

Cyclone Gulab

September 29th, 2021

A depression formed on 24th September in the Bay of Bengal, very quickly intensified into a Deep Depression and further into a Cyclonic Storm making landfall in the evening on 26th September between Kalingapatnam in Andhra Pradesh and Gopalpur in Odisha. The Government of Odisha and the Government of Andhra Pradesh proactively took measures to reduce impact. Odisha's Chief Minister Naveen Patnaik set a 'zero casualty' target¹ in the coastal districts of the State as Odisha government evacuated as many as 3049 people and shifted them to 204 relief shelters². 42 teams of the Odisha Disaster Rapid Action Force (ODRAF) and 24 squads of the National Disaster Response Force (NDRF), along with about 102 teams of fire brigade personnel were dispatched to seven at-risk districts -- Gajapati, Ganjam, Rayagada, Koraput, Malkangiri, Nabarangpur and Kandhamal. In Andhra Pradesh, 61 relief centers³ were opened in Srikakulam and at risk population were shifted to the relief centers. Railway network was affected as several trains were cancelled, short-terminated or rescheduled by Indian Railways⁴. There are reports of several fishermen from both Andhra Pradesh and Odisha missing, despite early warnings issued by nodal agencies⁵.

¹ shorturl.at/blxHX

² <https://www.indiatoday.in/india/story/odisha-evacuation-shelter-homes-cyclone-gulab-landfall-1857413-2021-09-26>

³ shorturl.at/lxPQ0

⁴ <https://www.livemint.com/news/india/cyclone-gulab-indian-railways-cancels-several-trains-till-27-september-full-list-11632621429038.html>

⁵ shorturl.at/gvPRZ

The system is currently over Maharashtra having weakened into a well-marked low (WML) and is likely to move north-westward and weaken gradually during next 24 hours. The IMD also warn of further emergence of the system into northwest Arabian sea and coastal Gujarat around 30th September and further intensifying into a depression.

Rainfall and Wind warnings

As per bulletin no. 25 of the IMD, the following places are likely to face rainfall and wind:

Table 1 Forecasted impact on the States in the next 48 hours – Rainfall and Wind

Date	Rainfall	Wind
29 th September	Extremely heavy to very heavy/ heavy rainfall likely over South Gujarat Heavy to very heavy rainfall over north Madhya Maharashtra, and Konkan Heavy rainfall over Marathwada	
30 th September	Heavy to very heavy rainfall over Saurashtra, Kutch Heavy rainfall over Gujarat	

WRF PRECIPITATION FORECAST

RMSI has analyzed WRF forecasted rainfall for September 29th and 30th to identify the major precipitation hotspots.

Gujarat: Anand, Bharuch, Bhavnagar, Botad, Devbhumi Dwarka, Jamnagar, Morvi, Navsari, Porbandar, Rajkot, Surendranagar, Vadodara, and Valsad districts are expected to receive high amounts of rainfall on 29th September. On 30th September, however, only Devbhumi Dwarka is expected to experience high rainfall.

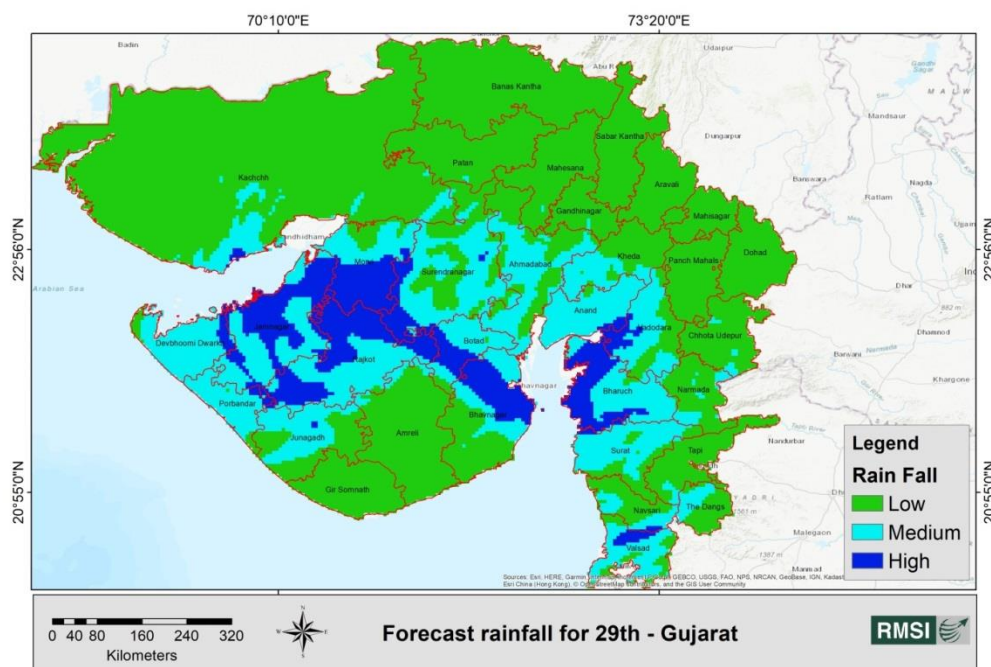


Figure 1 Rainfall Forecasts Gujarat - 29th September 2021

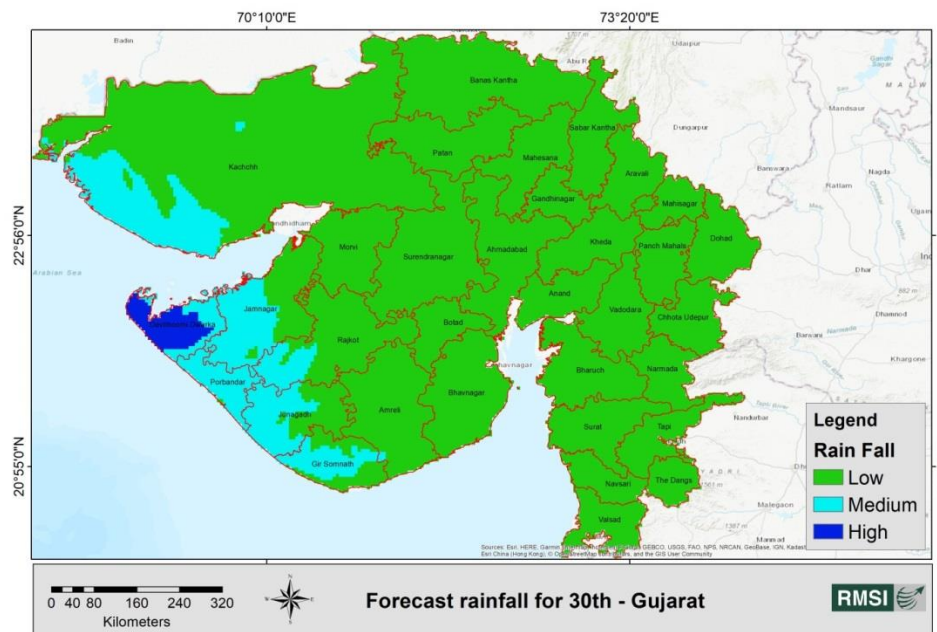


Figure 2 Rainfall forecasts Gujarat - 30th September 2021

Maharashtra: Amravati, Dhula, Buldana, Mumbai Suburban, Raigadh, Kolhapur, Jalgaon, Thane, Sindhudurg, Ratnagiri, Pune, Palghar, Nandurbar and Nashik districts are expected to receive high rainfall on 29th September. Nashik, Satara, Ahmadnagar, Gondiya, Gadchiroli, Bhandara, Nagpur, Sindhudurg, Kolhapur, Pune, Palghar, Ratnagiri, Thane, and Raigadh districts are expected to receive heavy rainfall on the 30th.

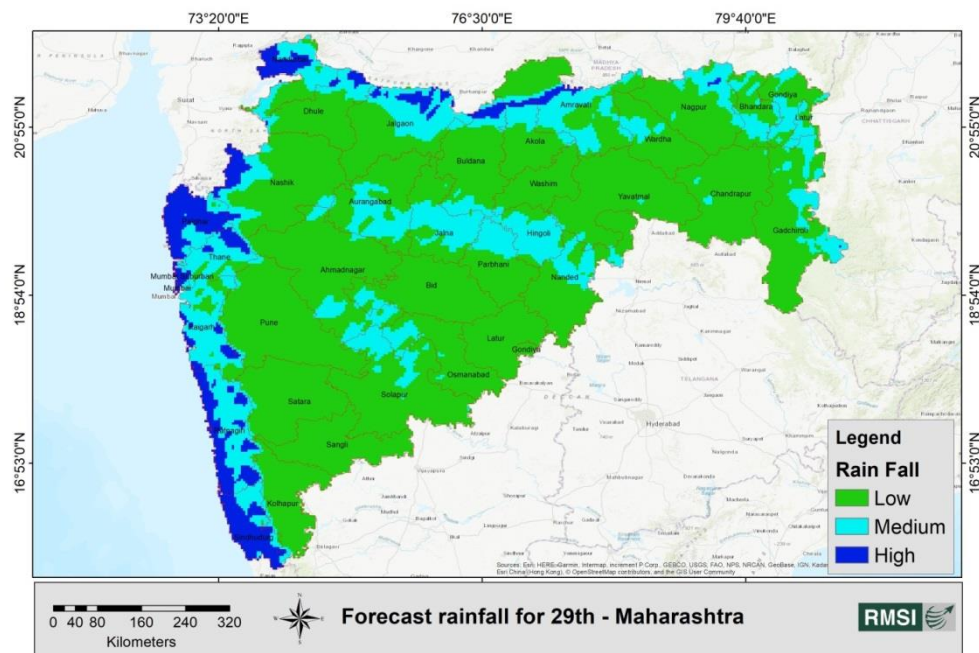


Figure 3 Rainfall forecasts Maharashtra - 29th September 2021

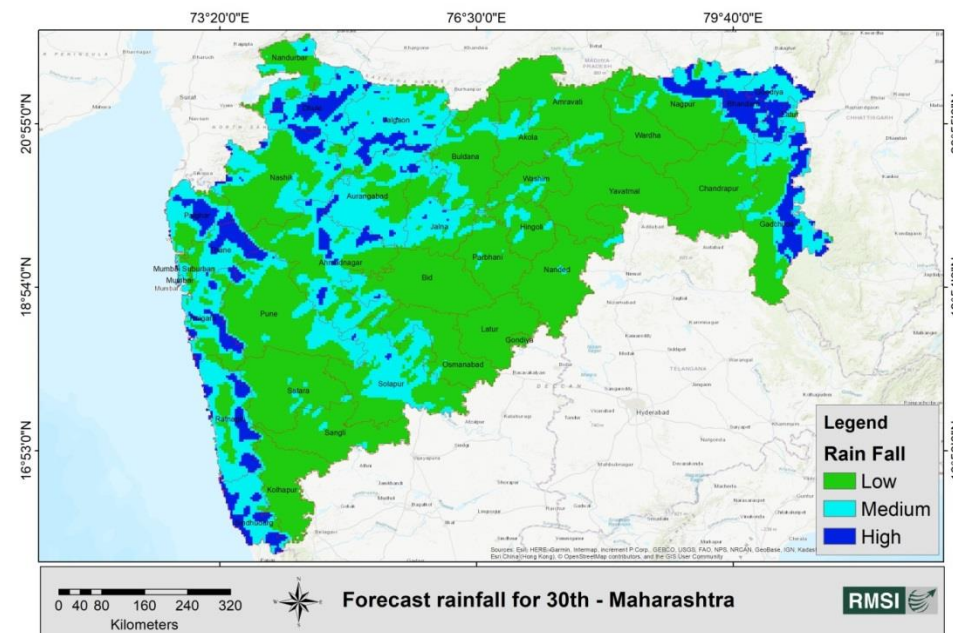


Figure 4 Rainfall forecasts Maharashtra - 30th September 2021

ANALYSIS

RMSI analyzed potential flood and wind impacts due to Cyclone Gulab (based on hazard information from the IMD bulletin on September 26th 2021 at 1830 hours IST and forecast rainfall for 25th, 26th and 27th). The following maps depict the potential flood and wind affected areas.

As per our analysis, Srikakulam, Vizianagaram districts in Andhra Pradesh and Ganjam and Gajapati districts in Odisha faced maximum winds due to Cyclone Gulab.

FLOOD IMPACT

East Godavari, West Godavari, Guntur, Krishna, Prakasam, Srikakulam and Visakhapatnam districts in Andhra Pradesh faced significant flood impacts while in Odisha Bhadrak, Kendrapara, Puri, Jajapur, Jagatsinghpur, Cuttack, Baleswar, Khorda and Cuttack faced significant impacts due to flooding.

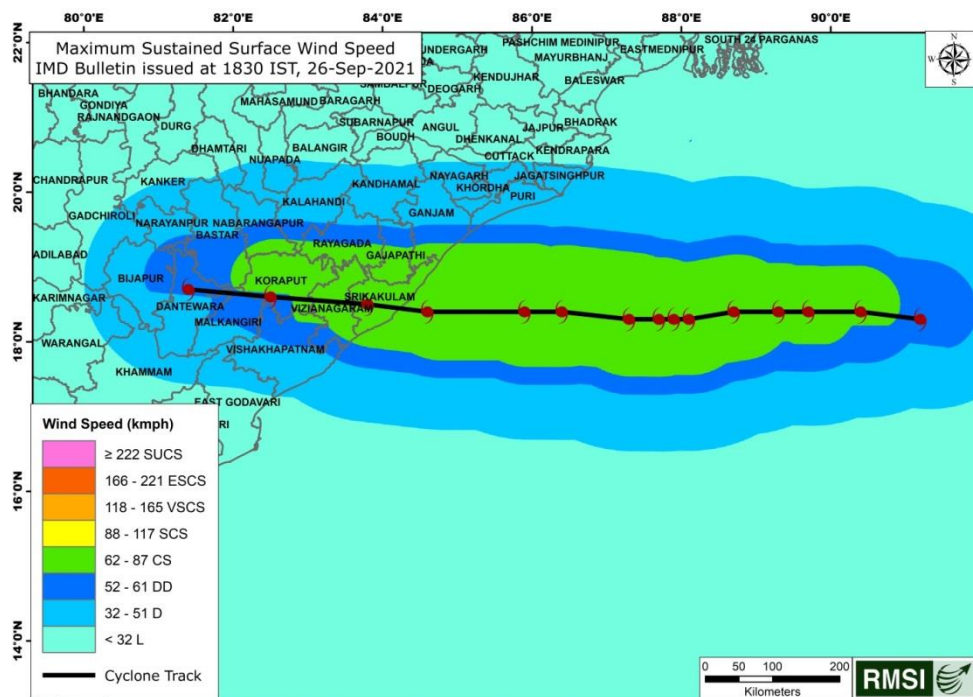


Figure 5 Potential Impact due to wind over Eastern India (Odisha, Andhra Pradesh) due to Cyclone Gulab

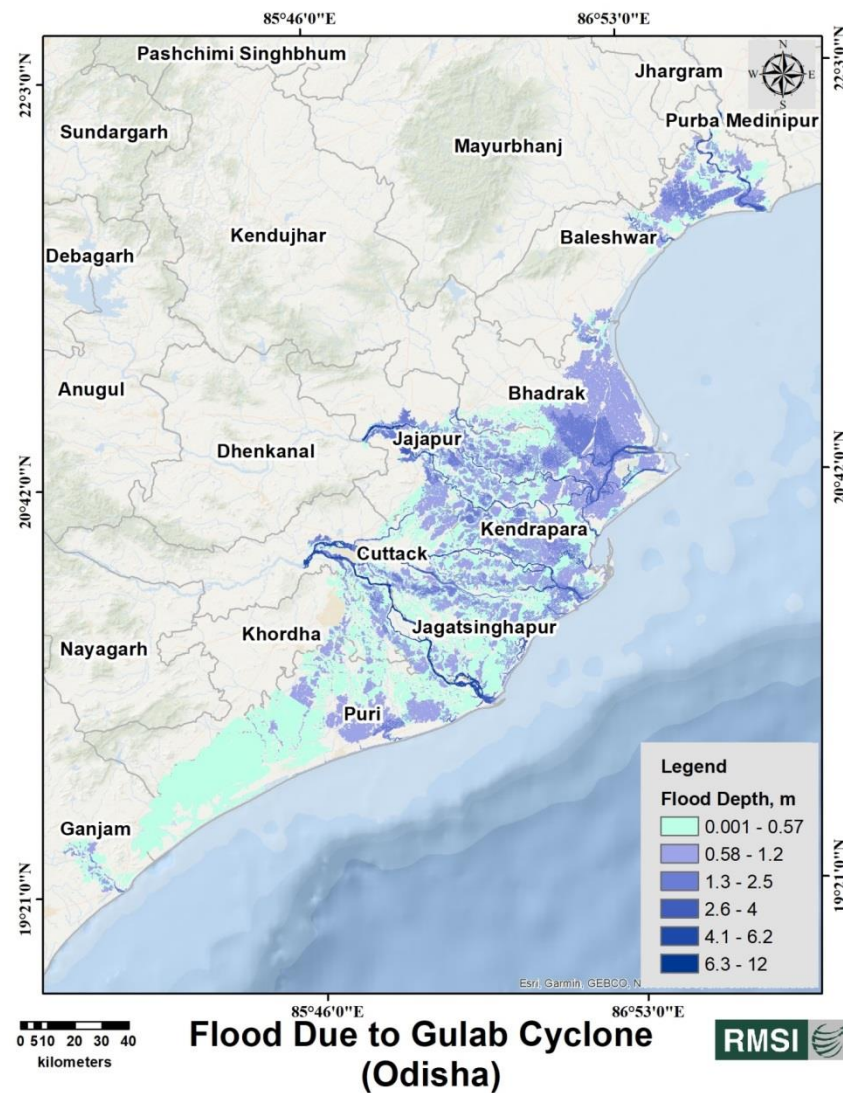
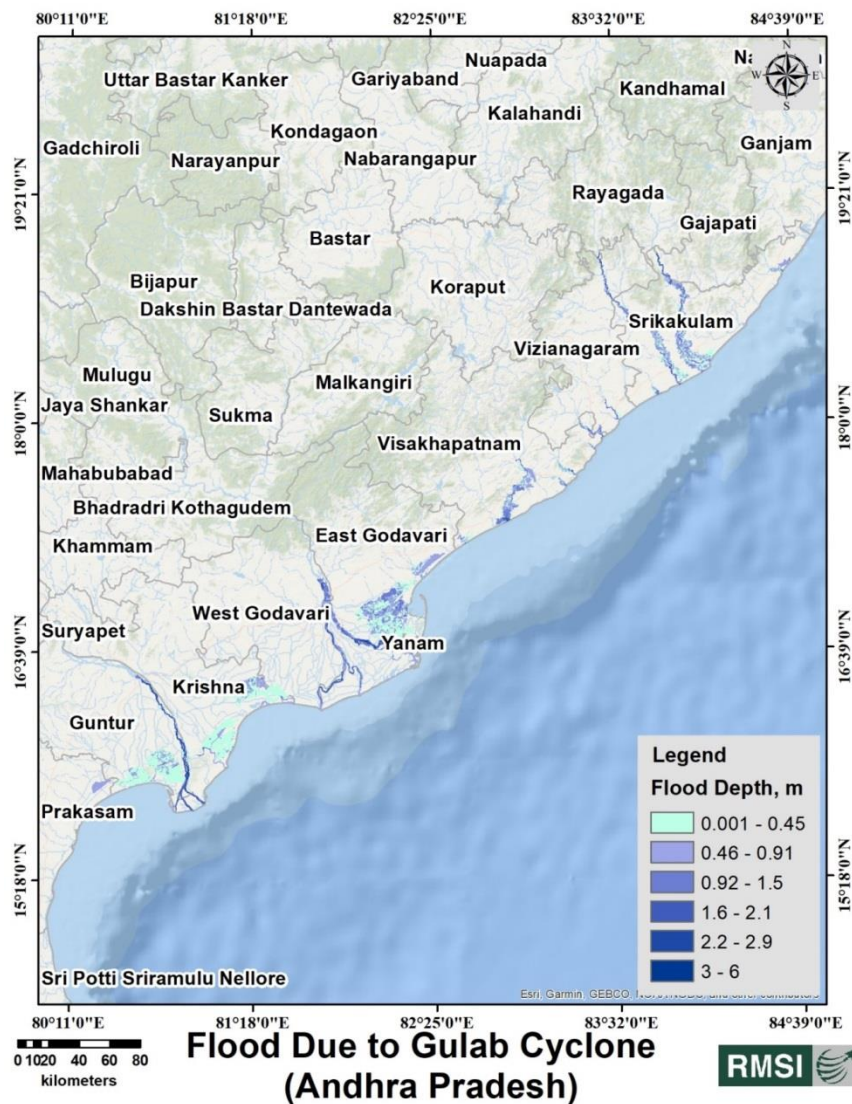


Figure 7 Potential Impact due to flood in Odisha - Cyclone Gulab

Figure 6 Potential Impact due to flood in Andhra Pradesh - Cyclone Gulab

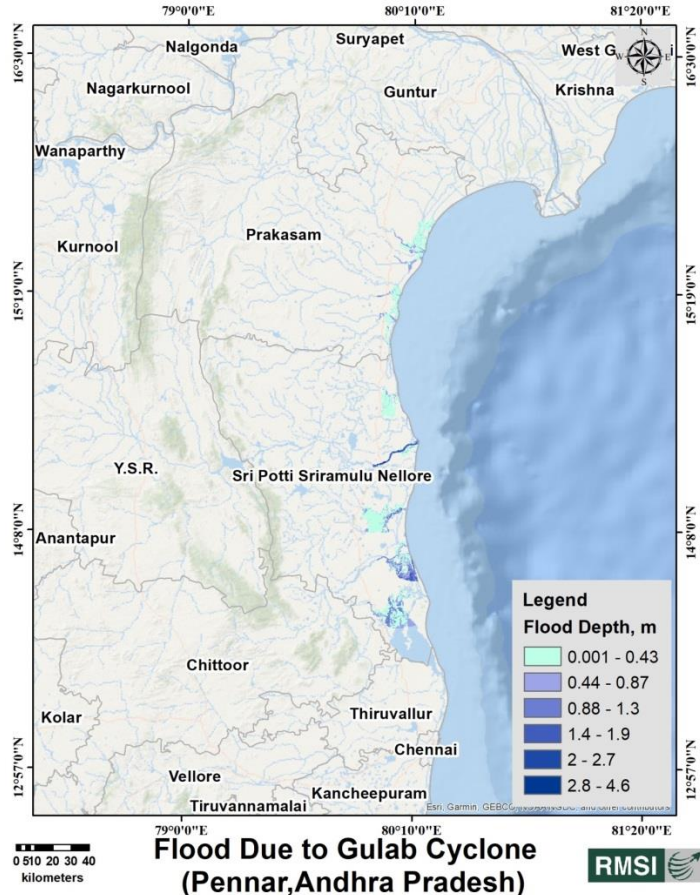


Figure 8 Potential Impact due to flood in Pennar, Andhra Pradesh - Cyclone Gulab

ANALYSIS AT PIN-CODE LEVEL

RMSI performed a series of analyses using its proprietary models to estimate the projected impact of wind and floods due to Cyclone Gulab (from September 24 to September 26) at the pin-code level.

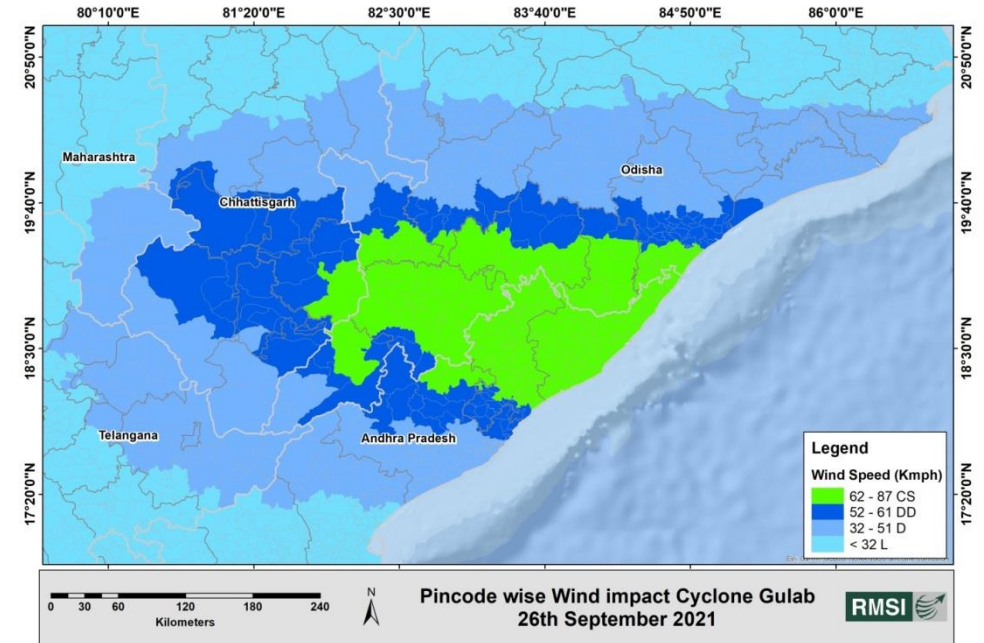


Figure 9 Pin-code wise impact due to wind hazard - Cyclone Gulab

Table 2 Potential wind affected pin codes in India due to Cyclone Gulab

District	Cyclonic Storm	Deep Depression	Depression
Andhra Pradesh			
Srikakulam	532243, 532219, 532263, 532222, 532221, 532264, 532242, 532220, 532292, 532284, 532218, 532291, 532203, 532216, 532322, 532290, 532212, 532211, 532215, 532201, 532457, 532455, 532213, 532456, 532312, 532214, 532195, 532460, 532443, 532459, 532461, 532430, 532428, 532432, 532426, 532440, 532458, 532474, 532462, 532445, 532421, 532429, 532122, 532190, 532427, 532425, 532406, 532123, 532127, 532186, 532405, 532148, 532168, 532185, 532404, 532484, 535128, 532402,		

	532401, 532005, 532001, 532410, 535125, 532407, 532403, 532408, 532409		
Vizianagaram	535534, 535523, 535594, 535524, 535521, 535526, 535502, 535525, 535522, 535527, 535463, 535501, 535593, 535546, 535547, 535559, 535557, 535591, 535573, 535568, 535558, 535124, 535126, 535578, 535579, 535592, 535102, 535580, 535581, 535101, 535270, 535220, 535217, 535280, 535260, 535218, 535003, 535204, 535002, 535213, 535006, 535215, 535216, 535001, 535004, 535221, 535160	535214, 535250, 535148, 535161, 535240, 535281	
Visakhapatnam	531149, 531151, 535273, 535005, 535145	531162, 531219, 531040, 531077, 531163, 531030, 530052, 531029,	530007, 531025, 531105, 530047, 530002, 531035, 530029, 530004,

		531024, 531173, 530048, 535183, 531028, 531027, 530041, 531022, 531111, 530045, 531034, 531075, 531118, 530043, 530040, 530017, 530022, 530013, 530024, 530003, 530028, 530016, 530051, 530008	530009, 530020, 530018, 531036, 530014, 531026, 530001, 530027, 531133, 531023, 530011, 530005, 530012, 530015, 530049, 531032, 530026, 530044, 531031, 530046, 531114, 530031, 530053, 531001, 530032, 531087, 531019, 531021, 531113, 531084, 531020, 531116, 531033, 531055, 531115, 531002, 531011, 531117, 531085, 531061, 531060, 531083, 531082, 531126, 531081, 531127
Odisha			
Gajapati	761215, 761212, 761211, 761210, 761201, 761208, 761207, 761200, 761206, 761213, 761016, 761214, 761017	761217, 761015	
Ganjam	761005, 761006,	760009, 761001,	761116, 761117,

	761009, 761004, 761010, 761209, 761008, 761037, 760003, 761011, 761042, 761002, 760002, 760007, 760010, 760005, 760008, 761045, 761007, 760001, 760004, 760011	761003, 761020, 761054, 761100, 761026, 761012, 761055, 761101, 761014, 761144, 761028, 761013, 761027, 761102, 761146, 761019, 761018, 761029, 760006, 761106, 761109, 761043, 761103, 761104, 761041, 761111, 761032, 761030, 761114, 761107, 761031, 761105, 761110, 761115	761035, 761122, 761118, 761108, 761151, 761123, 761025, 761119, 761124, 761143, 761052, 761120, 761140, 761125, 761121, 761133, 761126, 761131, 761132, 761141
Rayagada	765034, 765022, 765002, 765023, 765001, 765015, 764062, 765029, 765033, 765024, 765025, 765017, 765018, 765019, 765026	765016, 765020	765021
Koraput	764056, 764014, 764028, 764021, 764027, 765013, 764057, 764055, 764006, 763008, 764002, 764020, 764058, 763001, 763003, 764036,	764038, 764040, 764041, 764042, 764046	

	763004, 764039, 764005, 763002, 764043, 764001, 764011, 764004, 764003, 764037, 764044, 764081		
Nabarangapur	764078, 764063, 764059, 764075, 764061, 764070, 764085, 764071, 764049	764072, 764076, 764073	764077, 764074, 764088
Kalahandi	766026, 766018	766037, 766019, 766013, 766028, 766027, 766017, 766014	766103, 766023, 766015, 766002, 766020, 766001, 766029, 766016, 766110, 766100, 766011, 766036, 766118, 766101, 766012, 766102, 766107, 766031, 766032
Malkangiri		764045, 764052, 764051, 764048, 764086, 764047	764087
Khorda		752032	752030, 752031, 752034, 752035, 752027, 752022, 752021, 752023, 752019, 752020, 752115, 752018, 752037, 752038, 752114, 752062,

			752056, 752103, 752102, 752066, 752055, 751002 752057 752064 752061, 752100, 752054, 751028, 751019, 751020, 752101, 751018, 751014, 751006, 751030, 751009, 751025, 751003, 751029, 751026, 751001, 751008, 751010, 751012, 751027, 751007, 751022, 751011, 751015, 751013, 751004, 754001, 751021, 751005, 751023, 754012, 751017, 751016, 751031, 751024, 754005
Kandhamal		762021	762105, 762107, 762104, 762101, 762103, 762109, 762102, 762100, 762022, 762028, 762106, 762112, 762110, 762010, 762011, 762027, 762019, 762029, 762002

Puri		752010	752011, 752002, 752001, 752003, 752013, 752045, 752111, 752110, 752017, 752012, 752014, 752118, 752109, 752121, 752116, 752107, 752046, 752016, 752108, 752106, 752105, 752119, 752015, 752113, 752104, 752060, 752050
Chhattisgarh			
Bastar	494001, 494221, 494222	494442, 494223, 494010, 494224	
Sukma		494115, 494111, 494122	494114
Dantewada		494441, 494449, 494553, 494552, 494556	
Kondagaon		494229, 494226	494237, 494228, 494230, 494347, 494331
Bijapur		494450, 494444, 494447	494448, 494446
Narayanpur		494661	

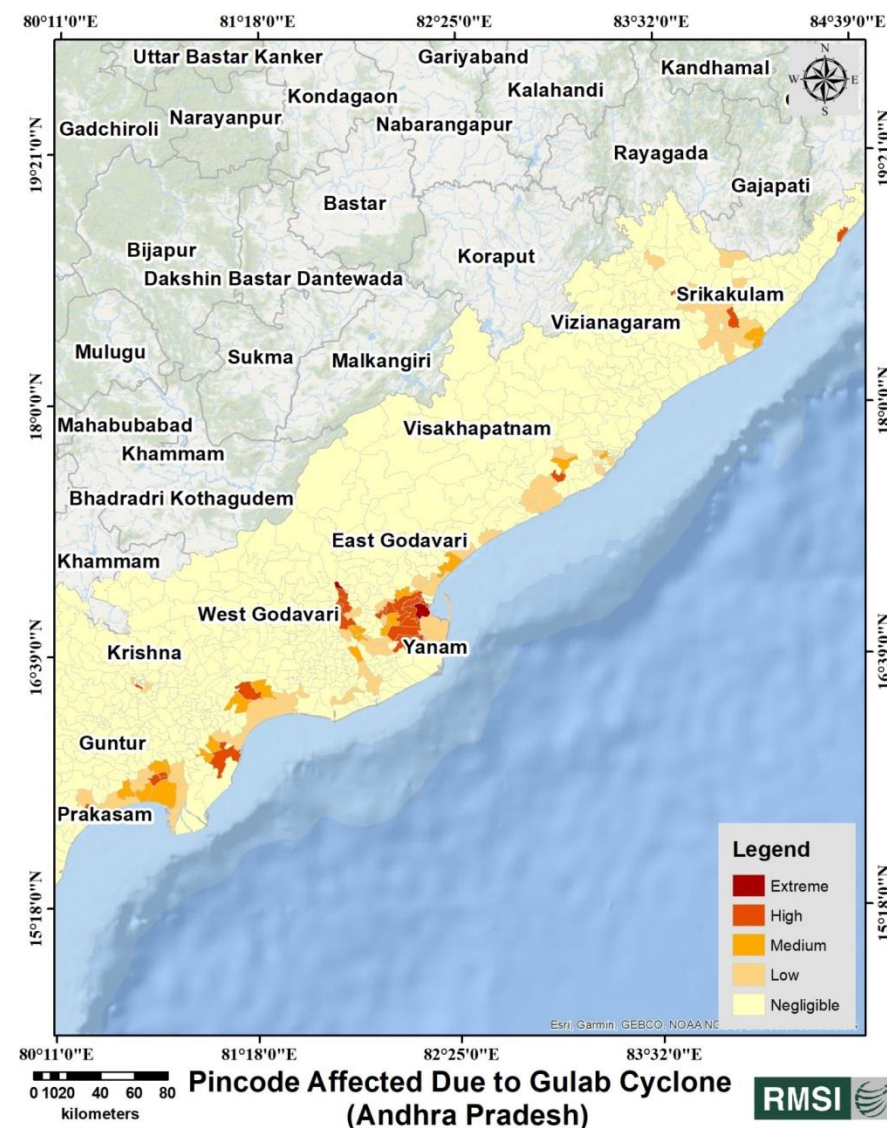


Figure 10 Pin-code wise flood impact due to Cyclone Gulab (Andhra Pradesh)

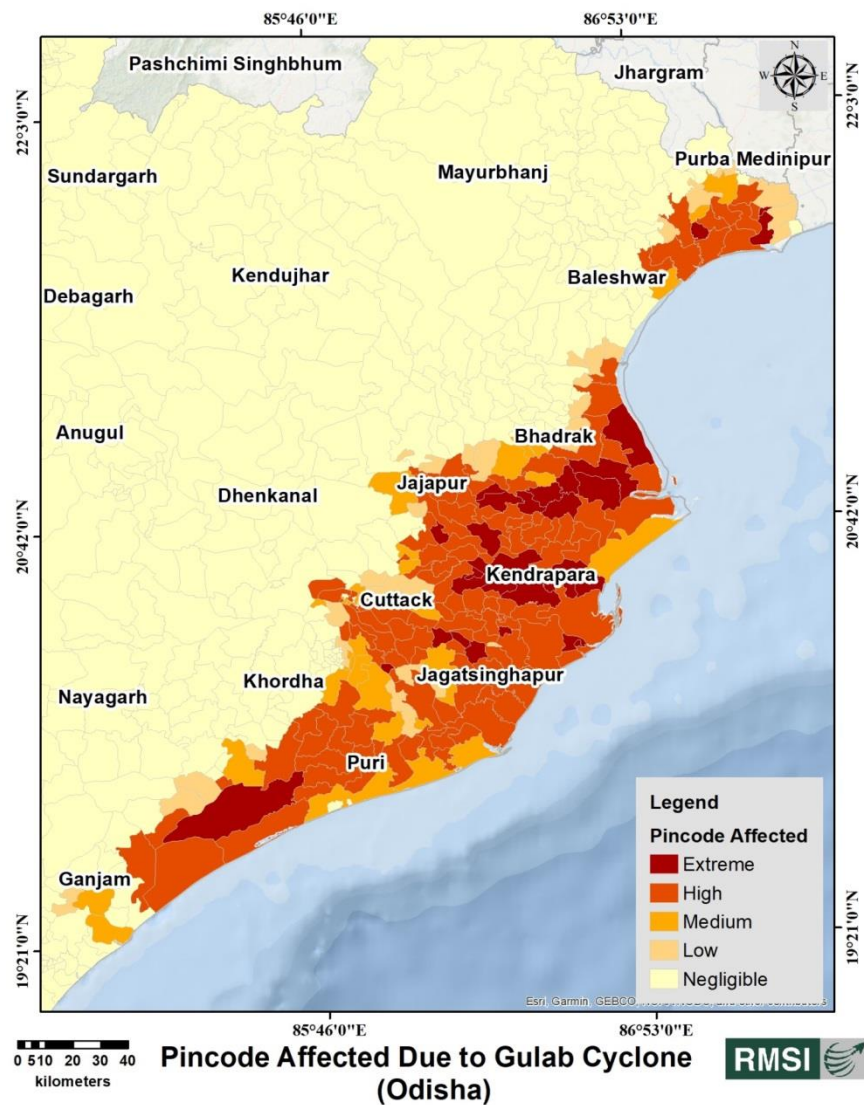


Figure 11 Pin-code wise flood impact due to Cyclone Gulab (Odisha)

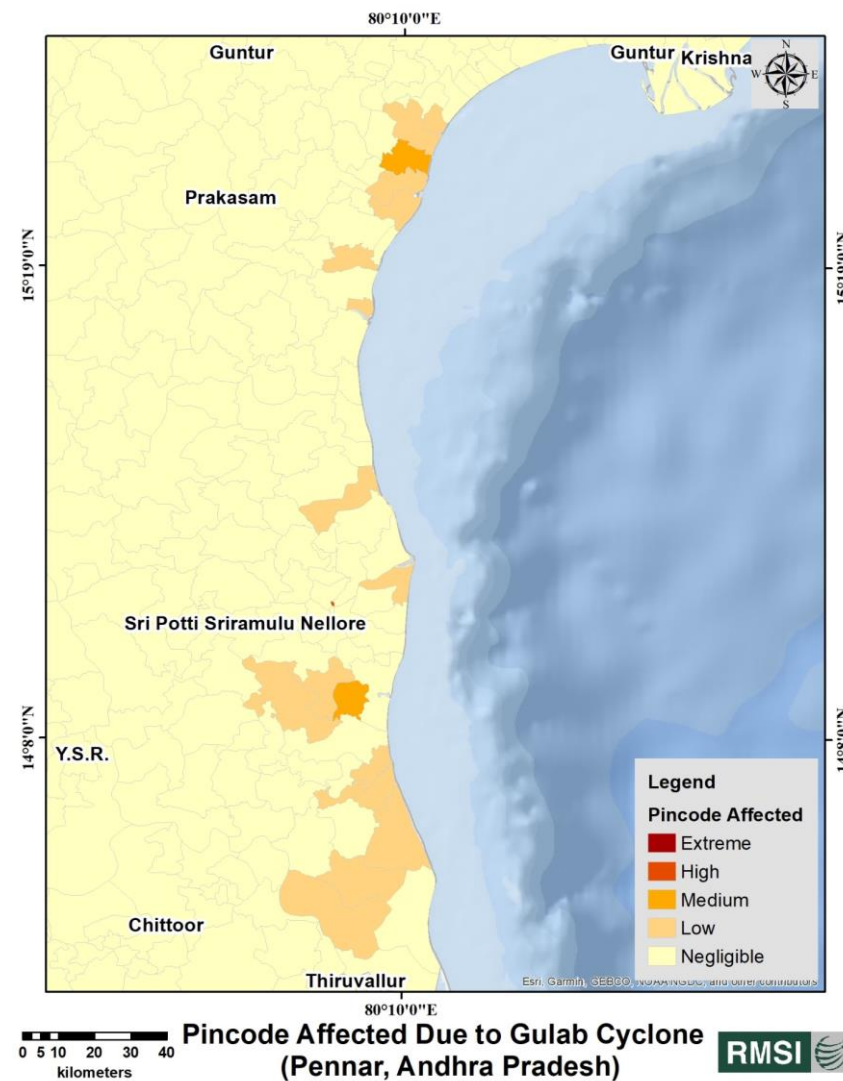


Figure 12 Pin-code wise flood impact due to Cyclone Gulab (Pennar, Andhra Pradesh)

Table 3 Potential flood-affected pin codes in Eastern states of India due to Cyclone Gulab

State	District	Pin-codes affected by significant flood
Orissa	Cuttack	754208, 754010, 754130, 754113, 754018, 753011, 754027, 754290, 754206, 754004, 754011, 754002, 753006, 754003, 754209, 753012, 753001, 754112, 754026, 753015, 754203, 754293, 754134, 754205, 754207, 754204, 753014, 754100, 754221, 753010, 754201, 754023, 753003, 753002, 754006, 753009, 752120, 754131, 754021
Orissa	Kendrapara	754211, 754216, 754227, 754250, 754212, 754289, 754217, 754245, 754240, 754248, 754218, 754222, 755061, 754153, 754231, 754223, 754246, 754224, 754215, 754213, 754244, 754253, 754210, 754239, 754220, 754219, 754228, 754225
Orissa	Jagatsinghapur	754132, 754136, 754143, 754142, 754133, 754162, 754145, 754137, 754114, 754135, 754110, 754119, 754140, 754139, 754102, 754120, 754106, 754108, 754104, 754138, 754111, 754141, 754294, 754103, 754107
Orissa	Jajapur	755027, 755049, 755062, 755003, 755011, 755013, 755051, 755007, 755006, 755004, 755009, 754214, 754024, 755008, 755010, 755043, 754292, 755017, 755016, 755005, 755012, 755014, 755023, 755036
Orissa	Puri	752011, 752010, 752013, 752116, 752016, 752105, 752017, 752012, 752046, 752118, 752015, 752014, 752110, 752104, 752121, 752045, 752107, 752119, 752108, 752002,

		752111, 752106, 752109
Orissa	Baleswar	756038, 756080, 756039, 756029, 756027, 756081, 756079, 756003, 756023, 756083, 756026, 756034, 756024, 756025, 756086, 756022
Orissa	Bhadrak	756164, 756133, 756138, 756132, 756162, 756131, 756119, 756125, 756171, 756129, 756117, 756118, 756137
Orissa	Khorda	752032, 752030, 751024, 752022, 754001, 752114, 752100, 752021, 752102, 751002, 751018, 751010, 752101
Orissa	Ganjam	761029, 761026, 761019
Andhra Pradesh	East Godavari	533016, 533345, 533344, 533264, 533006, 533462, 533346, 533262, 533263, 533260, 533464, 533468, 533002, 516005, 533256, 533255, 533274, 533434, 533233, 533447
Andhra Pradesh	Guntur	522268, 522258, 522314, 522256, 522259, 522111, 522262
Andhra Pradesh	Krishna	520013, 521343, 521131, 521329, 521344, 521162, 521003
Andhra Pradesh	Srikakulam	532425, 532263, 532462, 532429, 532406
Andhra Pradesh	West Godavari	533104, 533125, 533101, 533235, 533237
Andhra Pradesh	Visakhapatnam	531033, 530009, 531001
Andhra Pradesh	Prakasam	523155

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