



INTERNATIONAL RESEARCH CENTER OF BIG DATA
FOR SUSTAINABLE DEVELOPMENT GOALS
可持续发展大数据国际研究中心



Pan-Eurasian Experiment (PEEX) Program collaborators' Online Seminar

HiMAC-Ex : Combination of Space and Station based Observations across Eurasia

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Aerospace Information Research Institute, Chinese Academy of Sciences (AIR-CAS)**

2024.04.11

Challenges to HiMAC Region

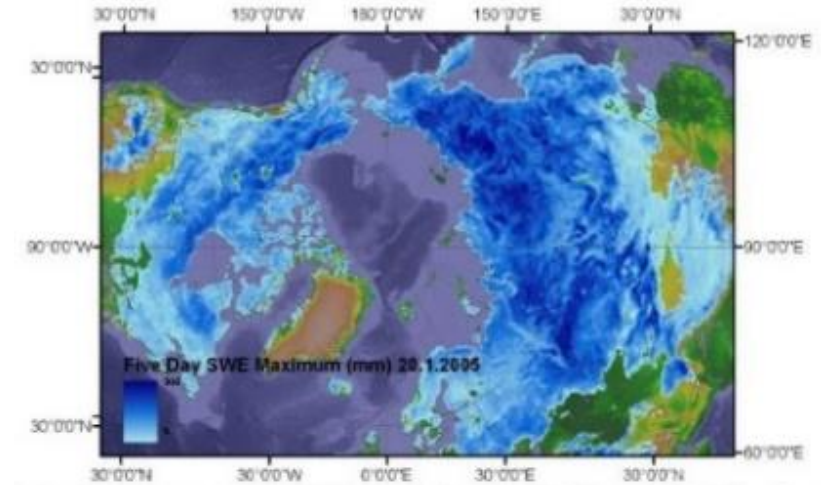


- Environmental changes in the Earth cold regions cannot be observed and understood in isolation, because of the **teleconnections in global climate and socio-economic effects**.
- Along the B&R region, the understanding of these changes has posed big challenges because of remoteness and of **sparse observations**. To adapt to the changes and ensure regional sustainable development, it is necessary to observe multiple **essential variables** over a large area.
- Require more accurate, coordinated, and integrated observations, such as **ground-, space-based observations and multi-dimensional data collections**, for improving the **scientific understanding** of such remote areas.

HiMAC Observations : HiMAC at PEEEX Domain



HiMAC – High Mountain and Cold Regions

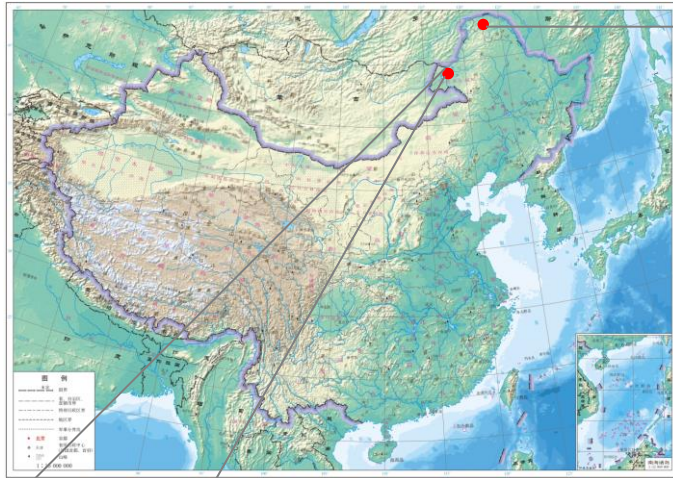


Earth observations: large coverage for the whole PEEEX domain
In-situ Measurement: validation and calibrations
Modeling : understanding

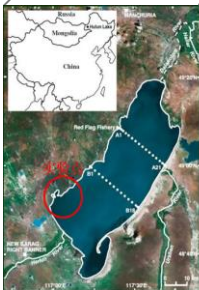
HiMAC Observations : Mohe Station



Mohe multi-sources data including weather, soil, landform...



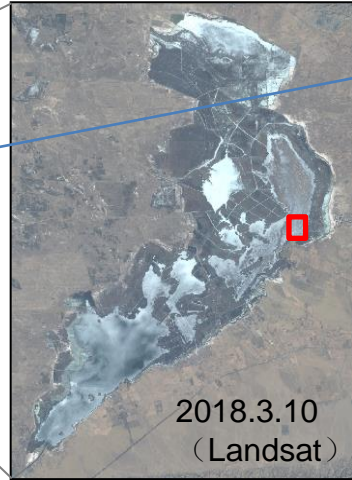
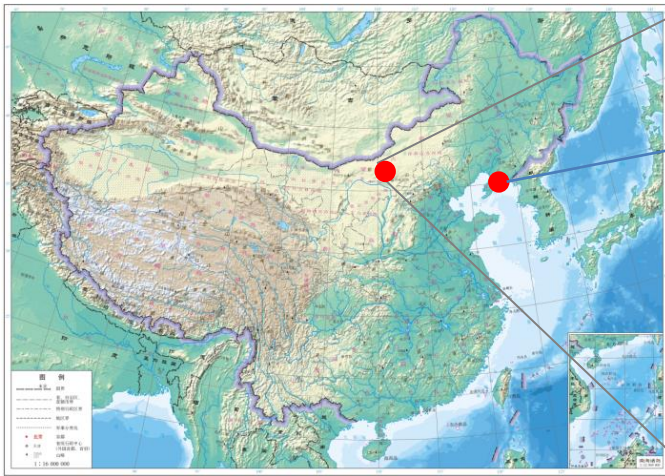
Ice buoy observation (SIMBA)



站名	站号	站址	站类	站型	站高	站址	站类	站型	站高	站址	站类	站型	站高	站址	站类	站型	站高	站址	站类	站型	站高	
1001	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101
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1006	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106	106
1007	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107	107
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1009	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109
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Hulun Lake Ice Observation Platform

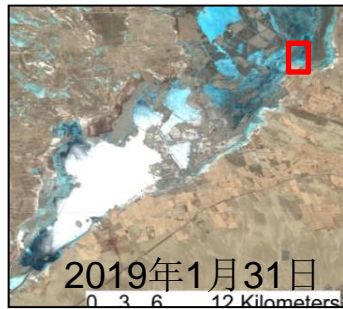
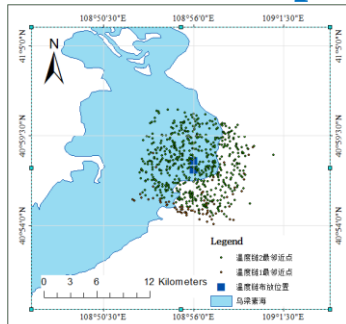
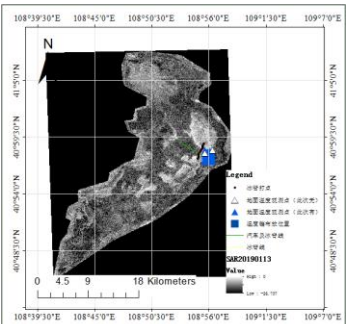
HiMAC Observations : Wuliangshu Lake Station



Air-Ice-Water-Mug Environmental Floating Platform of Hanzhang Lake



Lake Ice Ground-Air Joint Experiment

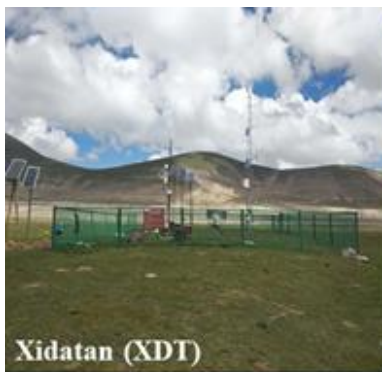
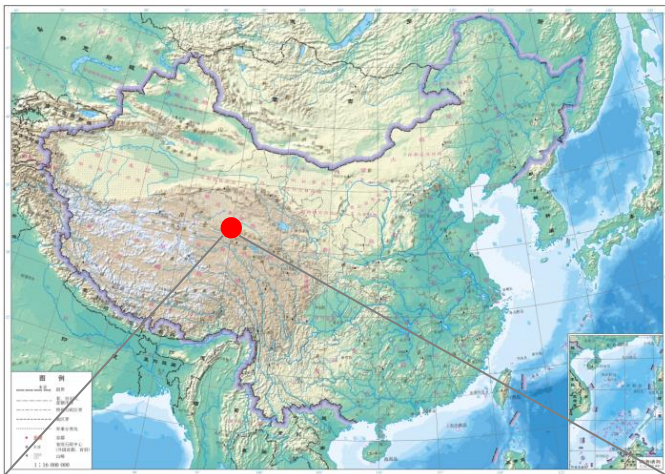


Real-time meteorological and hydrological parameters

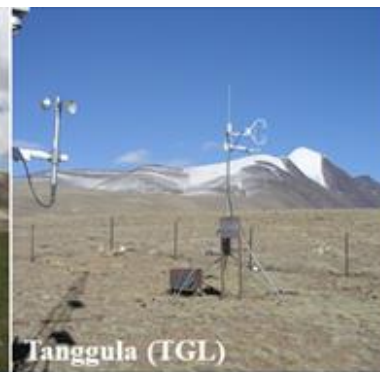
HiMAC Observations : Permafrost Station



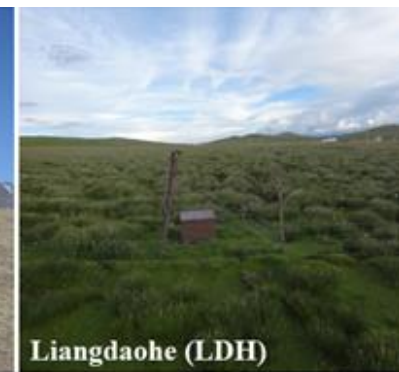
Cryosphere Research Station on the Qinghai-Tibet Plateau



Xidatan (XDT)



Tanggula (TGL)



Liangdaohe (LDH)



Ayake (AYK)



Zhuonaihu (ZNH)

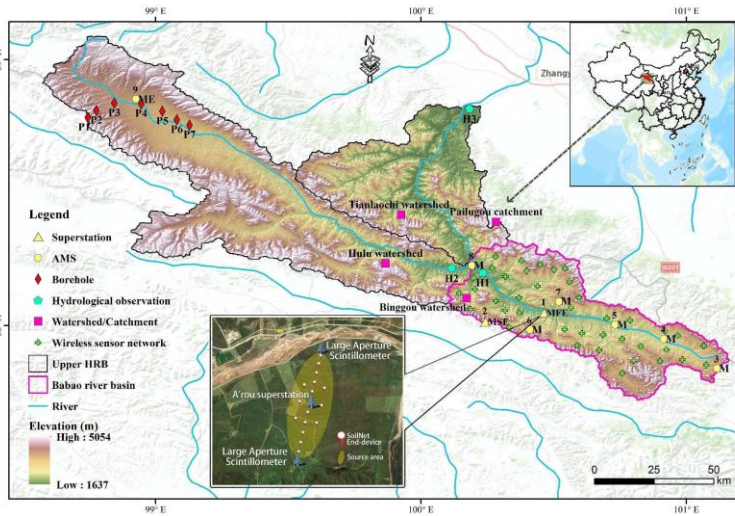


Tianshuihai (TSH)

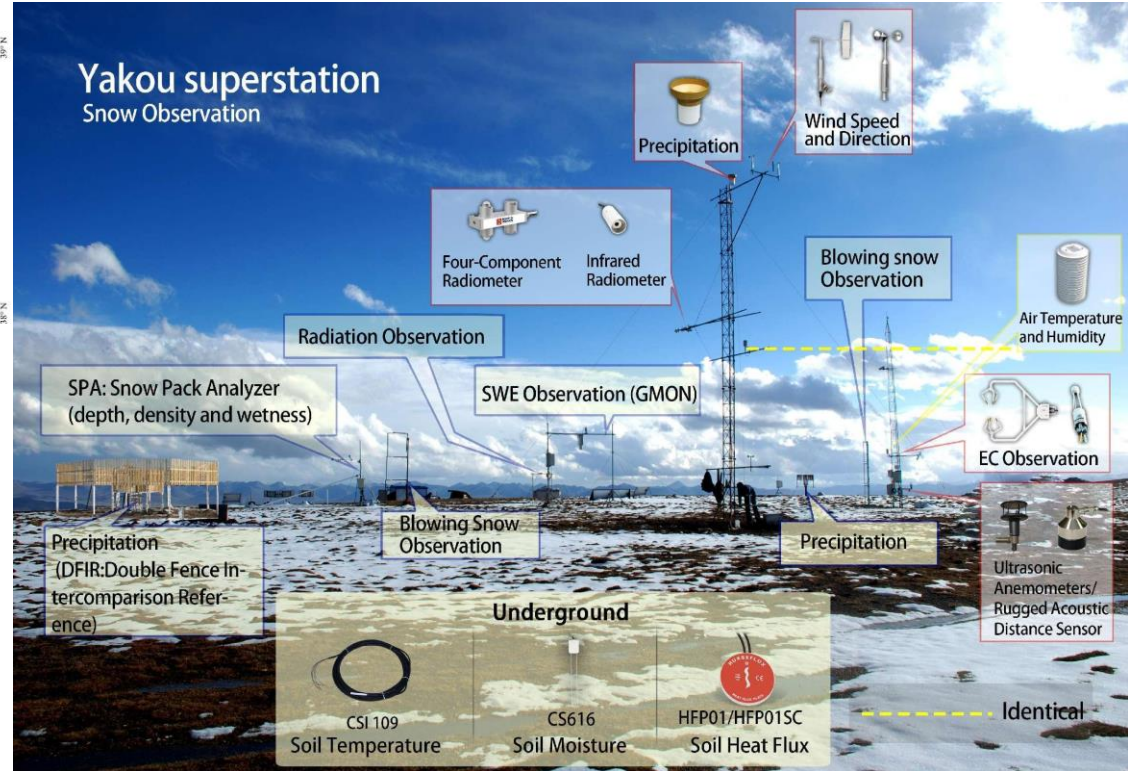
HiMAC Observations : Permafrost Station



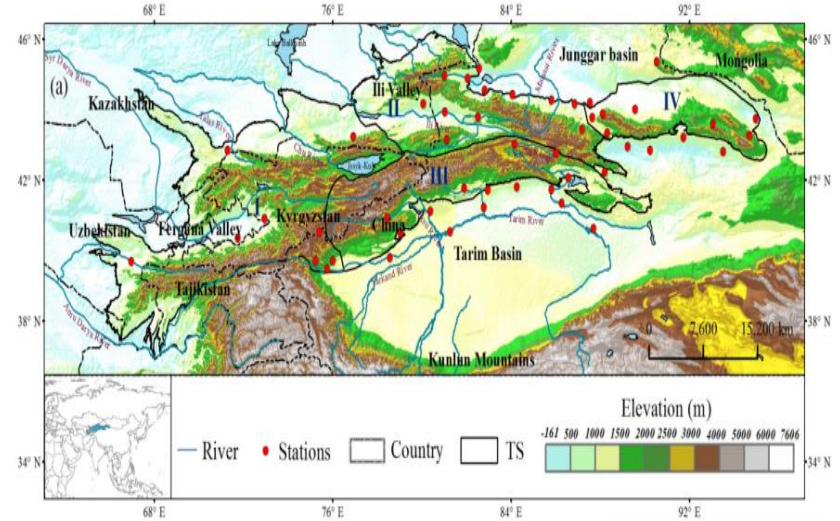
Snow observation of the Qilian mountain, northeastern Qinghai-Tibet Plateau



Snow depth, snow water equivalent (SWE), albedo of the snow surface and blowing (drifting) snow flux



HiMAC Observations : Tianshan Snow Avalanche Station



1. Survey of Snow properties in Central Asia
2. Lake dynamic
3. Yili River
4. Ecological hydrological interaction

HiMAC Observations : SMEAR Station of PEEEX

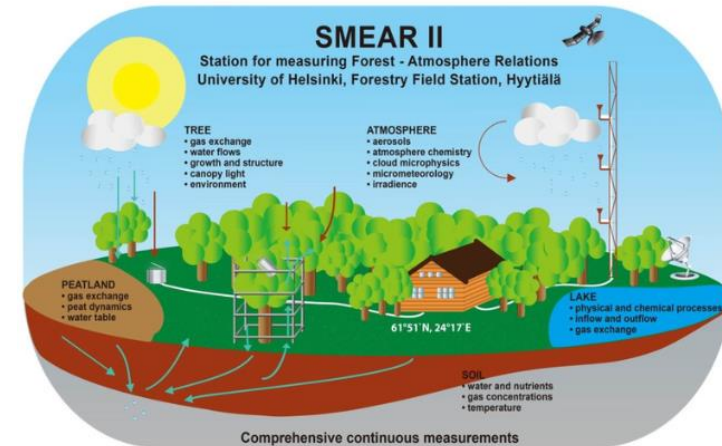
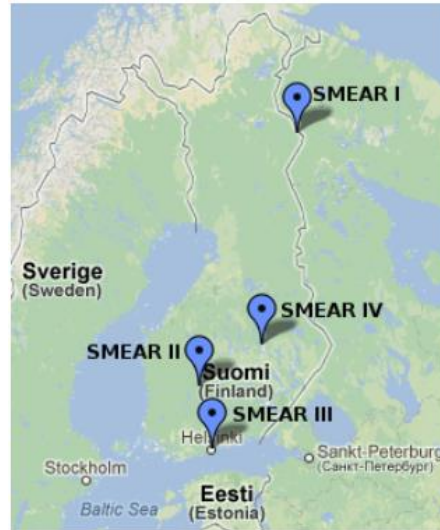


Pan-Eurasian Experiment (PEEX)



Station for Measuring Ecosystem-Atmosphere Relations

	Parameter	Device	Measurement height
Weather	dry temperature	Rotronic MP100H	2, 4, 6, 6, 9, 15 m
	wet temperature	Rotronic MP100H	2, 4, 6, 6, 9, 15 m
	wind speed	Delta-TAN1	2, 4, 6, 6, 9, 15 m
	wind speed	Thies 2D	16 m
	wind direction	Thies 2D	16 m
	PAR (photosynthetically active radiation)	LI-Cor LI-190SB	16 m
	global radiation	Middleton Solar SK08	16 m
	UVA	Solar Light 501A UVA	16 m
	UVB	Solar Light 501A SUV	16 m
	air pressure	Druck DPI 260	
	visibility	Biral VF500 visibility sensor	2 m
	precipitation	Thies Laser Precipitation Monitor	2 m
	rainfall	Delta-T RG1	1.5 m
soil temperature	Pt-100	0 m	
Aerosols	total concentration	CPC TSI 3022	9 m
	size distribution	DMA / CPC TSI 3025	2 m
	size distribution	DMA / CPC TSI 3010	2 m
Trace gases	ozone	Thermo Electron corp. 49i	2, 6, 6, 9, 15 m
	sulphur dioxide	Thermo Electron corp. 43i-TLE	2, 6, 6, 9, 15 m
	total oxides of nitrogen	Thermo Electron corp. 42i-TL	2, 6, 6, 9, 15 m
Scots pines	photosynthesis	chamber measurements	appr. 10 m
	CO ₂ -exchange	URAS 3G analysator	appr. 10 m
	H ₂ O	URAS 3G analysator	appr. 10 m
	PAR	LI-Cor LI-190SB	appr. 10 m
	temperature	thermoelement Cu Ko	appr. 10 m
	growth in thickness	solartron sensors	several heights
	growth in length	calliper	appr. 10 m



HiMAC snow and ice over the lakes across Eurasia continent



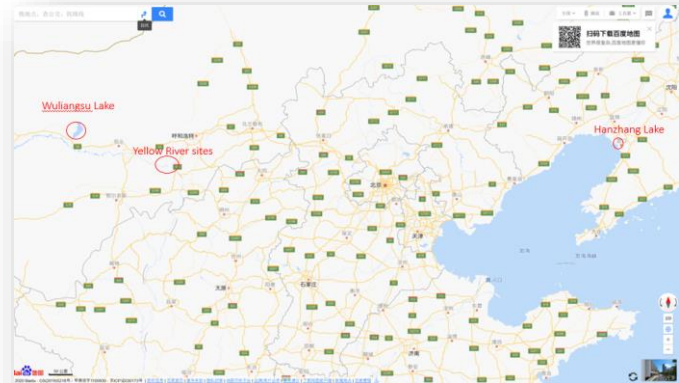
Aims:

- (1) Atmosphere and Ecosystem in the HiMAC regions, and across with PEEEX stations, combined with Earth observations.
- (2) **Lake ice/snow on lake ice modeling** : leveraging on the extensive *in situ* data collection on lake ice and snow properties in midwinter.
- (3) **Validation or comparison** : for the remote sensing products, like snow and ice thickness development with sentinel, GF dataset.
- (4) **Satellite and *in situ* measurement data** : Microwave or optical spectrum characteristics of snow and ice, and the Integration of *in situ* and remote sensing measurement

Satellite observations



- Satellite data (Sentinel1, GF3, AMSR2 and FY3): enhanced understanding the physical change of snow and ice
- Data coordination (GF and Sentinel series): clear snow flooding and snow ice formation long-term dataset for monitoring sites
- Sensors measurement (microwave, AIR-CAS's sensor): possibility of microwave sensor testing in Sodankylä or AIR-CAS's sensor in Tianshan?



Tianshan Snow Avalanche Station



- Two field trips to measure snow properties in Xinjiang in the past
 - 1st snow properties varying with elevation along Yili River in western Tianshan mountains)
 - 2nd extended the snow properties measurement to the Pamir mountains
- Planning to visit Kyrgyz Republic for measuring snow properties in **Western Tianshan mountains**.
- If necessary, we can measure the properties in the **Lake Isaacs** in **Western Tianshan of Kyrgyz** where snow is quite deep.

Finland Observations for lake ice



- Air-snow-ice-water temperature monitoring program in lake Orajärvi since 2009. The temperature was measured SIMBA ice mass balance buoy. Snow depth and ice thickness can be derived from temperature profile.
- Snow-ice and superimposed ice formation can be investigated.
- The lake snow/ice surface temperature as well temperature below surface with 2cm interval can be obtained.
- The weather data available since early 1900s in the region.
 - The snow was unexpected thick, so it might be difficult to use skidoo to carry our cross section lake snow and ice survey if the weather is continuing like now.
 - The SIMBA in lake Orajärvi works fine, thanks Juha's effort last week

Cold environment laboratories for ice physics and mechanics, ice physical processes in-situ, that means often change my work site based on the fund and cooperation partners.

- **Wuliangsu Lake** from 2015-2016 winter, ice physics, ice optics and ice mechanics. Look for the **climate changes impact on ecosystem** under ice and the technology for the ice observations. (**past 4 winters**, I work on the ice at WULIANGSU HAI Lake where is nearby Yellow River and the ice in Yellow River.)
- 2019/2020 winter, (1) the **dust effect on the albedo** and dissolved **oxygen consume under the ice**, (2) Ice thickness profile, (3) Ice crystal and air, dust in ice, (4) ice flexural strength, (5) Ice gas bubbles and dust effect on ice optical irradiation in laboratory.
- **Yellow River** from 2014-2015 winter, ice physics, ice optics and ice mechanics. Radar, Optical measurements on the Yellow River ice.
- **Hanzhang Lake** from 2019, the ice observation platform for observation of ice period.

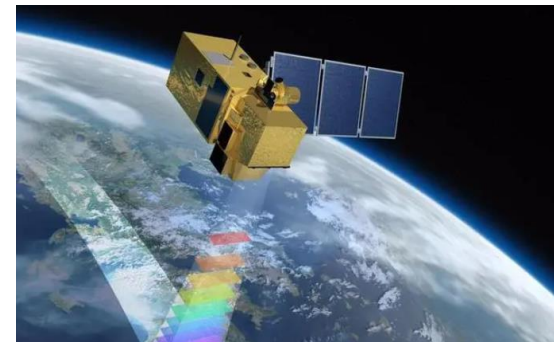
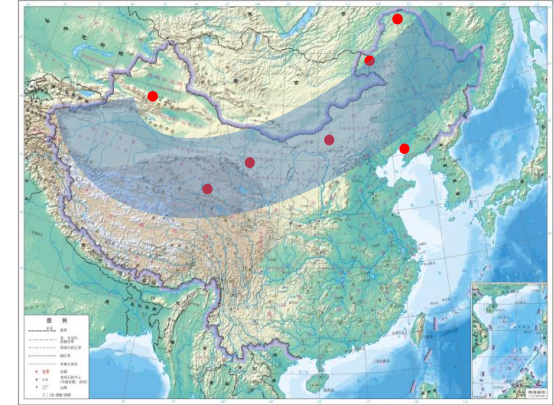
HiMAC-Ex : Combination of Space and Station based Observations across Eurasia



Earth observations: large coverage, spatio-temporal continuous dataset

In-situ Measurement: validation and calibrations

Modeling : enhanced understanding of mechanism





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Thanks

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