Enhancing Climate Prediction Information by Capturing Where People Aren't Looking

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Enhancing Climate Prediction Information by Capturing Where People Aren't Looking

- Processes of extremes (can blame it to GW?)
- Sources of predictability (can or can’t forecast?)
- Education (ready for a new discipline?)
One solution to

Enhancing Climate Prediction Information

lies in

Higher Education 2.0
Enhancing Climate Prediction Information

Build Bachelor & Master Degrees for

Meteorologist (BS) vs.

• Climate Forecaster (Ph.D.)
• Climate Communicator (?)
Weather
Immediate, can feel

Climate
Delayed, mixed feeling

Change
Extrapolated
Weather
I know what I need

Climate
Not sure what I need

Change
Think what I will need

Information
User
What is it that you need?

Weather

Climate

Change

Information

User

Provider
AccuWeather

Papua New Guinea Weather

Now | Weekend | Extended | Satellite

Next month | Next month | Next year | Next decade

SAT AUG 18

88°/74°F
Partly sunny; humid

88°/74°F
A stray morning thunderstorm

87°/74°F
Partly sunny, a stray shower

87°/74°F
Clouds and sun; humid

89°/74°F
A little afternoon rain

Information
Climate Prediction
?
VISION AND RESEARCH STRATEGIES FOR THE NEXT DECADE

S2S forecasts will be as widely used a decade from now as weather forecasts are today.
Climate Forecast
Climate Prediction Information
Climate Prediction

(1)

- **Timescale**: (weeks, season, decade)
- **Content**: (beyond El Niño/ENSO)
- **Extremes**: (unexpected)
2018 Korea & Japan: from flood to heat

Extremes (unexpected)
climatological rainfall (5-day) →

Extremes (↑ what’s expected)

East Asian summer monsoon lifecycle

wet

hot
Climate Prediction

Projection (end of century)

Prediction (season, year, or decade)

Extremes (that’s unexpected)

2018 rainfall

East Asian summer monsoon lifecycle

flood

heat wave

climatological rainfall (5-day)
Climate Prediction Information

Projection (end of century)

Prediction (season, year, or decade)

Extremes (or is it so unexpected?)

CMIP5 projection (RCP8.5) - - - future

East Asian summer monsoon lifecycle

Boosted?
Goal:

(1) ≈ (2)
How does the U.S. do it?

Drought Information System (NIDIS)

+ River Forecasting Centers

Storm Prediction Center

National Water Center

Climate Prediction Center

Hydrological Prediction Center
How does the U.S. do it?

Product development should be driven by consumers – rather than scientists or donor agencies assuming what data might be useful or what climate impacts are of most concern.

- Webber and Donner (2017)
Require **bottom-up forecast** development. But can only afford top-down forecast development. said Chief of the Operations Branch

Climate Prediction Center
...for it’s impossible for government entities to meet everyone’s different needs!
Still, the gov needs regional “centers” to handle and deliver climate information.
Regional Integrated Sciences and Assessments (RISAs)

Currently Funded RISAs:

- Alaska Center for Climate Assessment and Policy (ACCAP)
- Climate Impacts Research Consortium (CIRC)
- Western Water Assessment (WWA)
- Great Lakes Regional Integrated Sciences and Assessments Center (GLISA)
- Consortium on Climate Risk in the Urban NE (CORUN)
- Northern Mariana Islands
- Marshall Islands
- Federated States of Micronesia
- Guam
- Hawaii
- American Samoa
- California-Nevada Applications Program (CNAP)
- Climate Assessment for the Southwest (CLIMAS)
- Southern Climate Impacts Planning Program (SCIPP)
- Carolinas Integrated Sciences and Assessments (CISA)
- Mid-Atlantic Regional Integrated Sciences and Assessments (MARIAS)
But...still not enough to meet user needs.

...Still not bad air quality!
Localized Forecasts

Inversions...

30-day forecasts

Localized Forecasts

First Freeze...

30-day forecasts
Localized Forecasts

Pest control Nowcasting
water level vs. zoning

Build it or not build it?
Colorado River Water Supply

GSL water level

forecast

future fun?
University extension: its researchers and educators engage individuals and organizations in asking the challenging questions to discover science-based answers that make a difference.
State Climate Offices
(state climatologists)
Asian countries have similar extension entities, maybe smaller or fewer.

How do we do?
Asian countries

Faculty who does everything other faculty members do

in the U.S.:
Faculty who has specific roles (not evaluated by traditional research)
An example from Central Weather Bureau

2016 “King” Cold Surge

Implications of the WNP
Application of S2S forecasting

A seasonal prediction for the wet–cold spells leading to winter crop damage in northwestern Taiwan with a combined empirical–dynamical approach

Parichat Promchote, S.-Y. Simon Wang, Yuan Shen, Paul G. Johnson, and Ming-Hwi Yao

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4 Agricultural Engineering Division, Agricultural Research Institute, Taichung, Taiwan
An example from Central Weather Bureau

Forecast for damaging cold events 2 month ahead

<table>
<thead>
<tr>
<th>Weather event (abbreviation)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold</td>
<td>Temperature &lt; 10°C</td>
</tr>
<tr>
<td>Dry-cold (DC)</td>
<td>Temperature &lt; 10°C with no precipitation (0 mm) before, during, and after the cold day</td>
</tr>
<tr>
<td>Wet-before-cold (WBC)</td>
<td>Temperature &lt; 10°C with precipitation ≥5 mm in the previous day only</td>
</tr>
<tr>
<td>Wet-with-cold (WWC)</td>
<td>Temperature &lt; 10°C and precipitation ≥5 mm on same day only</td>
</tr>
<tr>
<td>Wet-after-cold (WAC)</td>
<td>Temperature &lt; 10°C with precipitation ≥5 mm on the following day only</td>
</tr>
<tr>
<td>Wet-cold (WC)</td>
<td>Temperature &lt; 10°C with precipitation ≥5 mm either before, during, or after the cold day</td>
</tr>
</tbody>
</table>

*Int. J. Climatol. (2017)*
Accelerated increase in the Arctic tropospheric warming events surpassing stratospheric warming events during winter

S.-Y. Simon Wang1,2, Yen-Heng Lin1,2, Ming-Ying Lee3, Jin-Ho Yoon4, Jonathan D. D. Meyer1,2, and Philip J. Rasch5

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21 Jan 2016

Far-flung effect of Arctic warming (on cold East Asian winter)
21 Jan 2016

Winter Storm Jonas (Jan 22-24)

East Asia cold snap kills 85 in Taiwan

ABS-CBN News
Posted at 01/26/16 3:44 AM

Record Siberian High and snowfall in subtropical Asia (Jan 24-26)
(a) AO (CPC)

21 Dec 2015

300mb HGT

21 Jan 2016

Winter Storm Jonas (Jan 22-24)

Record Siberian High and snowfall in subtropical Asia (Jan 24-26)
(a) AO (CPC)

(b) Polar Cap Height

Waugh et al. (2016)
Since 1950, RTW cases have been increasing while SSWs remain flat.

Increased RTW impacts extremes and challenges S2S prediction.
Forecast for diurnal episodes 3 weeks ahead of time.

Wea. Forecasting (2013)
Climate Forecasts (S2S): national centers

producers

translators

economically valued met info

career opportunities

public, private, & non-profit

users

rich & poor

Buizer et al. (2016 PNAS)
Challenges ahead

A good translator:

• Localized knowledge
• Meteorological professionalism

but people are trained differently!
Challenges ahead

Need to change education to produce a new discipline in climate prediction science
Producing a future generation with...

New degrees in:

- Climate Science
- Climate Communication
- Climate Informatics

BS, MS, PhD
Solutions for the current generation

Colleges should add

- Climate Change
- Climate Systems as gen-eds
Solutions in the mean time...

Engage in extension: create *extension* *climatologists*, but don’t pressure them on *traditional* academic duties.
Thank you!

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