

Emergency Communications for Disaster Relief in China: Experiences and Lessons Learned

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- ◇ Nature disasters in China: an overview
- ◇ Disaster emergency communications in China
- ◇ Satellite communications for emergency and e-resilience
- ◇ Considerations on international cooperations
- ◇ Conclusions and discussions

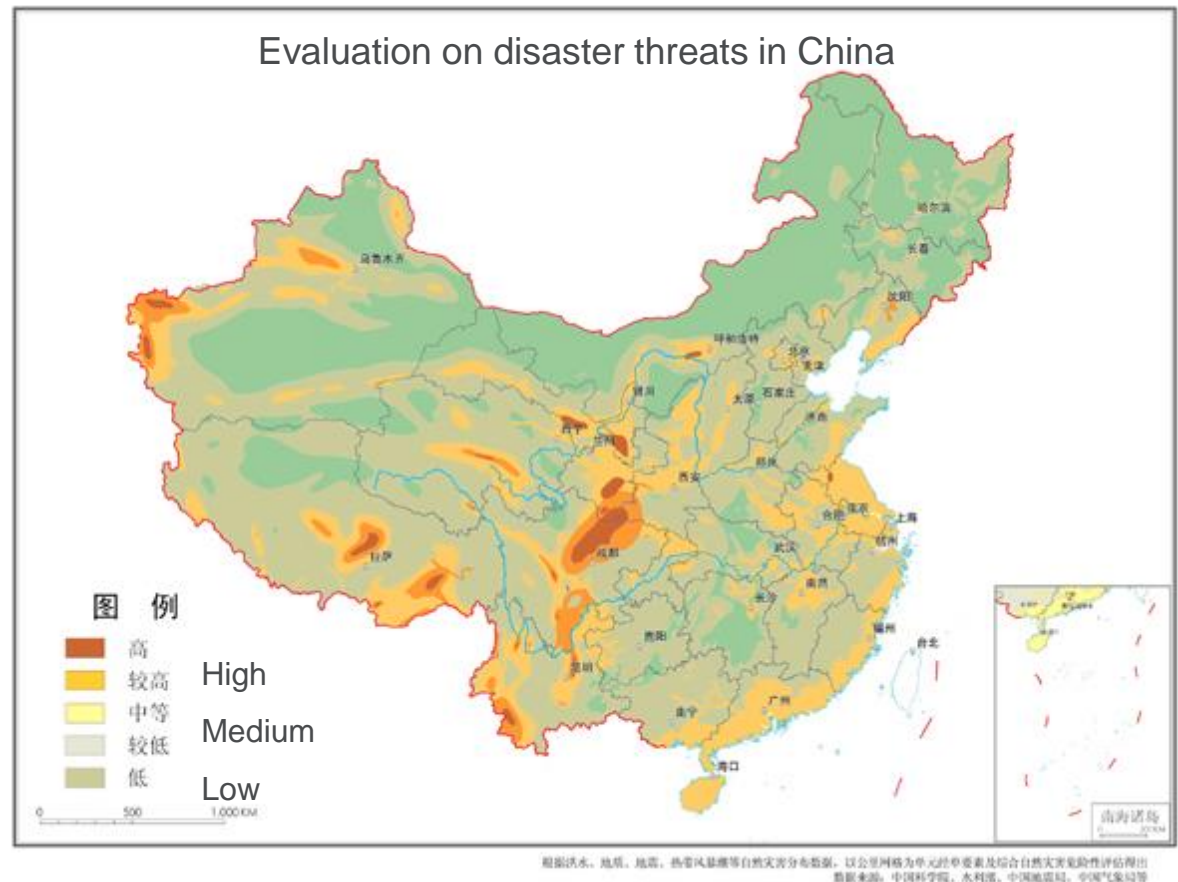


Nature Disasters in China- Overviews

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China is one of the countries most affected by nature disasters in the world. Nature disasters occur frequently in China that seriously threaten the human lives, and also have huge impacts to economy and social development of China.

- Characters of Nature Disasters in China
 - Widely affected: almost every provincial region
 - Various type: earthquake, floods, typhoons etc, most of major nature disaster occurs in China
 - Seasonal features: June- Sept. flooding affected many area of China(mostly South China and Northeast China)



Source: The State Council of P.R.CHINA,2010

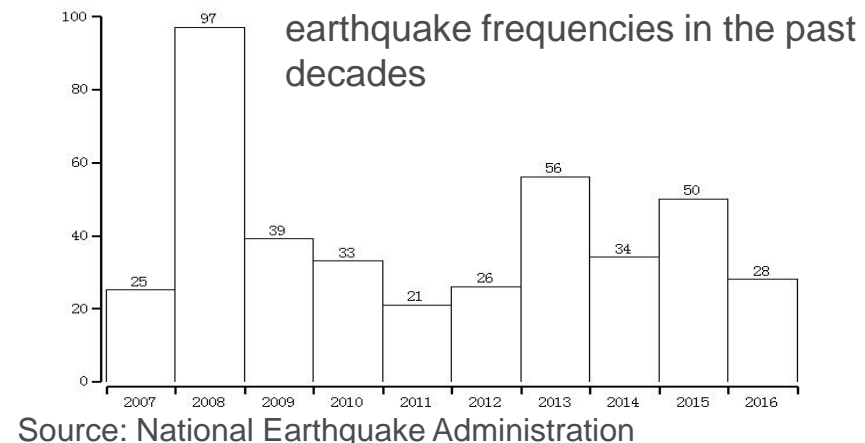
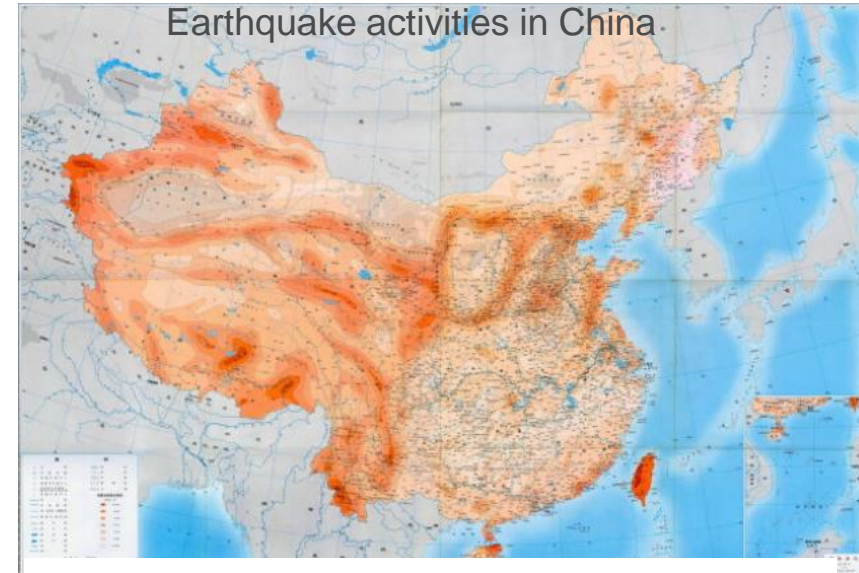


Nature Disasters- Earthquakes affected China

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Earthquake is one of the most frequent disaster in china, and devastating earthquake mostly affected Westen-China, Yunnan, Sichuan,Tibet, Gansu, ShanXi ,Qinghai in recent years

- 5.12 Wenchuan Earthquake
 - May 12, 2008, Wenchuan county, Sichuan Province;magnitude 8.0
 - 70,000 death,374k injured; \$100 billion lost
- 4.20 Lushan(Ya'an)Earthquake
 - April 20, 2013, Lushan county, Sichuan Province; magnitude 4.8
 - 196 death, 11k+ injured;
- 7.22 Dingxi Earthquake
 - July 22, 2013; Dingxi ,Gansu province, magnitude 6.6
 - 95 death, 800+ injured
- 8.3 Ludian Earthquake
 - August 3, 2014 Ludian Yunnan province; magnitude 6.5
 - 617 death,3.1k+ injured;\$71 million lost



Source: National Earthquake Administration



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Disaster's Influences to ICT infrastructure

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ICT infrastructure is one of the most critical resources for saving lives when a disaster happens. However, the ICT infrastructure is also fragile during disaster.

- disasters damage ICT infrastructure, result in telecom network and service outage within the affected area.
- disasters destroy power grid and result in power failure to ICT equipments.
- functionally disables telecom services of affected area due to large amount inquiry calls





Emergency Communications for Disaster Relief

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Emergency Communications:

- Communications methods in support of disaster prevention and disaster relief operations.
- Enhancement of resilience for public communications network
- Alternative communications methods during outage of public networks

Disaster Phase	Actions/Operations	Roles of ECDR
<ul style="list-style-type: none">• Pre-Disaster	<ul style="list-style-type: none">• Preparedness	<ul style="list-style-type: none">• Improvement of resilience of networks and services• Deployment of EC equipments• Manoeuvres/Exercises
<ul style="list-style-type: none">• Disaster Strike	<ul style="list-style-type: none">• Disaster Response	<ul style="list-style-type: none">• Early warning for publics• hazard Information collecting and reporting
<ul style="list-style-type: none">• Disaster Impact	<ul style="list-style-type: none">• Disaster Mitigation	<ul style="list-style-type: none">• On-site communications support
<ul style="list-style-type: none">• Post Disaster	<ul style="list-style-type: none">• Disaster Recovery	<ul style="list-style-type: none">• Reconstruction of network• Recover public telecom services

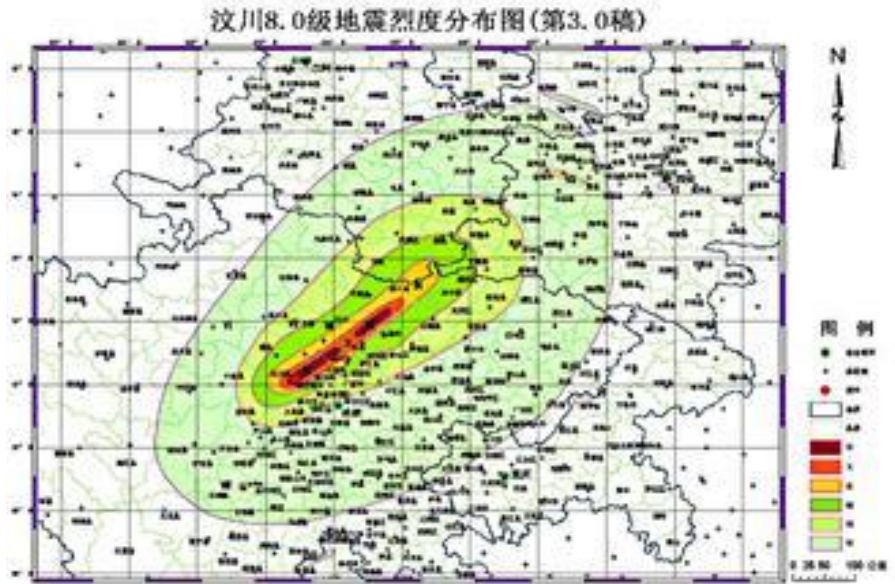


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Emergency Communications :Earthquakes cases

5.12 Wenchuan Earthquake(2008):

- **Impacts:** telecom service out in 13 counties, 14k+ base stations damaged, optic fiber cable cut in many areas; power failure in all affected area
- **Emergency Response:** thousands of emergency communications equipment and supporting facilities (ie. electricity generators) deployed, 30k+ staffs engaged
- **Service Recovery:** satellites communications activated in some disaster area in two days; telecom services in all affected area recovered in 10 days since the earthquake hit.





Lessons Learned from the Catastrophic Earthquake in Wenchuan

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- Catastrophic earthquakes damages communications infrastructure dramatically and often isolate the affected area from outside -"isolated island of communications" which may ultimately lagged the life rescue operations. (the Golden 72h principle)
- Satellite communications is one of the critical methods for communications recovery during disaster, and especially the mobile statelite services are very essential to early disaster response and life saving.
- Roads to the disaster area may be destroyed badly,large equipments are unable to deliver, small-size, portable equipments are necessary in rigorous environments.
- Power failures results in further outages of communications network, temporary on-site power supply is essential to telecommunications recovery.



Measures adopted after the Wenchuan earthquake

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- Developed and Implemented National Communications Emergency Preparedness Plan
- Enhanced satellite based emergency communications methods, especially in terms of Mobile Satellite based systems
- Improved the deployments of emergency communications equipments and facilities to each province
- Implemented pilots projects of early warning systems based on telecommunications network in the area of high disaster threats



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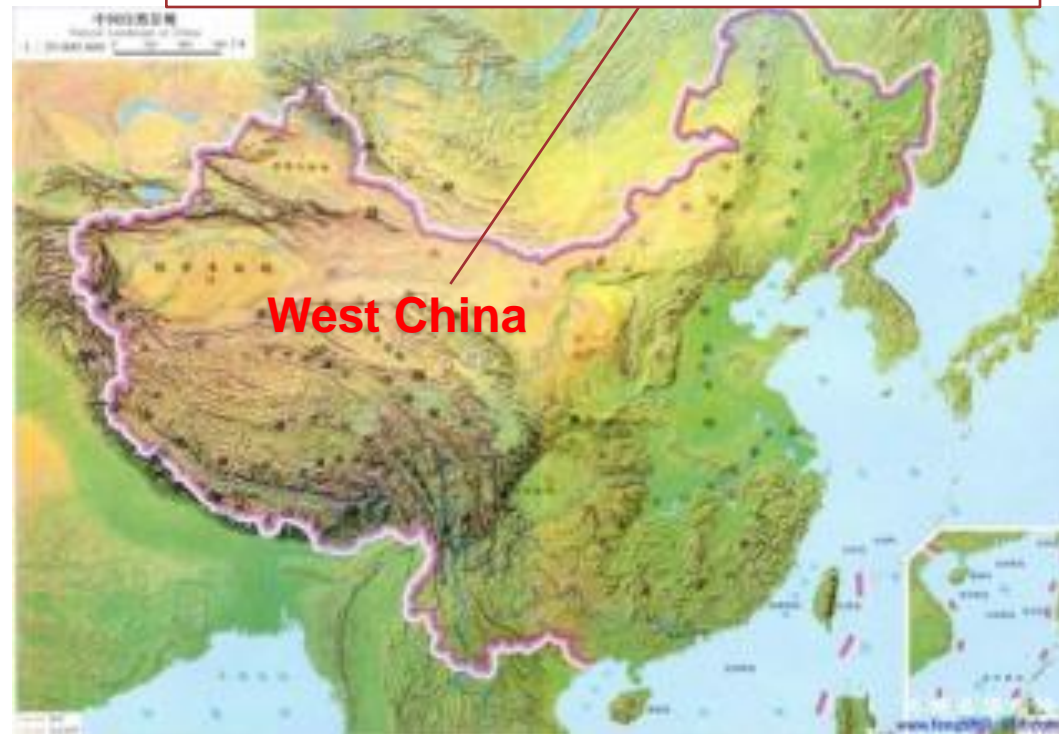
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Satellite communications for e-resilience and emergencies in China: Overviews

key areas for satellite communications in China : Western China, especially rural districts

- ◇ high risk of disasters , especially the risk of devastating earthquake
- ◇ high cost for terrestrial network construction and maintainance.
- ◇ low reliability of ICT infrastructure, fragile to disaster.
- ◇ rigorous geographical environments for recovery when disaster hits

- high risk of disasters
- high cost for terrestrial network construction
- poor network coverages and reliability



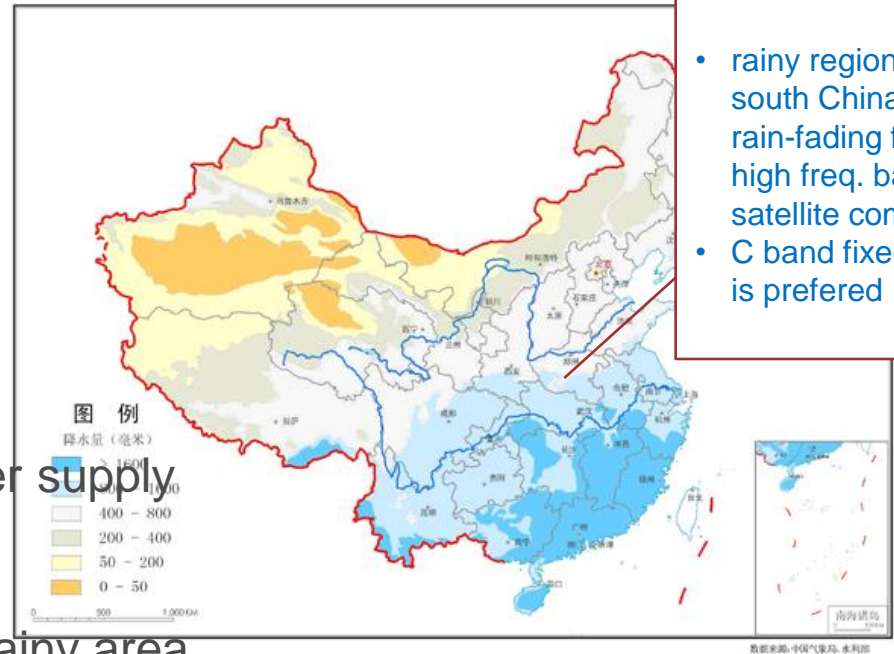
satellite communications can provide feasible cost/effective solutions for ICT resilience in Western china area



Satellite communications for e-resilience and emergencies-Fixed Satellite Services(FSS)

FSS: GEO satellite equipped with C/Ku/Ka band Transponders

- Typical services bandwidth :
 - 1-8Mbps for C and Ku
 - 8Mbps+ for Ka
- Use Cases:
 - backup link for telecom network
 - VSAT
 - highspeed on-site data/video
- Constrains:
 - high quality and high density power supply required
 - professional O&M required
 - high rain-fading for Ku and Ka in rainy area



- rainy region in south China, high rain-fading for high freq. bands satellite comm.
- C band fixed Sat is preferred

Transponder Band	frequency range	service bandwidth	Rain-fading	Applications
C	3.4 – 7.1 GHz	Low	Low	Rainy area/season
Ku	10.7–14.5 GHz	High	Medium	Broadband backhaul; Internet
Ka	17.7 - 21.2GHz 27.5 – 31 GHz	Very High	High	Broadband backhaul; Internet

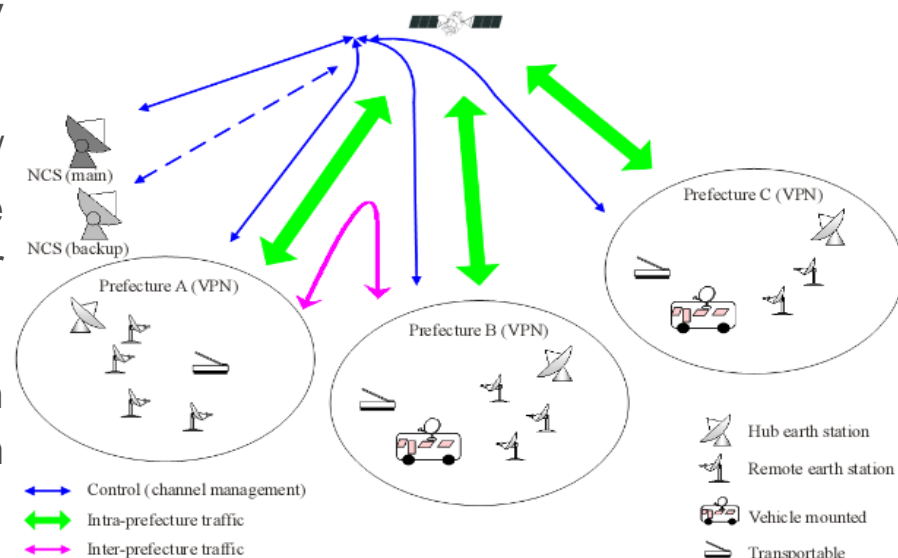


Fixed satellite communications services for disaster emergency communications

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Major Satellite backhauled emergency communications services

- VSAT Services with vehicle based/portable terminals, supports on-site voice/video communication for disaster response teams
- Vehicle mounted mobile base station with satellite backhaul for on-site telecom support
- Super Base Stations: mobile telecom base stations with satellite acted as the backup routes, to improve resilience of public telecom networks



source: ITU-R REP S.2151

Report 2151-02



Mobile Satellite Services for disaster emergency communications

- ◇ Satellite: L band and S band mobile communications satellite
- ◇ Mobile satellite telephony services and terminals
 - ◇ 2.4k Voice services
 - ◇ Positioning services: terminal location report
- ◇ Broadband MSS services and terminals:
 - ◇ service bandwidth: 300-400kbps, supports live video communication with medium resolutions; satisfied requirements of general on-site emergency communications
 - ◇ small and lightweight terminal (<3kg), easy to carry by single person, nice portability compared with portable VSAT terminal (>20kg), suitable for early disaster response in severe conditions
 - ◇ easily O&M
 - ◇ battery power supply





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Mobile Satellite Services to enhance the e-resilience in rural areas

- ◇ ICT universal services-bridging the digital divide in China
 - ◇ first stage: to address the availability of ICT access (almost successfully accomplished in China), through national universal service funds;national broadband plans
 - ◇ second stage: e-resilience
 - ◇ Improve resilience for ICT infrastructures in rural areas
 - ◇ ICT to enhance sustainable development in rural area in case of disasters
 - ◇ Future plans:
 - ◇ universal service /broad band plans with e-resilience objectives
 - ◇ initial the e-resilience projects in rural areas.
 - ◇ deploy MSS terminals to county and township districts
 - ◇ to costomize MSS services and terminals for rural district
- in Oct. 2016 China launched a new Mobile Communications Satellite, Tiantong-1, RFS in first Q 2017, will facilitate the related programs



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Considerations of International cooperations

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- ◇ International cooperation is essential for e-resilience and disaster relief activities, esp. at the regional level.
 - ◇ The principles of resilience: the more participants, the less risk for each party (think of the case of insurance)
 - ◇ countries in regional/subregional have similar challenges, close in relationships and geographical locations
- ◇ Initiatives
 - ◇ enables experience, knowledge and resource sharing and exchange among countries in the region/subregion



Considerations of International cooperations

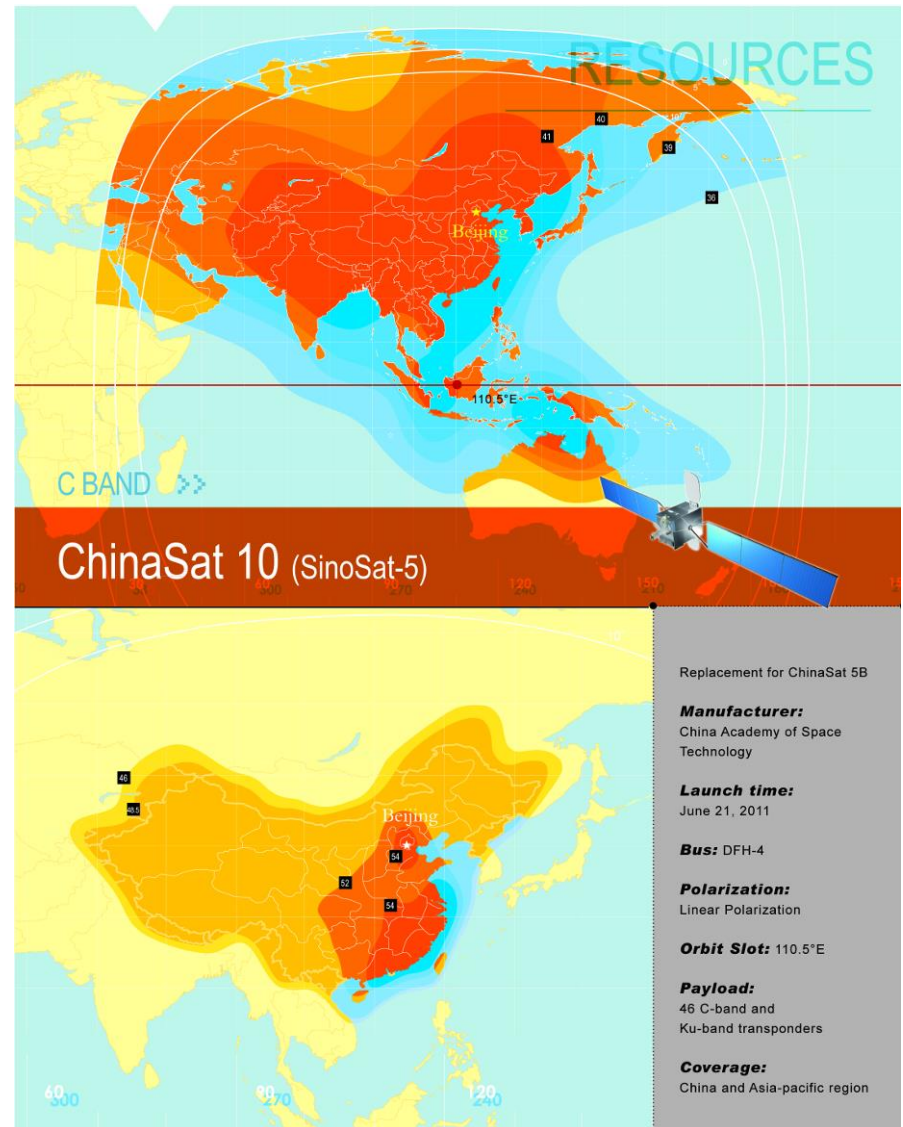
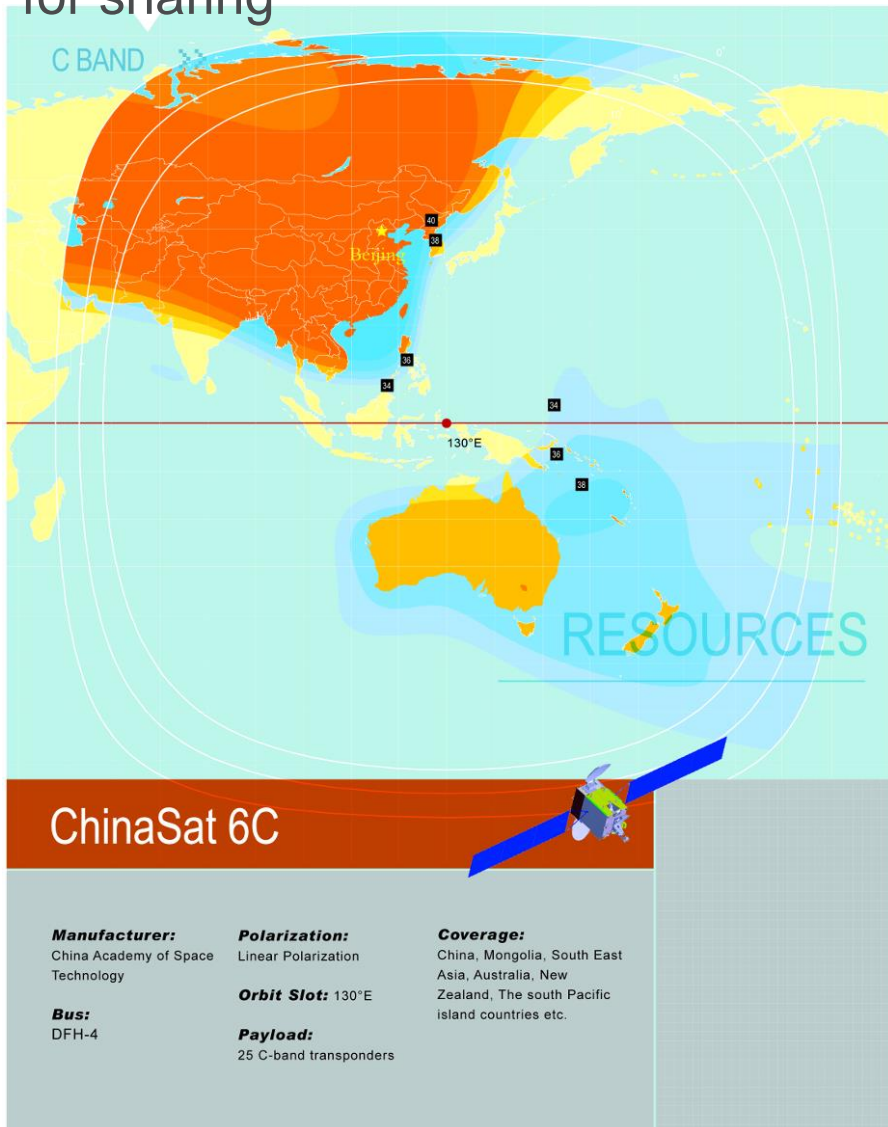
- ◇ preliminary ideas under AP-IS e-resilience mechanism
 - ◇ workshops/seminars for experiences exchanges, to identify best-practices in the region
 - ◇ capacity building programs
 - ◇ establishment of regional resources sharing mechanisms
 - ◇ enables mobilization on e-resilience ICT technologies, products and solutions in the region/sub-region.
 - ◇ regional emergency resource bank/pools (including optical cables, satellite, frequency, and fundings)
 - ◇ the balance of affordable and the commercial sustainable for ICT-resilience



Resource bank: the satellite resource pool (1)

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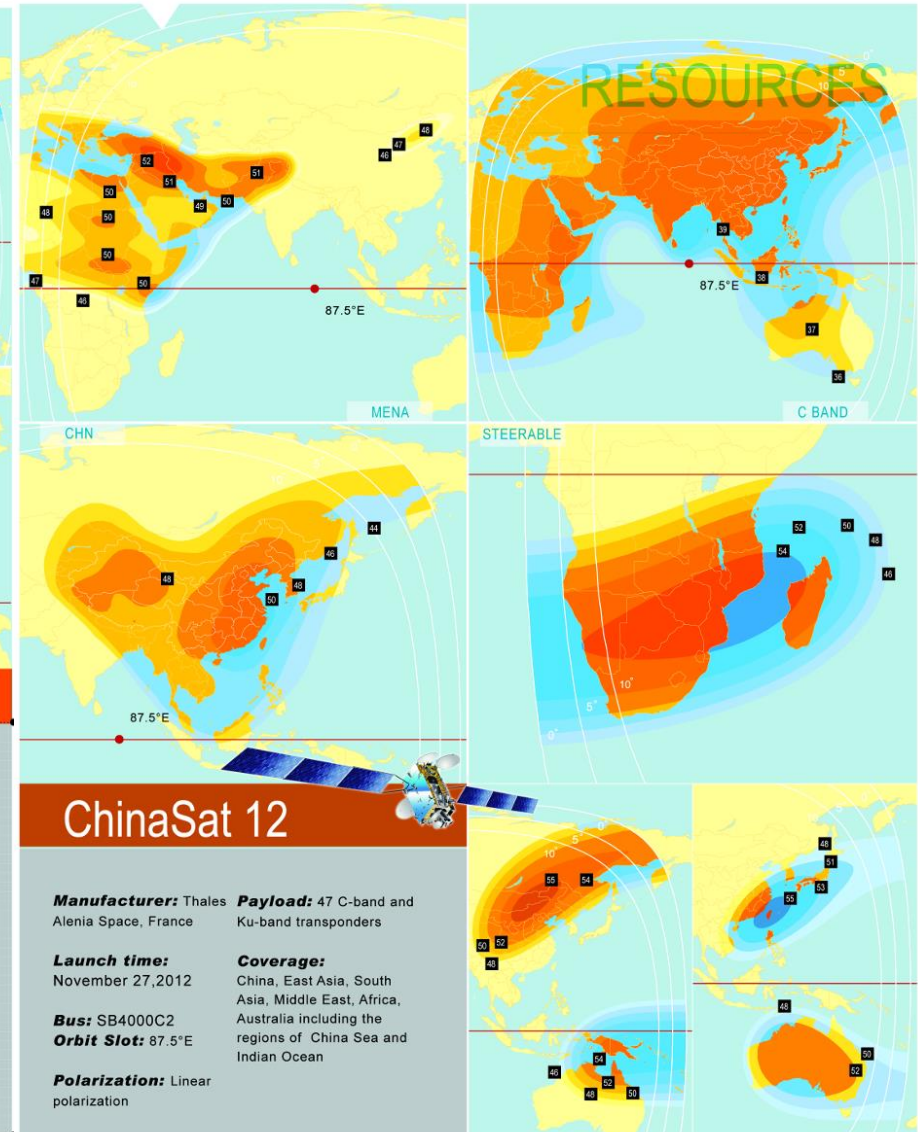
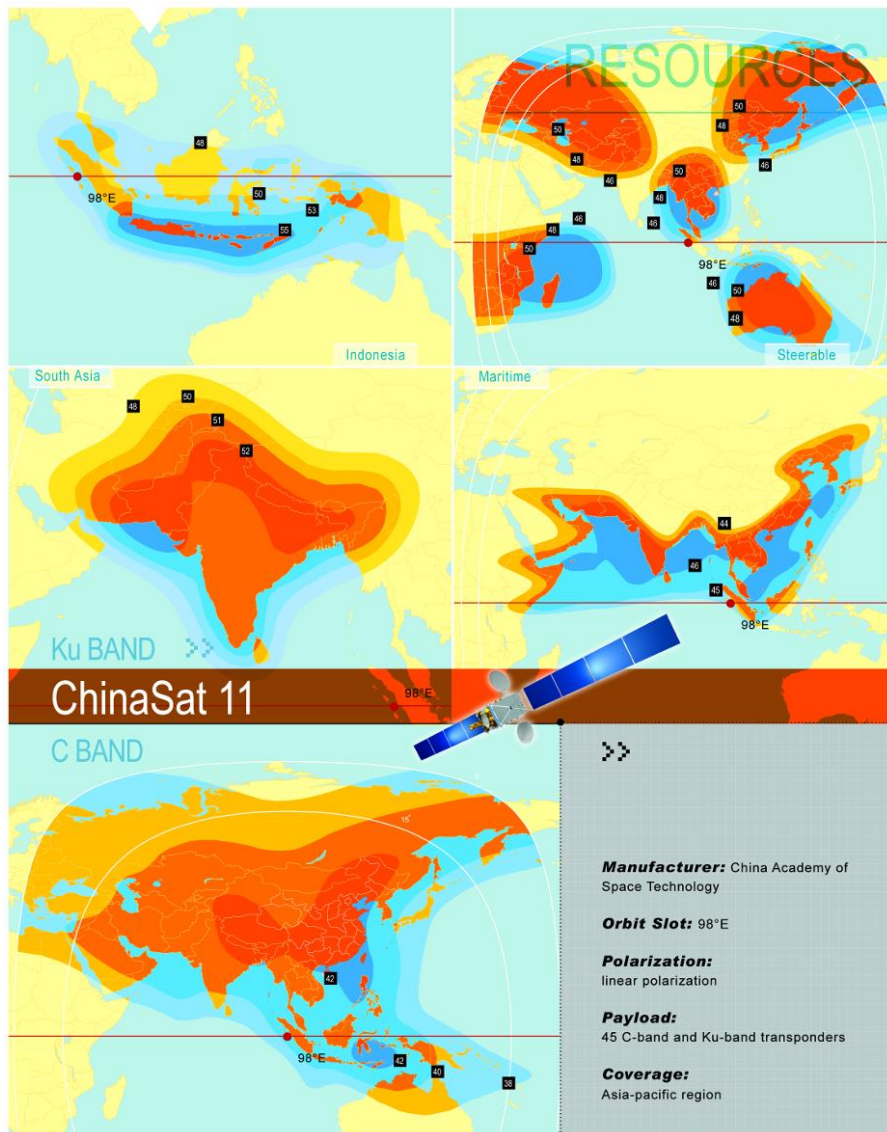
Satellite is one of the most important resources for e-resilience and easy for sharing





Resource bank: the satellite resource pool (2)

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Conclusions and Discussions

- ❖ ICT infrastructure is fragile under disasters, especially under strikes by catastrophic earthquake
- ❖ preparedness always the best way for disaster-relief and e-resilience
- ❖ satellite communications is still the critical methods for disaster reductions and e-resilience.
- ❖ International cooperations especially regional/subregional coopeatons are very important for disaster relief
- ❖ Discussions: what's the best way forward under AP IS mechanisms