A Role of the Private Sector to Disaster Prevention in the 4IR Era.

Nov 20, 2018

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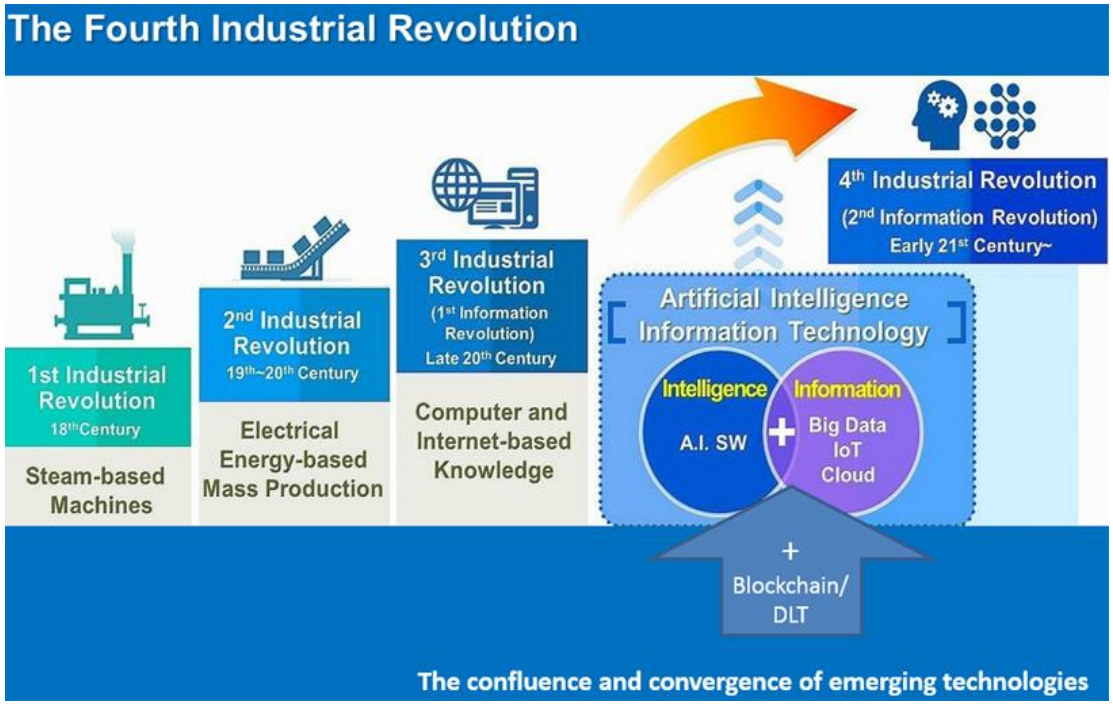
What is the 4IR?

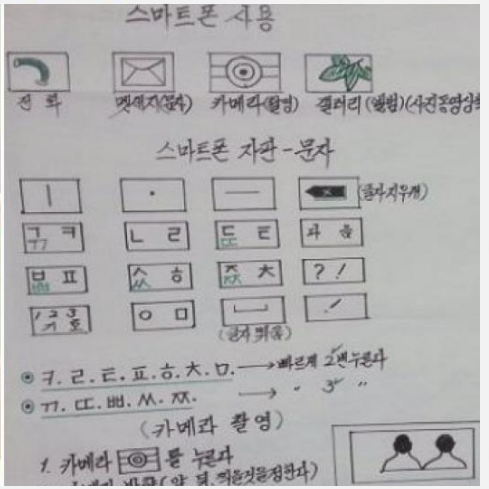
- The **Fourth Industrial Revolution** (**4IR**) is the fourth major industrial era since the initial Industrial Revolution of the 18th century. It is characterized by a **fusion of technologies** that is blurring the lines between the physical, digital, and biological spheres, collectively referred to as **cyber-physical systems**.
- It is marked by emerging technology breakthroughs in a number of fields, including **robotics, AI, nanotechnology, quantum computing, biotechnology, IoT, IIoT, 5G wireless technologies, additive manufacturing, 3D printing and fully autonomous vehicles**.



An easy explanation of 4IR Era

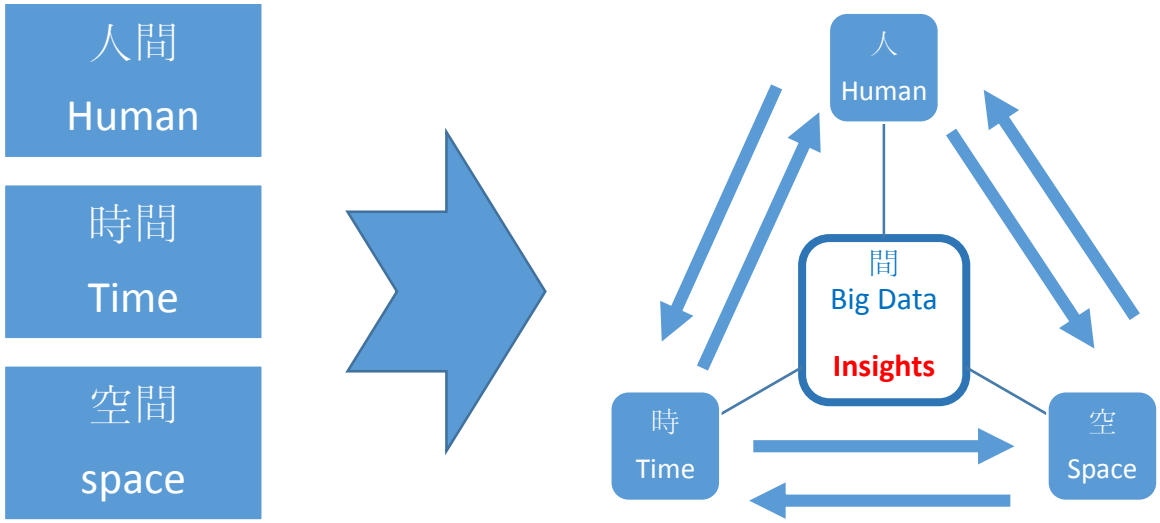
Arti's IT Smart Life

Where is the Galaxy smartphone manual?



An elegant explanation of 4IR Era

The civilization of mankind has been developed within the limits of time and space given



Time and space are modes by which we think and not conditions in which we live.

시간과 공간은 우리가 생각하는 방식이지 우리가 사는 조건이 아닙니다.

- Albert Einstein -

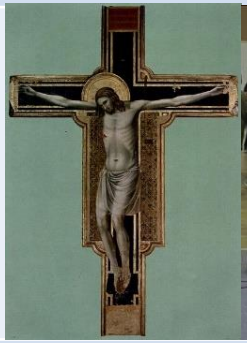
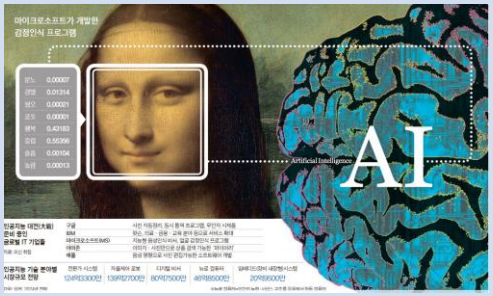
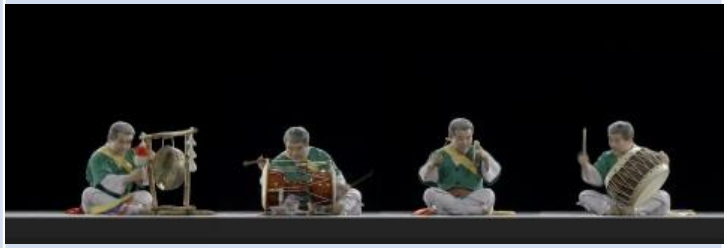
An enjoyable explanation of 4IR Era

Humans began to paint to escape the fear of empty spaces, and began to make music to escape the fear of time.

인간은 비어 있는 공간에 대한 공포에서 벗어나려고 그림을 그리기 시작했고, 시간에 대한 공포에서 벗어나려고 음악을 만들기 시작했다.

An enjoyable explanation of 4IR Era

- Invitation to the society of Hyper-connected, Superintelligence, Super-realization -

		Spatial dimension	
		plane	space
Temporal dimension	Non-exist		 
	exist		**Digital Chantourne** 

- ✓ **The speed of information exchange at home and society is speed-up more than 10 times.**
- ✓ **AI, robot, un-maned vehicles will be common.**

5G era: Does AI forecast weather?

nature International weekly journal of science

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Archive > Volume 548 > Issue 7668 > News > Article

NATURE | NEWS

How machine learning could help to improve climate forecasts

Mixing artificial intelligence with climate science helps researchers to identify previously unknown atmospheric processes and rank climate models.

Nicola Jones

23 August 2017

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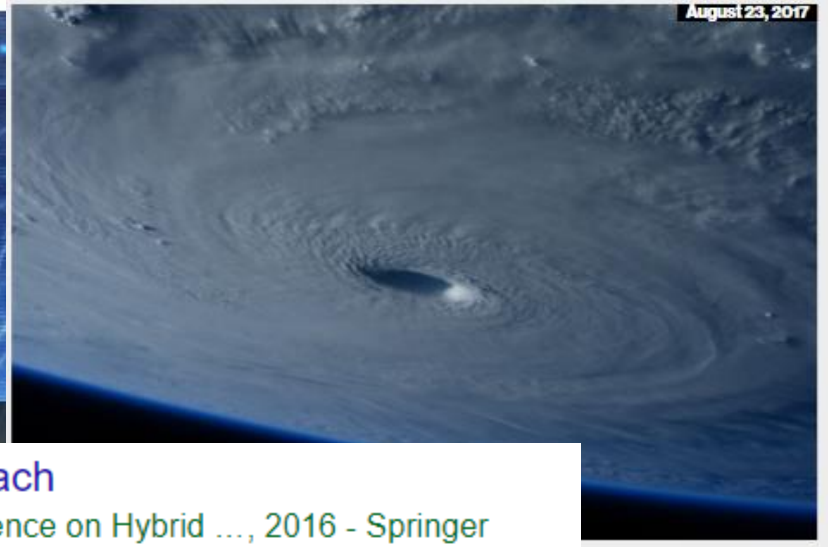
Many of the latest climate mo



Rainfall Prediction: A Deep Learning Approach

E Hernández, V Sanchez-Anguix, V Julian... - ... Conference on Hybrid ..., 2016 - Springer

Abstract Previous work has shown that the prediction of meteorological conditions through methods based on artificial intelligence can get satisfactory results. Forecasts of meteorological time series can help decision-making processes carried out by organizations responsible of disaster prevention. We introduce an architecture based on Deep Learning for the prediction of the accumulated daily precipitation for the next day. More specifically, ...

☆ 99 2회 인용 관련 학술자료 전체 3개의 버전

Rainfall Prediction: A Deep Learning Approach

J Palanca, N Duque - ... , HAIS 2016, Seville, Spain, April 18-20 ..., 2016 - books.google.com

Abstract. Previous work has shown that the prediction of meteorological conditions through methods based on artificial intelligence can get satisfactory results. Forecasts of meteorological time series can help decision-making processes carried out by organizations responsible of disaster prevention. We introduce an architecture based on Deep Learning for the prediction of the accumulated daily precipitation for the next day. More specifically, ...

☆ 99 관련 학술자료

ose of AI

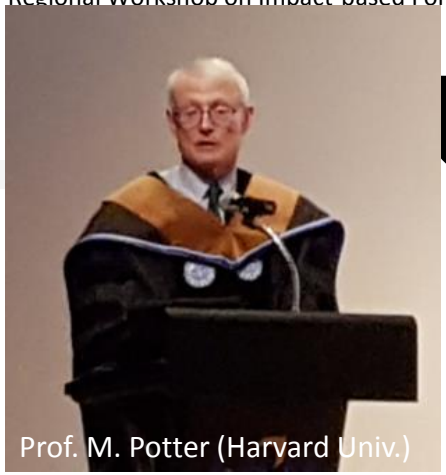
listing artificial intelligence to
g efforts to individual weather
nd themselves in need of
g.

e surge in AI. First, machine-
d in identifying tropical cyclones
cipitation on an area but aren't

models the IPCC uses to
dels can produce an analysis
lso increasingly using AI to help
xample.

pointed out before, computers
st problems in AI (see "The Dark
ncerned about relying too much
—or to make forecasts about

Posted by Michael Reilly
August 23rd, 2017 4:25PM



What happened?

- **Descriptive Analytics**

Why did it happened?

- **Diagnostic Analytics**

What will happen next?

- **Predictive Analytics**

How to improve results?

- **Prescriptive Analytics**

Past(과거)

Present (현재)

Future(미래)

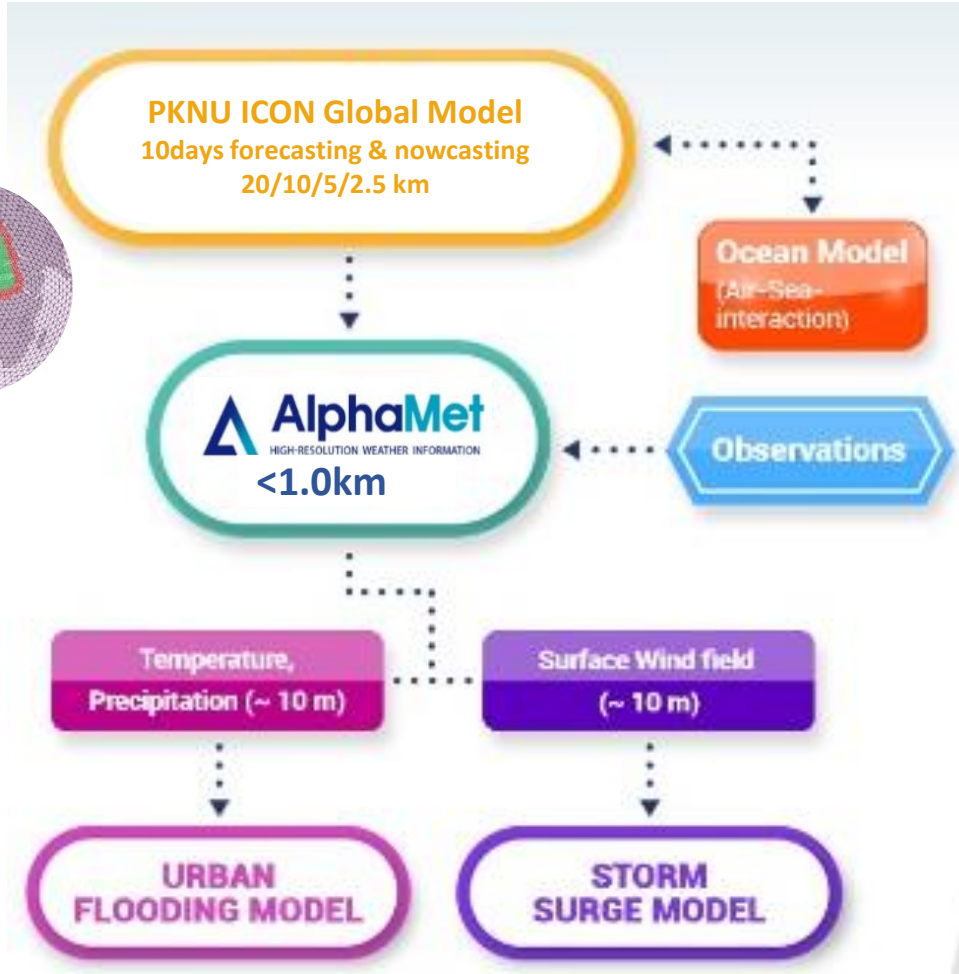
AlphaMet is coming

Seamless Full-spectrum – past, now & future

Major Components of AlphaMet

- **Look Backward in Time**
  Nano-scale (~10m) Recover Temp., Prec., & Wind for Ungauged Sites
- **Look Forward in Time globally**
  Ultra-High Resolution Global Prediction System (~20/10/5/2.5 km)
- **Look Backward in Time locally**
  Nano-scale (~10m) Prediction for Limited Target Area
- **Superintelligence by Machine Learning**
  Classification, Clustering, Regressing based on Nano-scale (~10m) Past & Future Information

Nano-Weather System



Nano-Weather
Earth Surface
= $4\pi R^2$
= 4 x 3.14 x 6350 x 6350
= 5.06 x 10^8 km^2

1 km^2 ≒ 2 x 10^{-9} Earth's Surface

- Objectives for Disaster Prevention
- 10day forecast (every week)
- Typhoon prediction
- Quantitative Precipitation Forecast
- Air pollution & Yellow sand prediction

- Climate Prediction Objectives
1. Seasonal prediction with Ensemble experiments
2. AMIP
3. Global Warming Scenario production

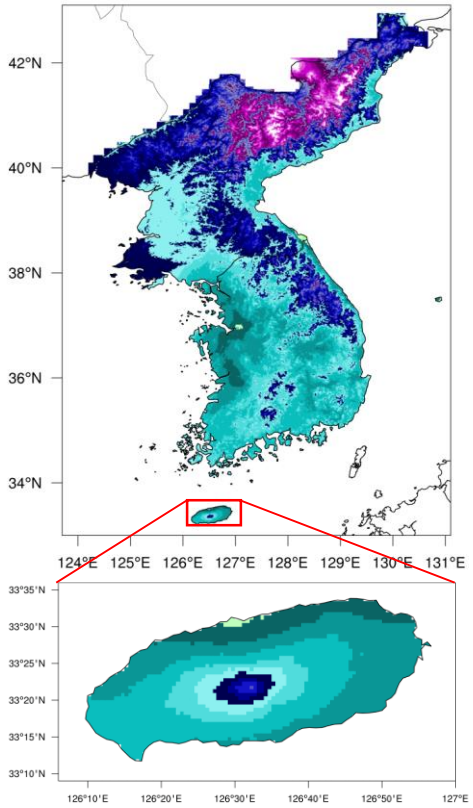
Nano C&W

AlphaMet

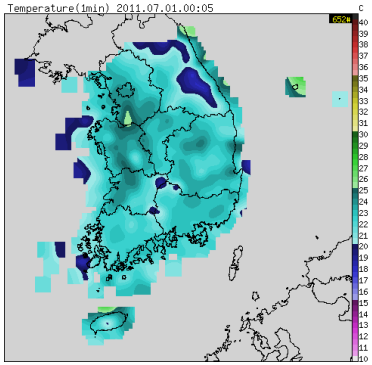
Comparison of synthetic data with AWS observation

Result of AlphaMet (1 km)

2011. 07. 01. 00 (KST) °C

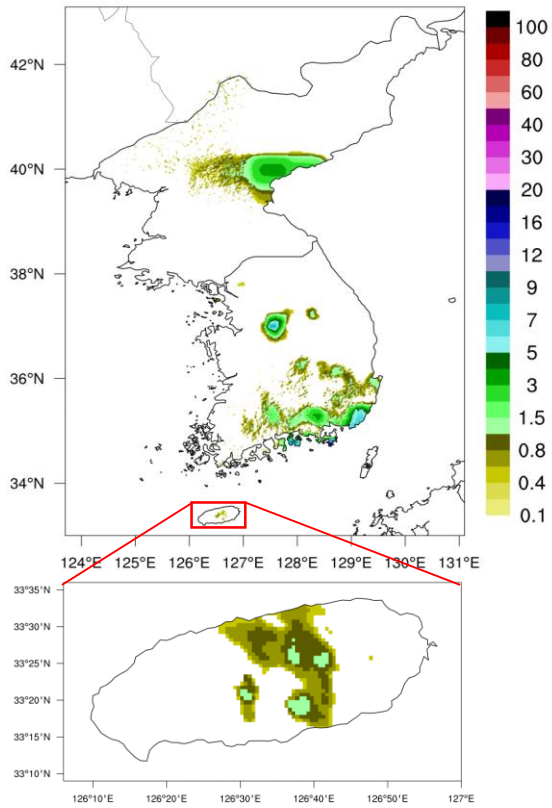


Temperature (KMA)

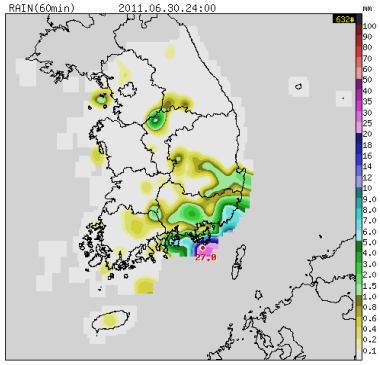


Result of AlphaMet (1 km)

2011. 07. 01. 00 (KST) mm



Precipitation (KMA)



Investigation on the Origin of Power Failure due to broken of the 154kV power line between Taeback to Gohan in Korea

Recovery of weather conditions along the 154kV HVPL

Rule of categorization of Icing

- **Accumulation of snow : wet show lays on the power lines**

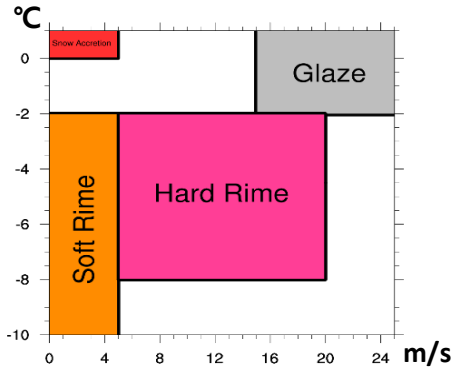
  → 0 ~ 1.5 ℃ & 5 m/s or less

- **Icing :**

→Soft Rime : Aggregation of cloud ice particles

Hard Rime : Aggregation of supercool cloud droplets or fog

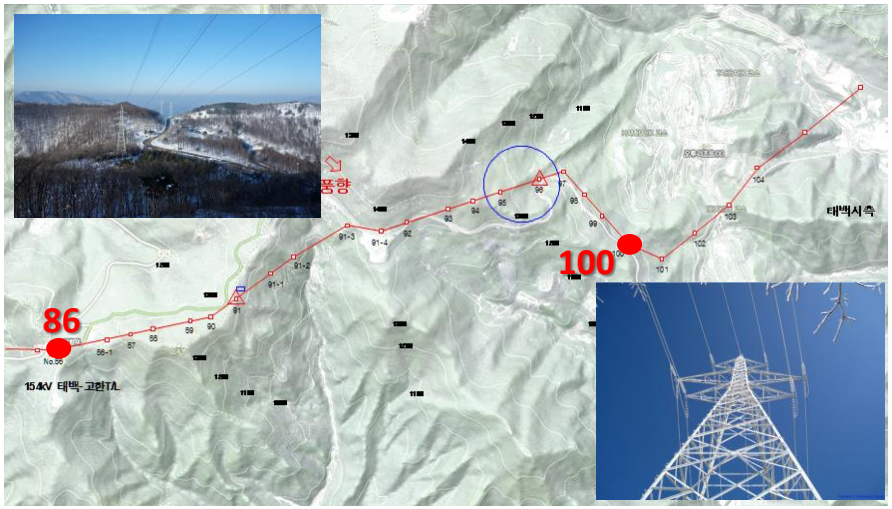
Glaze : Aggregation of freezing rain

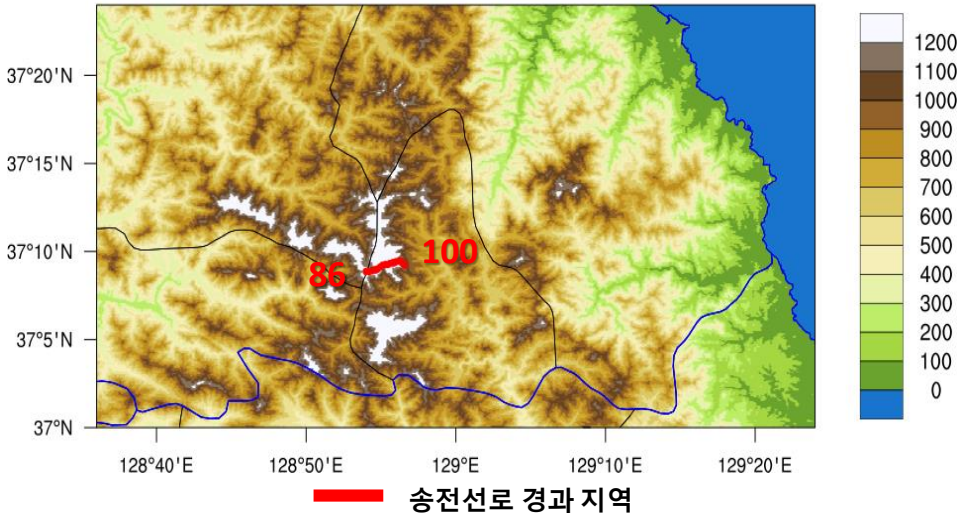


Class	Temperature	Wind velocity
Soft Rime	-3.0 ~ -10.0 ℃	0 ~ 5 m/s
Hard Rime	-2.0 ~ -8.0 ℃	5 ~ 20 m/s
Glaze	+1.0 ~ -3.0 ℃	15 ~ 25 m/s

Recovery of weather conditions along the 154kV HVPL

Elevation of the power Lines on the Target Range





- **Range of target region :**

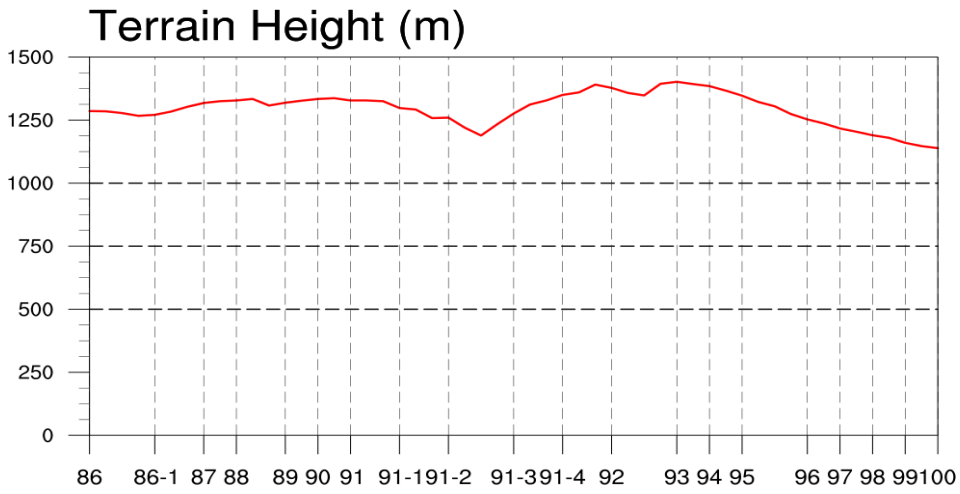
  → : 128.53~128.56 ˚E

- **Time of Power Failure Accident :**

  → Jan. 21th 01:27 (LST)

- **Range :**

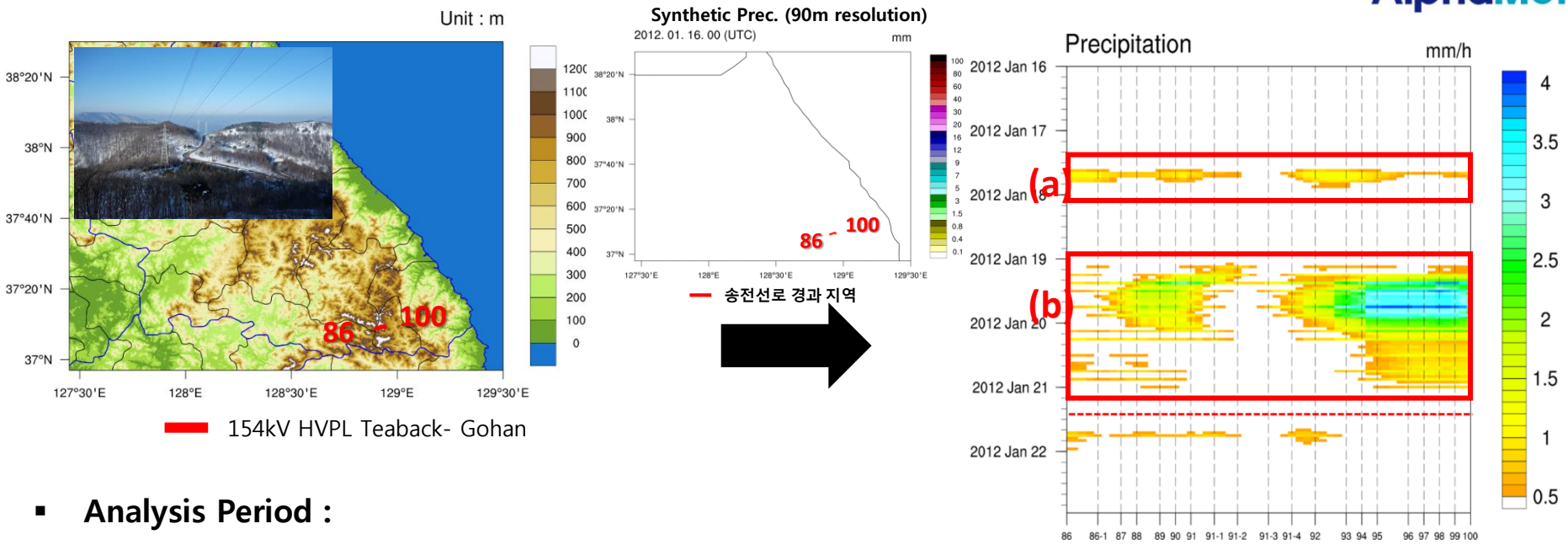
  → 154kV HVPL Teaback- Gohan T/L **No.86~100**



Recovery of weather conditions along the 154kV HVPL

AlphaMet

Synthetic Precipitation along the Power Line No.86~100



- **Analysis Period :**

  → Jan. 16th 00 LST ~ 22nd 23 LST, 2012

- **Time of Power Failure :**

  → Jan. 21st 01:27 LST

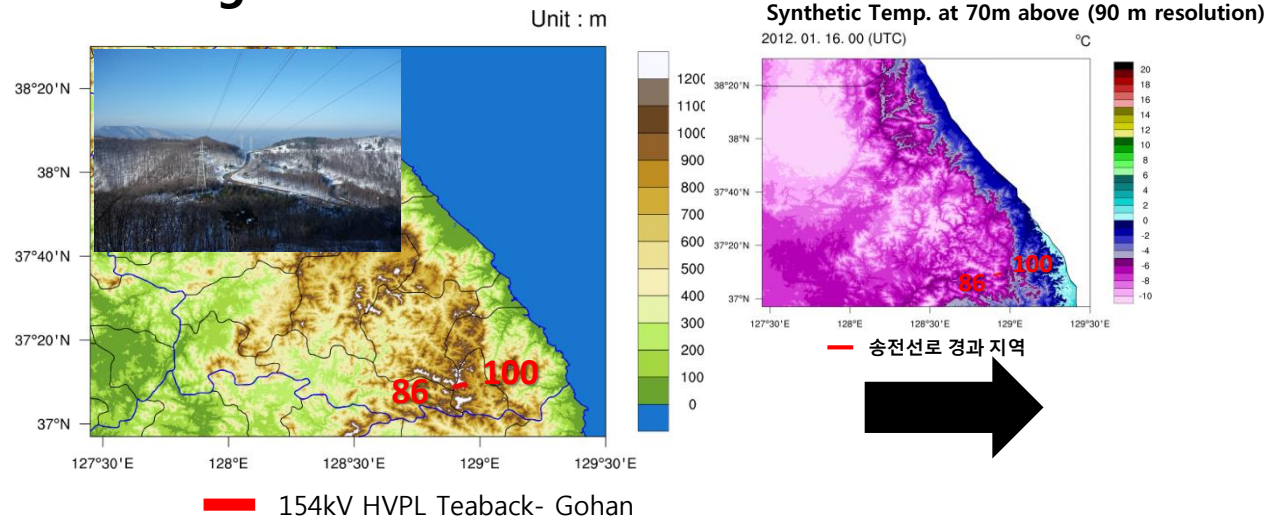
Fig 3. Distribution of precipitation at the Taebaek-Gohan transmission line before and after the accident (Red dot line : Time of the accident).

- There were 2 times precipitation events:
  - (a) : Jan.17, 2012 15:00-21:00 LST (7 hours)
  - (b) : Jan.19, 02:00- Jan. 21, 00:00 LST (47 hours)
- (a) The max Precipitation was 6.6 mm at the range of #93
- (b) The max Precipitation was 83.3 mm at the range of #91-2 ~ 91-3

Recovery of weather conditions along the 154kV HVPL

AlphaMet

Synthetic Temperature at 70 m above the ground along the Power Line No.86~100



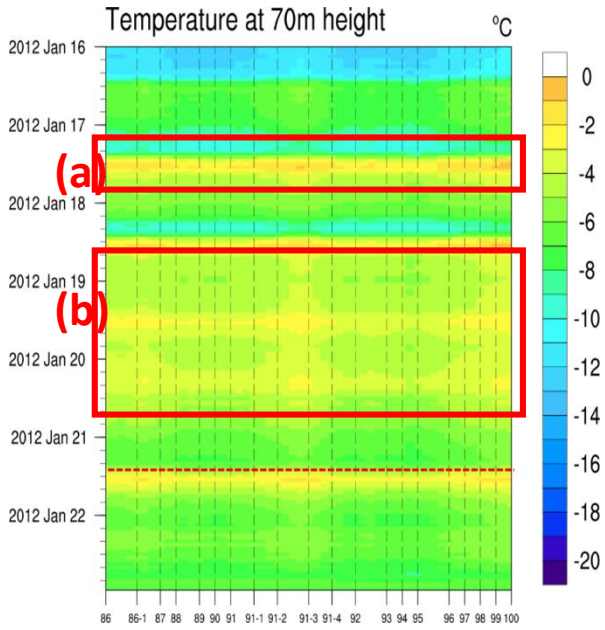


Fig 4. Distribution of temperature at 70m at the Taebaek-Gohan transmission line before and after the accident (Red dot line : Time of the accident).

- **Analysis Period :**

  → Jan. 16th 00 LST ~ 22nd 23 LST, 2012

- **Time of Power Failure :**

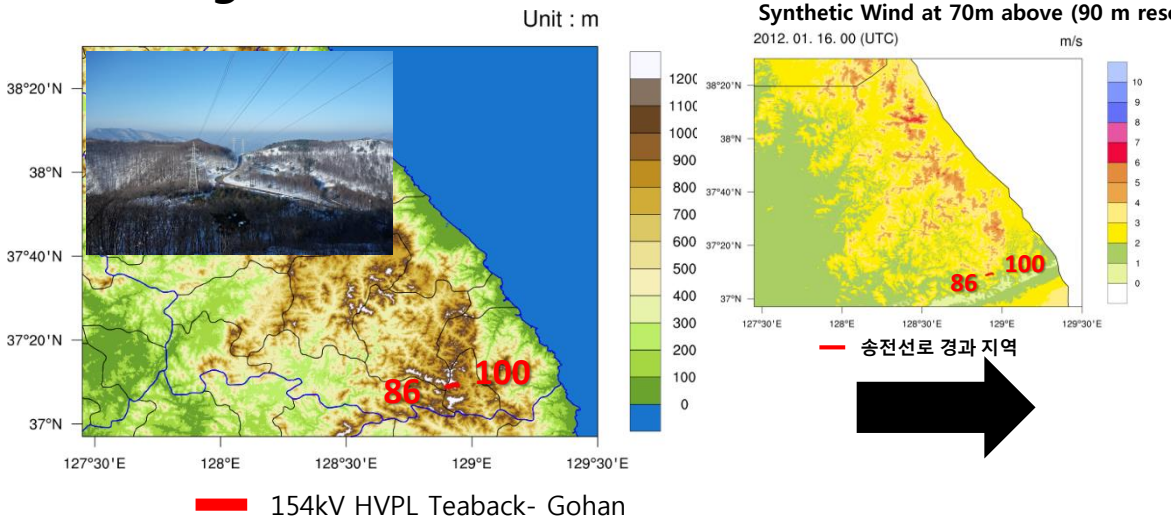
  → Jan. 21st 01:27 LST

- (a) The temperature was -4.3 ℃ on average with minimum -5.0 ℃ at #94 and maximum -3.6 ℃ at #100.
- (b)) The temperature was -4.2 ℃ on average with minimum -4.9 ℃ at #94 and maximum -3.5 ℃ at #100.

Recovery of weather conditions along the 154kV HVPL

AlphaMet

Synthetic Wind Speed at 70 m above the ground along the Power Line No.86~100



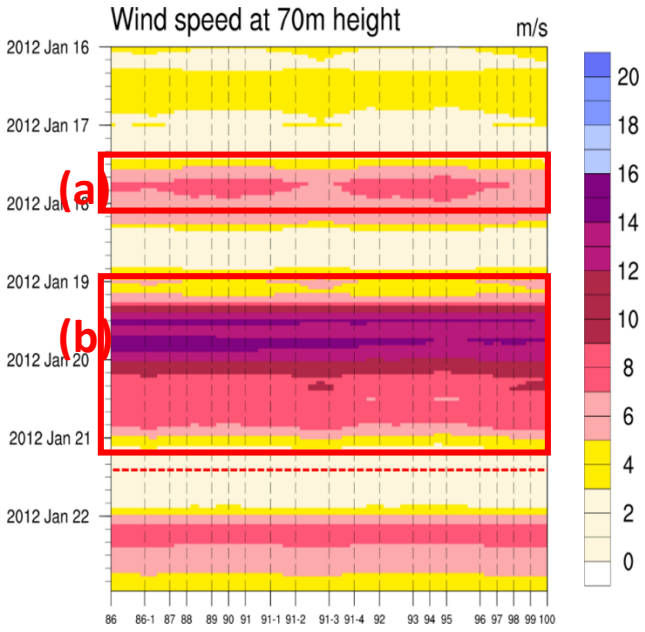


Fig 5. Distribution of wind speed at 70m at the Taebaek-Gohan transmission line before and after the accident (Red dot line : Time of the accident).

- **Analysis Period :**

  → Jan. 16th 00 LST ~ 22nd 23 LST, 2012

- **Time of Power Failure :**

  → Jan. 21st 01:27 LST

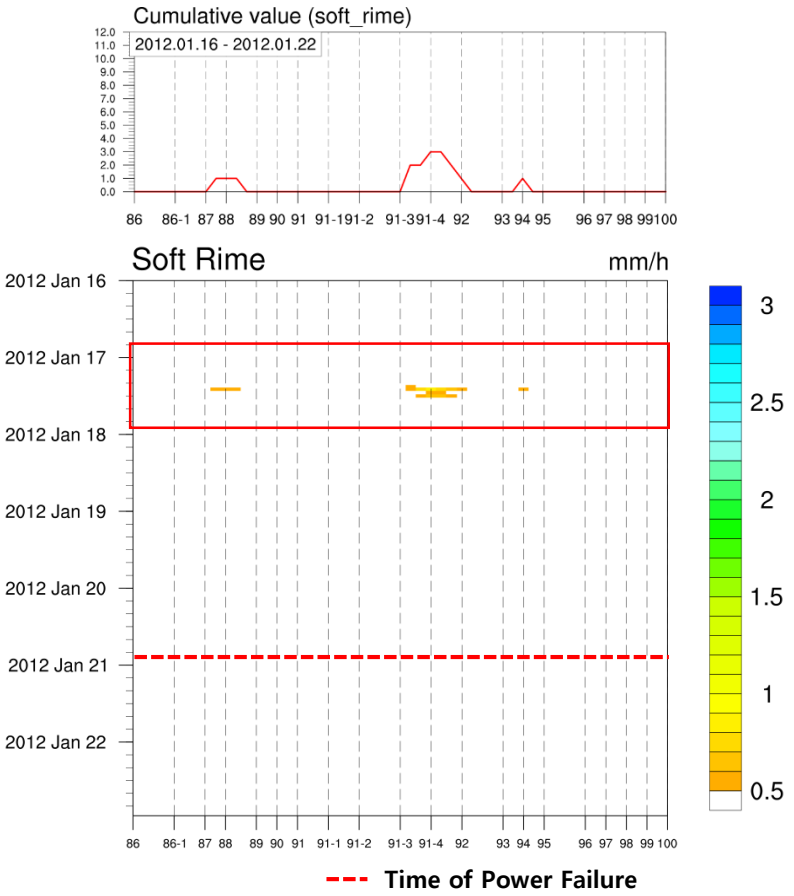
- (a) The wind speed was 7.0 m s^{-1} on average with minimum 7.4 m s^{-1} at #94 and maximum 6.4 m s^{-1} at #100.
- (b) The wind speed was 9.6 m s^{-1} on average with minimum 9.3 m s^{-1} at #94 and maximum 9.8 m s^{-1} at #100.

Icing Analysis on the 154kV HVPL

- **Weather Conditions for Soft Rime**

→ Temp. -10.0 ℃ ~ -3.0 ℃

Wind Speed 0 ~ 5 m/s



- **Weather Conditions for Hard Rime**

→ Temp. -8.0 ℃ ~ -2.0 ℃

Wind Speed 5 ~ 20 m/s

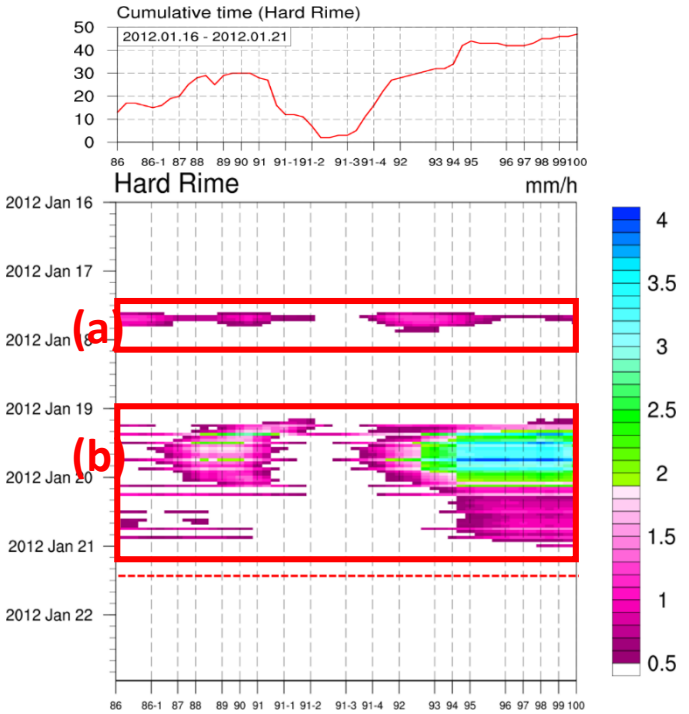


Fig 7. Distribution of precipitation under the environment of hard rime at the Taebaek-Gohan transmission line before and after the accident (Red dot line : Time of the accident).

Conclusion on the Investigation on Power Failure within the 154kV Taebaek-Gohan T/L by the Nano C&W

- **The high voltage power line, Taebeak-Gohan T/L L located at the high altitude over 1200 m, had disconnected on Jan. 21, 2012.**
- **Nano C&W made a conclusion that the accident might be cause from a significant potential hard rime condition during Jan. 17~18, 19~20, 2012 along the Taebeak-Gohan T/L based on the recovered synthetic temperature, precipitation & wind data with 90m resolution .**
- **Based on the recovery of weather condition data the reason of power in the line between Taeback-Gohan might be caused by the 47 hours hard rime condition together with 9.6 m/s strong wind during Jan. 18, 21:00 LST - Jan. 20 12:00 at the range Tower 98-100.**

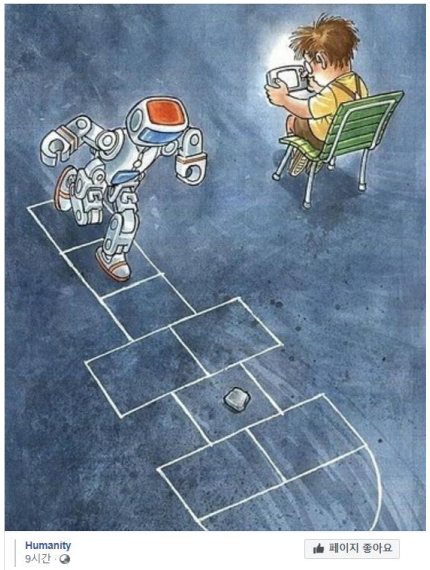
Conclusions

- **Ultra-high resolution prediction system provides useful data to society in detail.**
- **This system has the following advantage:**

① **Providing daily essential variables for disaster prevention not only on the rich observational data area but on the poor data area.**

② **Providing timely updated nano-scale seamless weather & Climate data in combination of the past, present and future data**

- **Ultra-high resolution prediction system may be able to contribute to a climate service to not only agricultural community but also to hydrological community to predicting flesh floods.**



The hardest thing in change is not to think of new things, but to get out of the frame that you had before.

- John Maynard Keynes (British economist)

Nano Climate & Weather

Thank you for your attention !

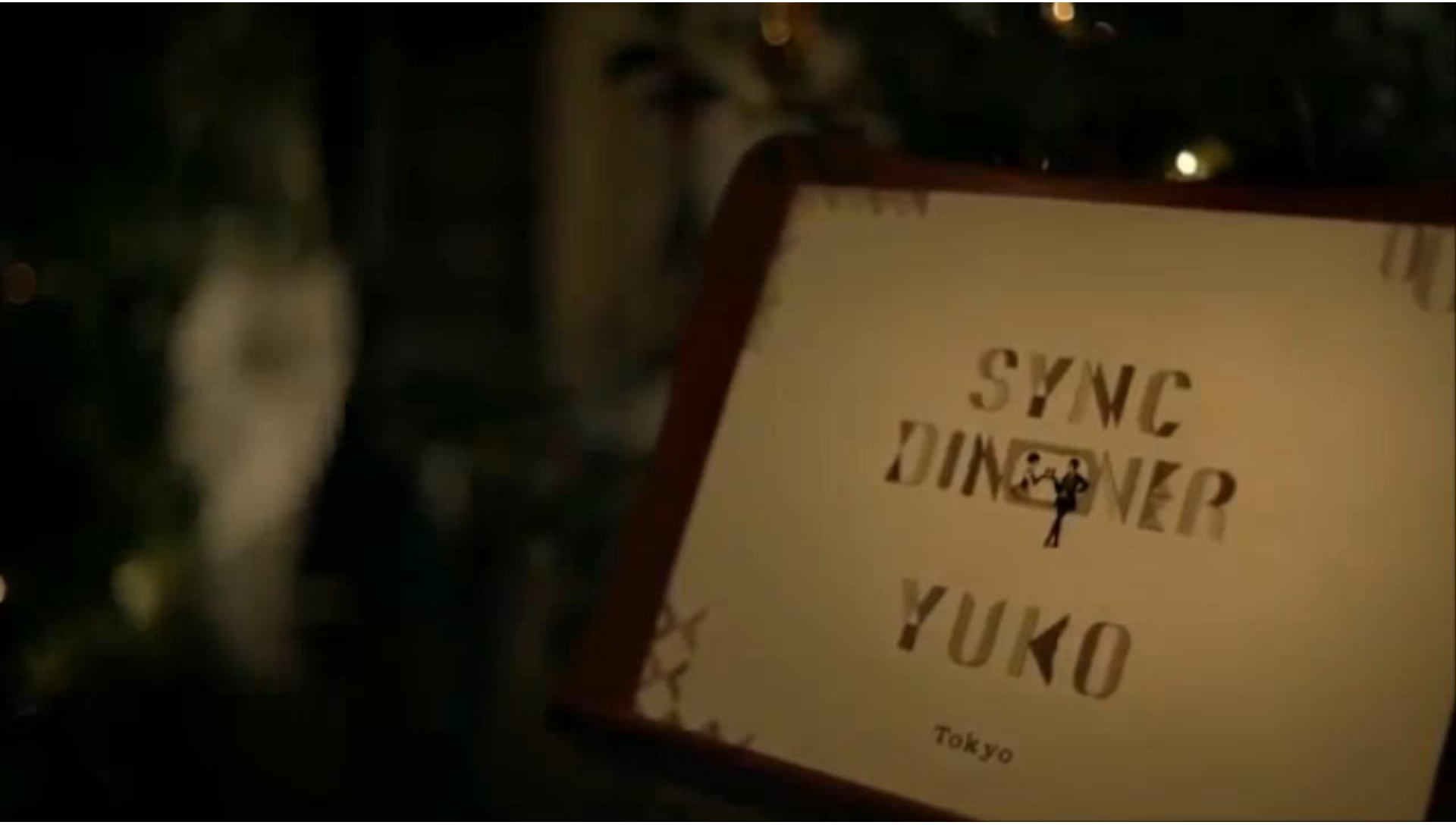
Nano C&W

Super-realization : overcome temporal limitation

4차 산업혁명과 경계의 매력 (전인태 KBS TV PD)

Superrealization : overcome spatial limitation

원격만찬으로의 초대 (KDDI, JAPAN)



Digital Chantourne

4차원의(4-D) 앙상블 퍼포먼스