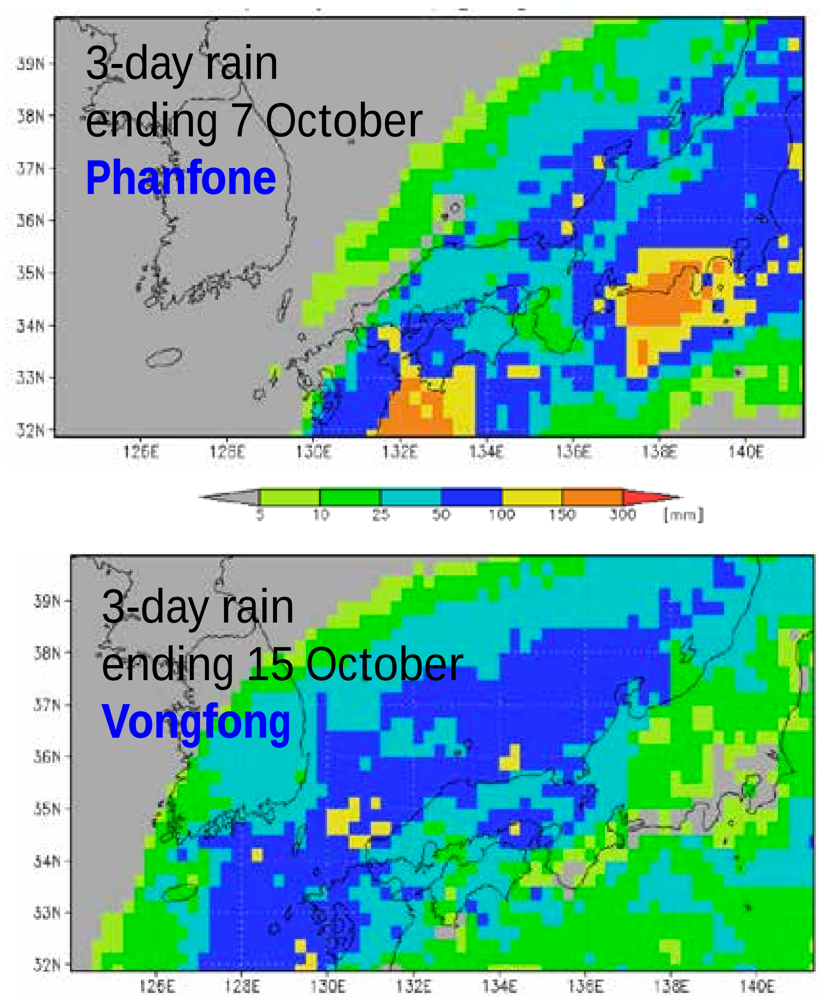
Rainfall and Flooding with Typhoons Phanfone and Vongfong (October 2014)

Streamflow above Flood Threshold (m^3/s)

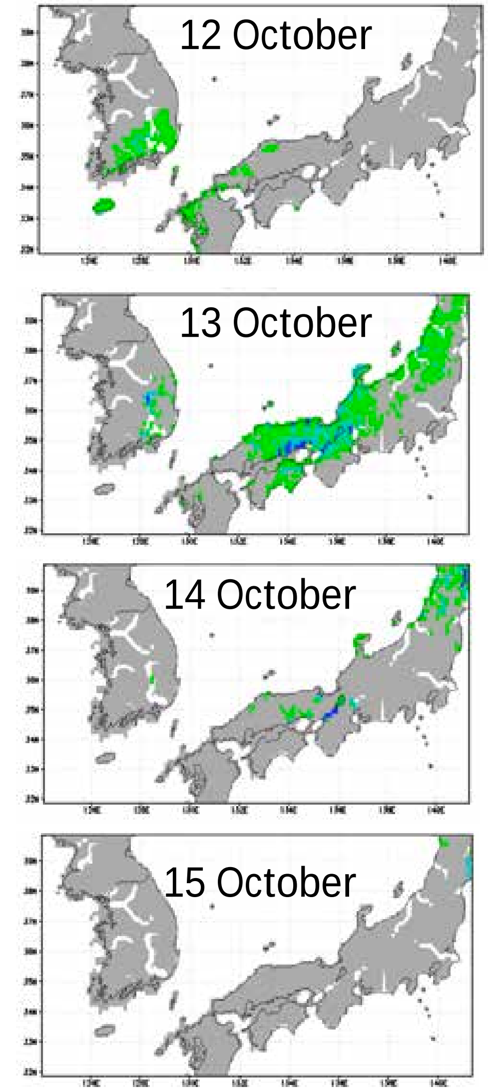




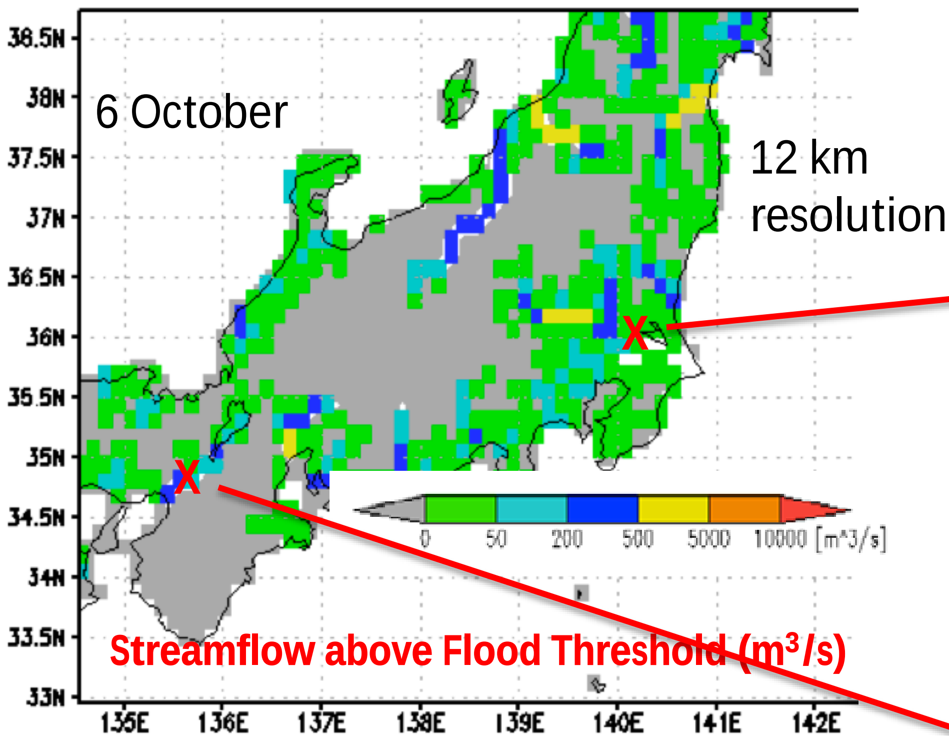
3-day rain

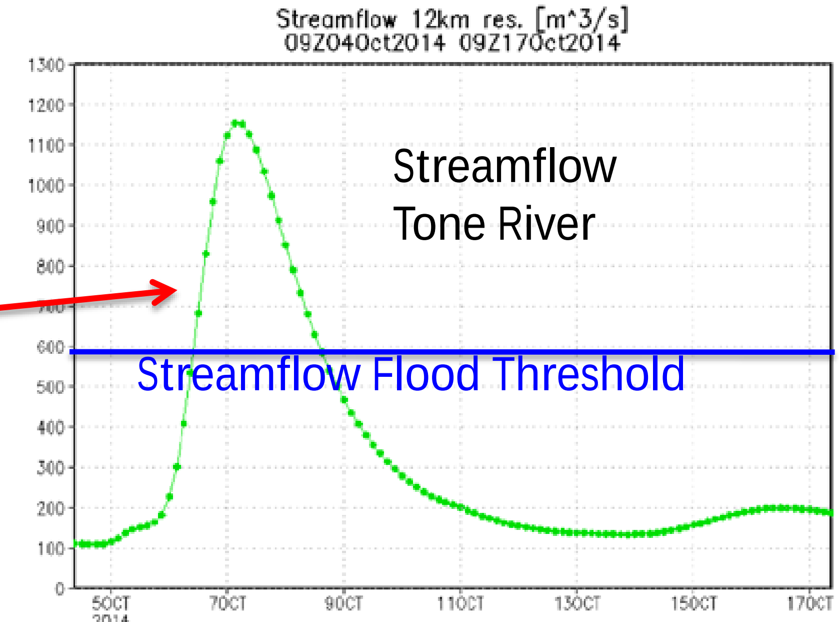


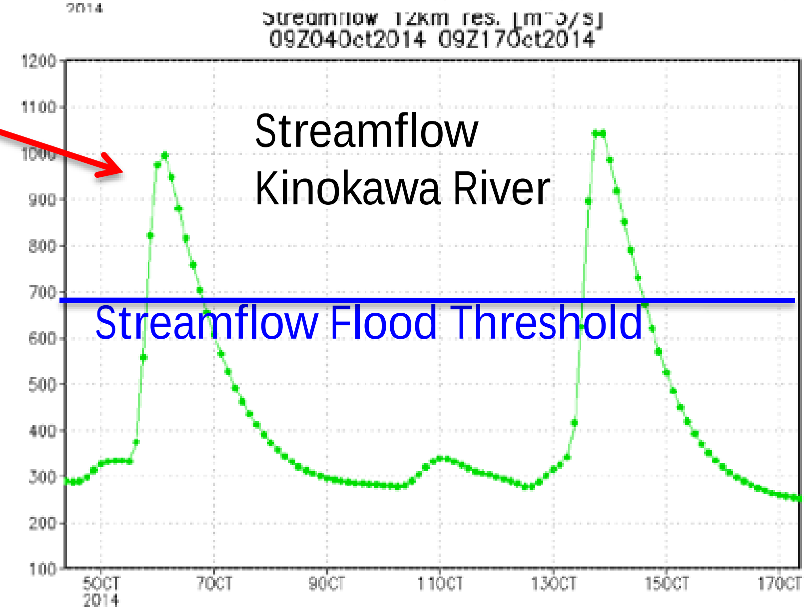
Streamflow above Flood Threshold (m^3/s)



Time Histories of Streamflow at Two rivers in Japan (3-17 Oct.)

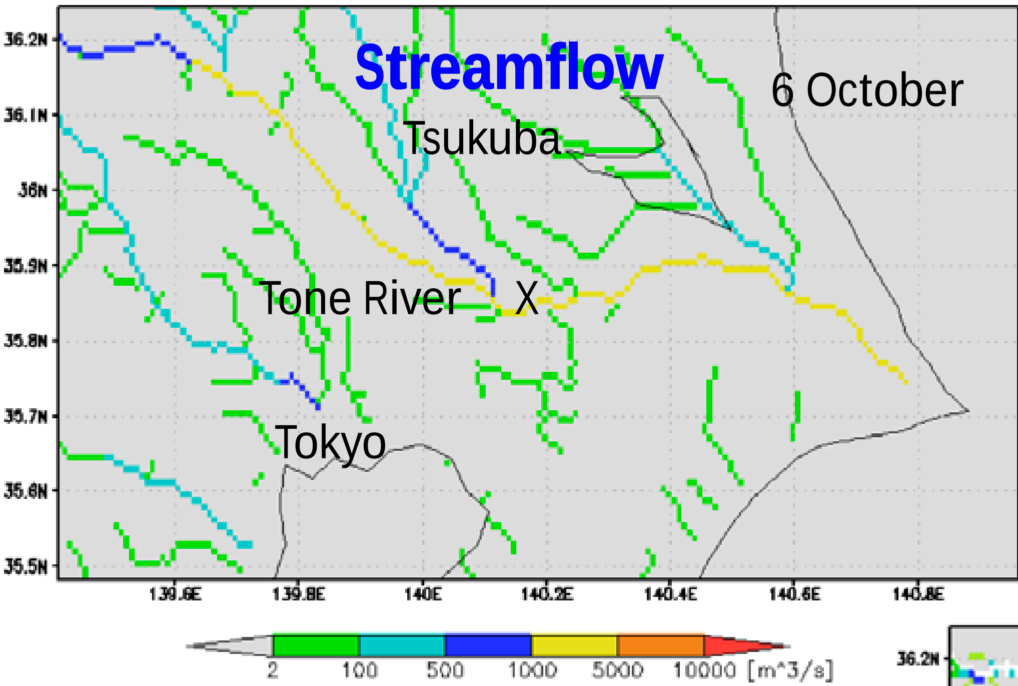




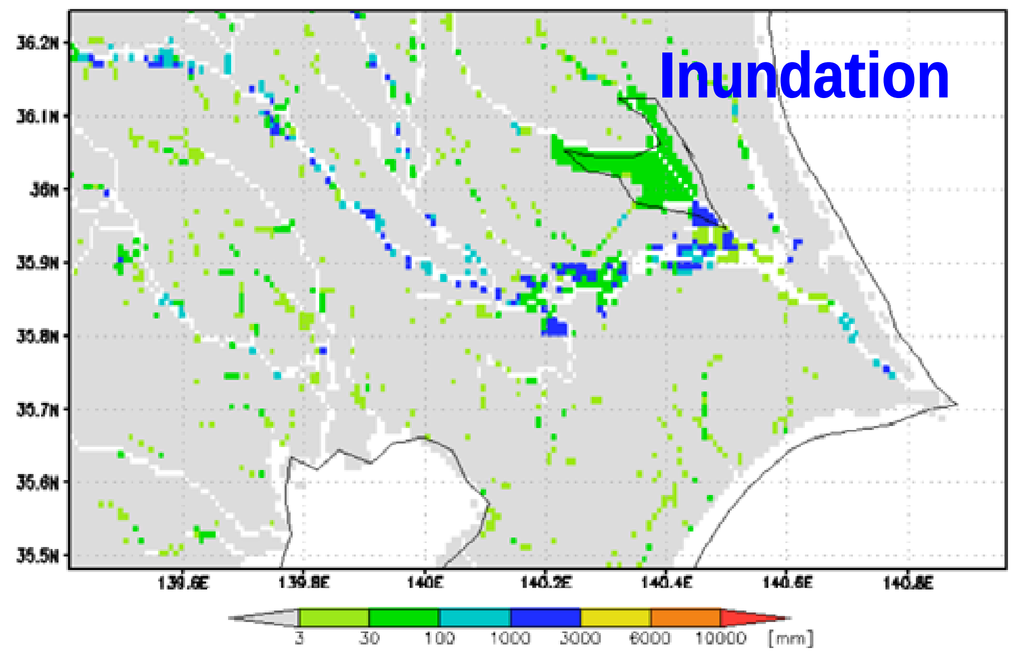


Panels at right show time histories of calculated streamflow in two Japan rivers indicating impact of the two typhoons, with earlier storm (Phanfone) showing higher values in Tone River (near Tsukuba). Also seen is time shift from south to north as storms travel across Japan.

Streamflow and Inundation Calculations at 1km Resolution

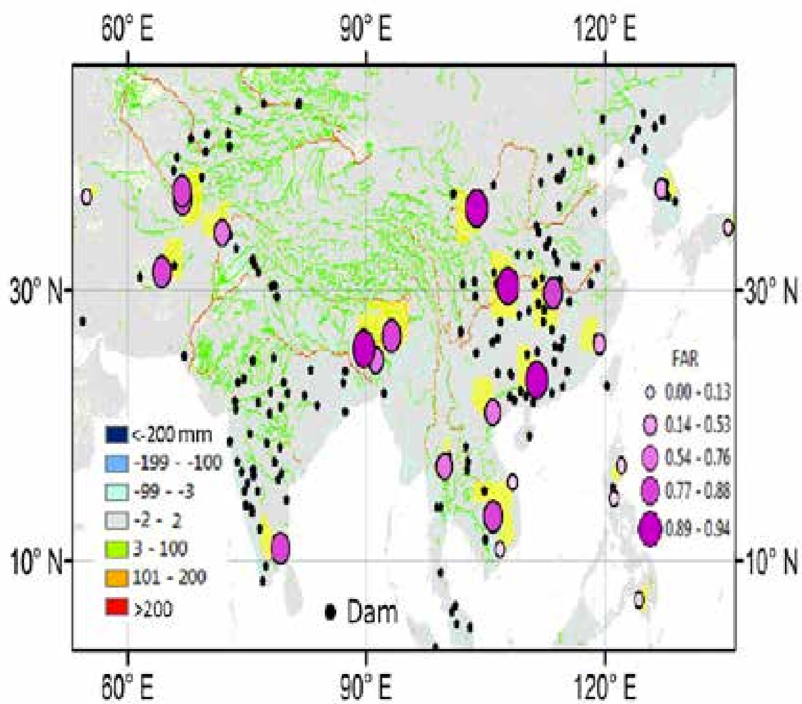


Typhoon Phanfone has swept through and produced some flooding, particularly north of Tokyo (see calculated inundation map [1 km resolution]).



Flood detection verification against the Dartmouth Flood Observatory (DFO) flood database over the 38 Well Reported Areas (WRAs) for floods with duration of one or more days (not flash floods).

Metrics	POD	FAR	CSI
Metrics averaged over all the 38 WRAs			
DRIVE-V7RT	0.90	0.73	0.25
DRIVE-V7	0.93	0.65	0.34
Metrics averaged over the 20 WRAs with ≥ 5 dam			
DRIVE-V7RT	0.93	0.80	0.19
DRIVE-V7	0.94	0.73	0.26
Metrics averaged over the 18 WRAs with < 5 dam			
DRIVE-V7RT	0.87	0.66	0.32
DRIVE-V7	0.92	0.56	0.43



Yellow regions are "Well Reported Areas" (WRA's)

Dots are dams

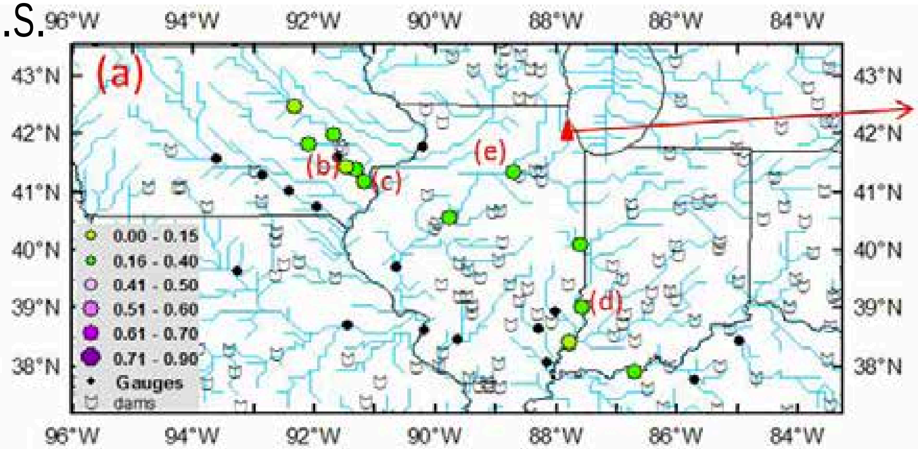
Better flood detection statistics with "research" (instead of RT) rain and with fewer dams (drop in FAR)

Bottom line—For 1+ day floods in basins with few dams using RT rainfall:

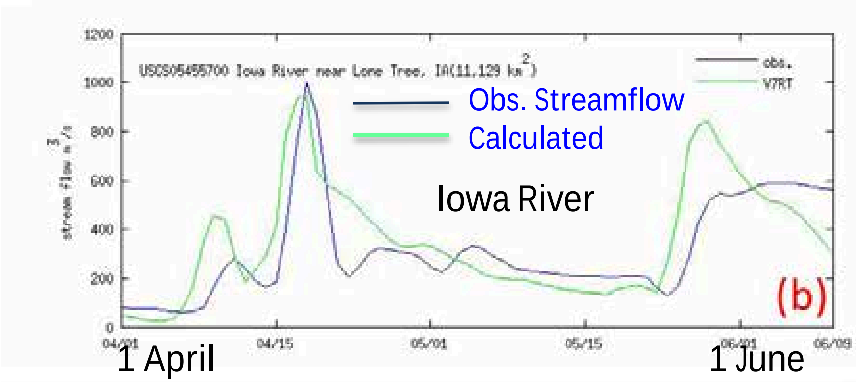
POD ~ 0.9 FAR ~ 0.7

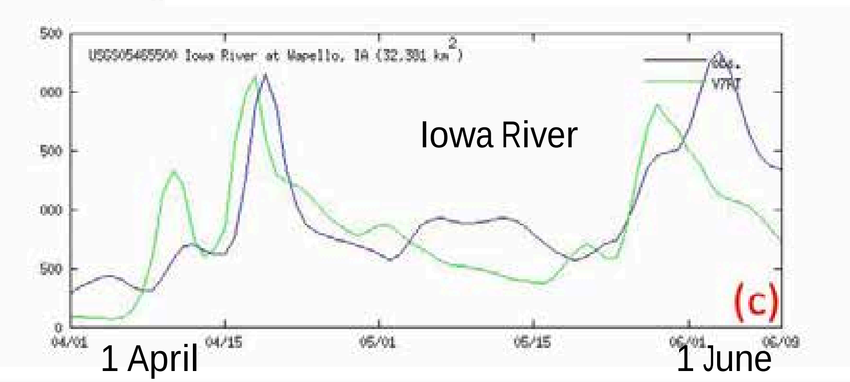
Wu et al., 2014 Water Resources Research

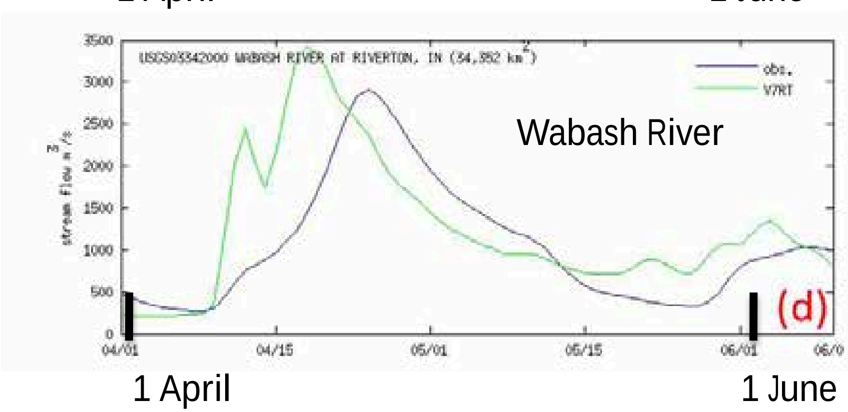
Streamflow Caluclations (1/8th Degree) Compared to Observations May 2013 over U.S.

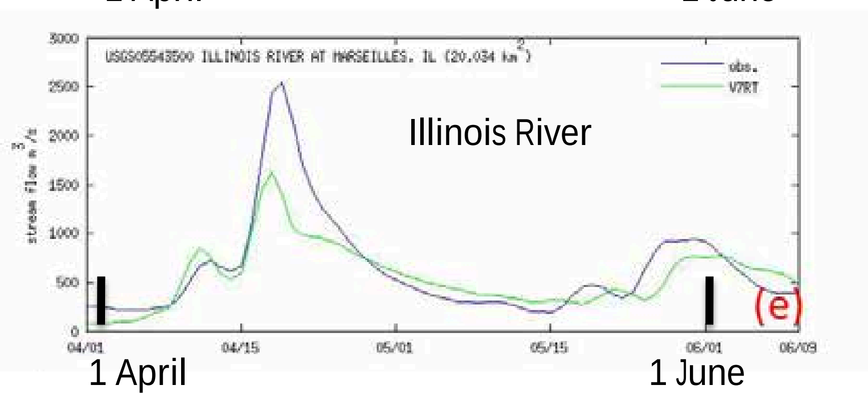


Internet source: April 19, 2013, Des Plaines, IL









Recent (in one month) Visitors/Users of GFMS website (http://flood.umd.edu)

Weekly Stats Report: 31 Mar - 6 Apr 2014
Project: Global Flood Monitoring System

	Mon	Tues	Wed	Thur	Fri	Sat	Sun	Total	Avg
Pageloads	104	29	25	17	25	4	5	**209**	30
Unique Visits	50	28	21	16	15	4	5	**139**	20
First Time Visits	27	11	10	9	10	2	3	**72**	10
Returning Visits	23	17	11	7	5	2	2	**67**	10