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**PFNS**  
DEPARTMAN ZA RATARSTVO I  
POVRTARSTVO



UNIVERSITÀ  
DEGLI STUDI  
FIRENZE  
**DISPAA**  
DIPARTIMENTO DI SCIENZE DELLE  
PRODUZIONE AGROALIMENTARI  
E DELL'AMBIENTE



UNIVERSITÄT FUER  
BODENKULTUR  
WIEN  
**BOKU**  
DEPARTMENT FÜR WASSER-  
ATMOSPHERE-UMWELT



EUROPEAN  
COMMISSION  
**Horizon 2020**  
EUROPEAN UNION FUNDING  
FOR RESEARCH & INNOVATION

**Guest lecture**

**6 November 2018**  
**Florence, Italy**



# Serbia for Excell

H2020-TWINN-2015

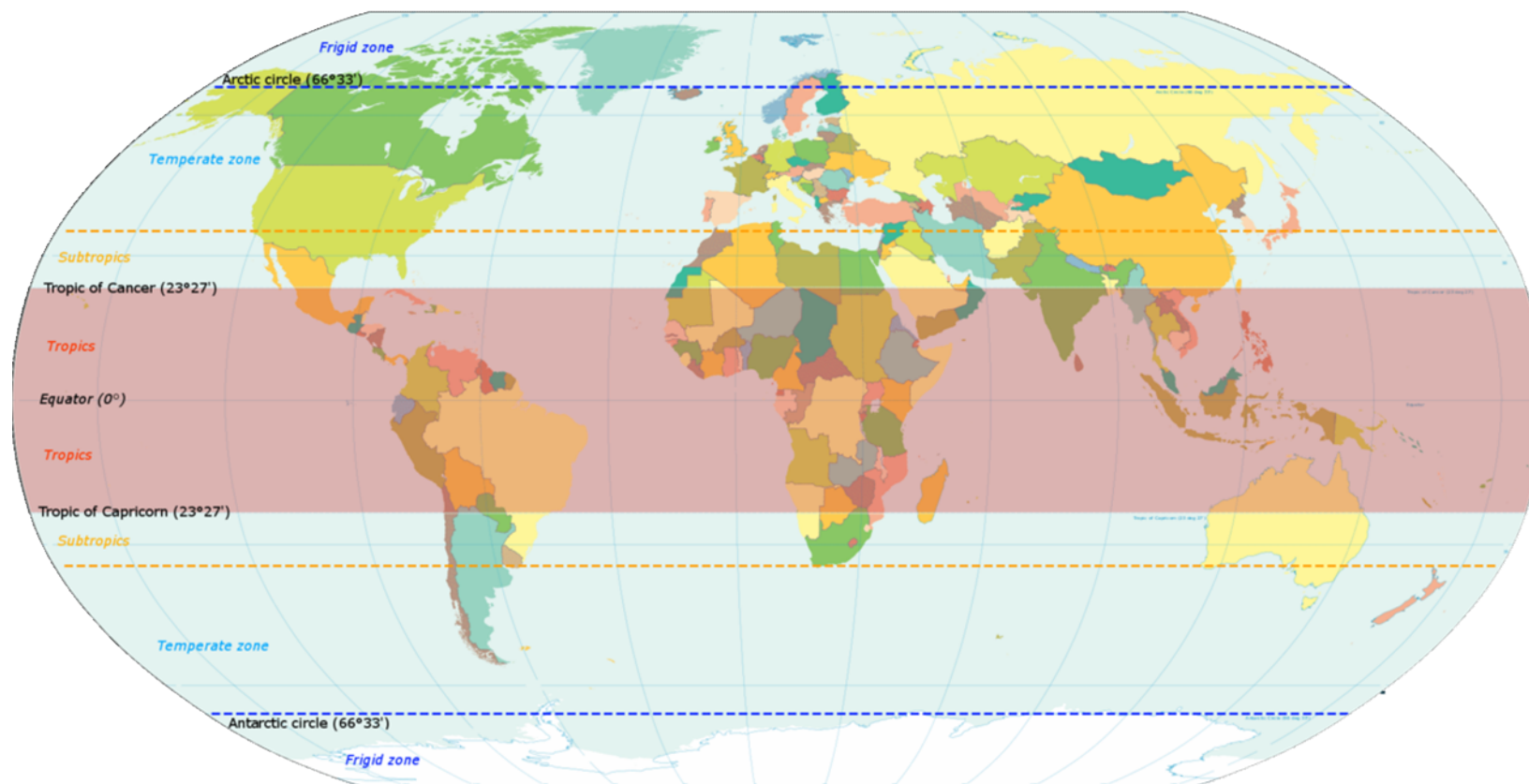
## Meteorological data: sources, representativeness & use

**Ao. Prof. Branislava Lalic**

**Institution: Faculty of Agriculture, University of Novi Sad, Novi  
Sad, Serbia**



## Meteorological data sources, representativeness & use: Challenges of tropical weather monitoring and forecasting



## WHEATHER DATA – AVAILABLE MORE THAN EVER

Browser tabs: Fiumicino - Aeroporti di Roma, New Tab, Ruma, Serbia Forecast, Personal Weather Station

Address bar: <https://www.wunderground.com/cgi-bin/findweather/getForecast?query=Ruma%2C+Serbia>

Navigation: Apps, Google, COST | Home, ECOST, Pokrajinski sekretarijat, Horizon 2020 - Europe, A&C Work and Equal, Bad Science, Calls for funding opp, Home, Other bookmarks

WEATHER UNDERGROUND | Maps & Radar | Severe Weather | News & Blogs | Photos & Video | Activities | Search Locations | Log in | Join

Popular Cities: San Francisco, CA (26.4 °C Clear), Chicago, IL (24.3 °C Mostly Cloudy), Boston, MA (31 °C Partly Cloudy), Houston, TX (32.9 °C Partly Cloudy), London, UK (25.9 °C Clear), New York, NY (31.1 °C Clear)

### Ruma, Serbia


Lacarak, Sremska Mitrovica, Srbija | Report | Change Station

© 7:23 PM CEST on July 08, 2017 (GMT +0200)

Forecast | History | Calendar | Rain / Snow | Health

Active Advisory: Potential disruption due to extreme high temperatures from 12AM CEST SAT until 11:59PM CEST SAT

Elev 0 m 45.00 °N, 19.57 °E | Updated 14 sec ago



Partly Cloudy

Feels Like **35 °C**

Wind Variable  
Gusts 0 km/h

Tomorrow is forecast to be **WARMER** than today.

Today: High 33 | Low 20 °C  
0% Chance of Precip.

Yesterday: High 37.2 | Low 17.3 °C  
Precip. 12.7 mm

[Allergy Alert](#)

Sign up for your Daily Forecast Email

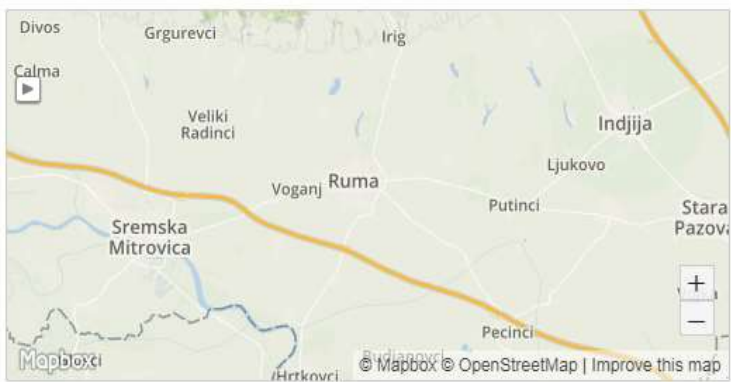
Pressure	1013.77 hPa
Visibility	-9999.0 kilometers
Clouds	
Heat Index	35 °C
Dew Point	21 °C
Humidity	52%
Rainfall	0 mm
Snow Depth	Not available.

Sun & Moon

5:02 am Full, 100% visible  
8:28 pm

METAR LYBE 081700Z 28010KT CAVOK 32/15  
Q1013 NOSIG

Radar | Satellite | WunderMap



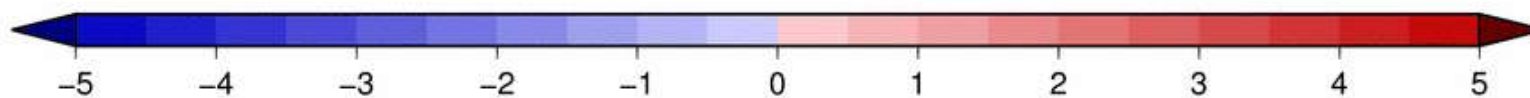
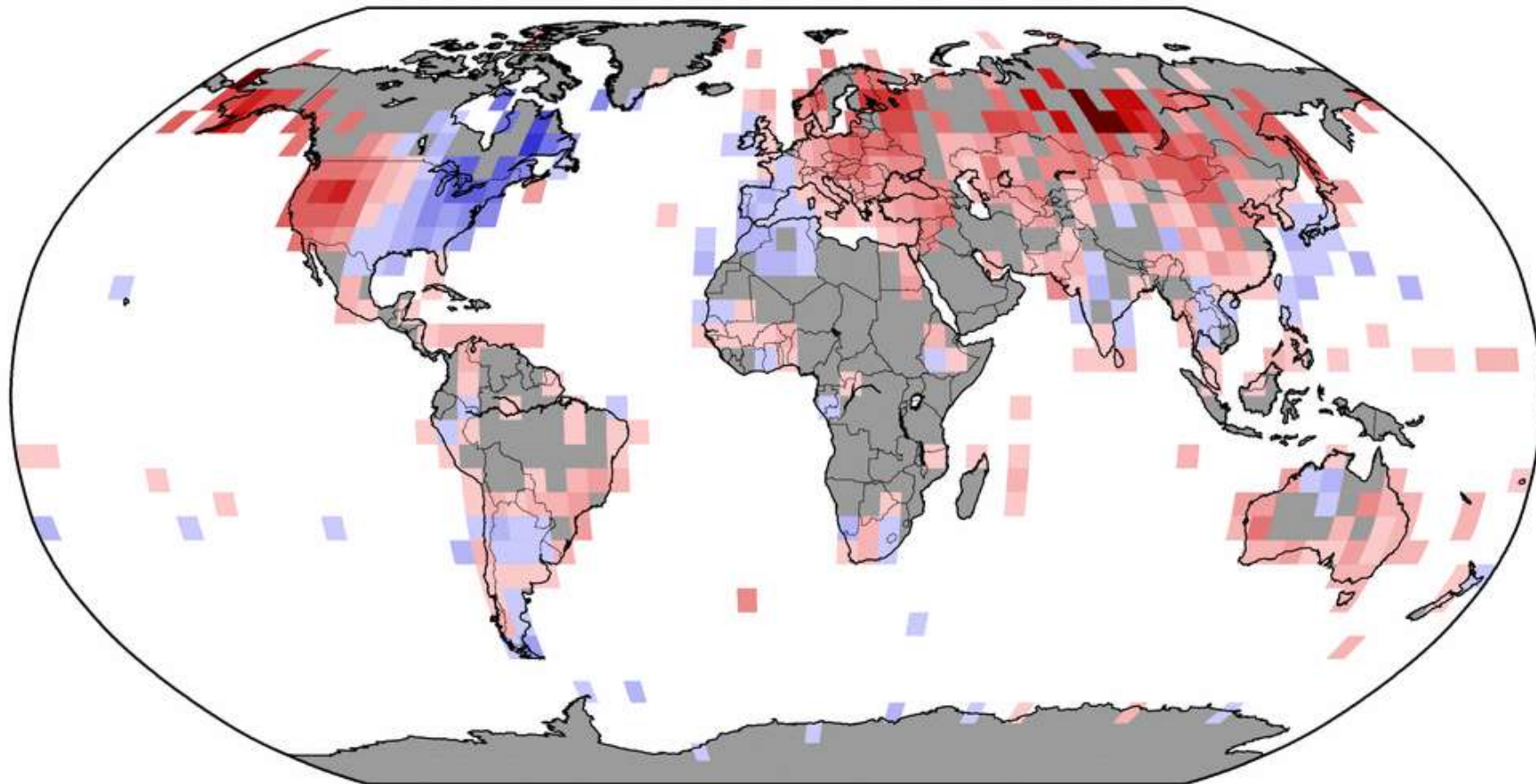
Show Webcams

Windows taskbar: Desktop, Libraries, Branka, Computer, Network, 19:28 8.7.2017



# Land-Only Temperature Departure from Average Dec 2014–Feb 2015 (with respect to a 1981–2010 base period)

Data Source: GHCN-M version 3.2.2



NOAA's National Climatic Data Center  
Sun Mar 15 19:10:34 EDT 2015

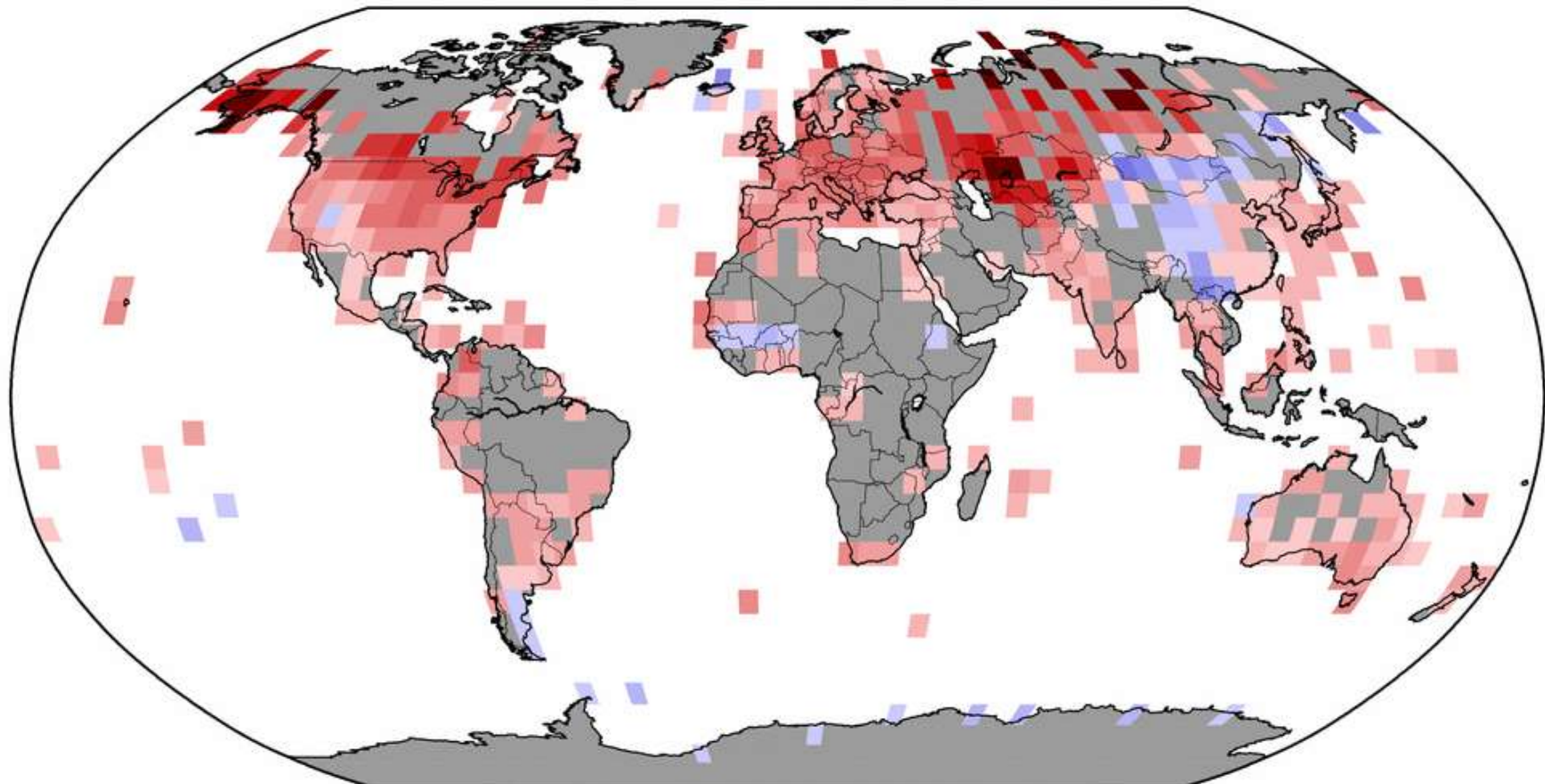
Degrees Celsius

Please Note: Gray areas represent missing data  
Map Projection: Robinson



# Land-Only Temperature Departure from Average Dec 2015–Feb 2016 (with respect to a 1981–2010 base period)

Data Source: GHCNM v3.3.0



National Centers for Environmental Information  
Mon Mar 14 06:20:13 EDT 2016

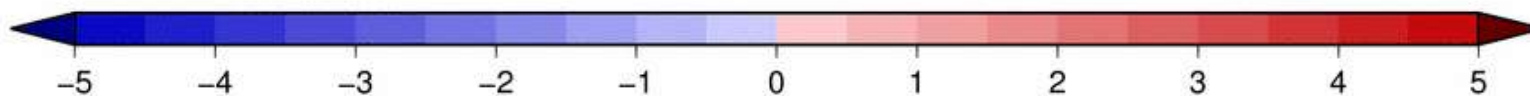
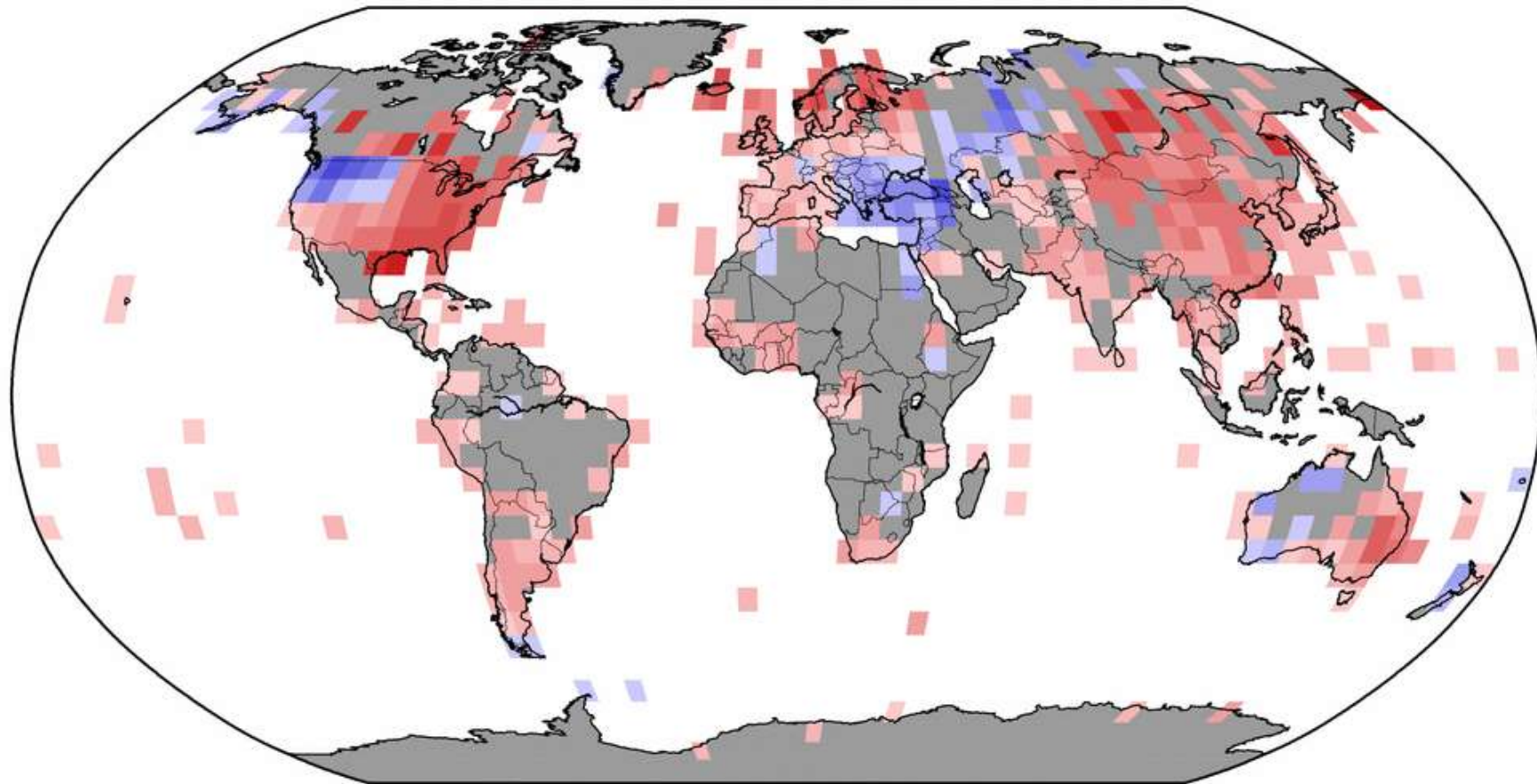
Degrees Celsius

Please Note: Gray areas represent missing data  
Map Projection: Robinson



# Land-Only Temperature Departure from Average Dec 2016–Feb 2017 (with respect to a 1981–2010 base period)

Data Source: GHCNM v3.3.0



National Centers for Environmental Information  
Sun Mar 12 06:22:12 EDT 2017

Degrees Celsius

Please Note: Gray areas represent missing data  
Map Projection: Robinson



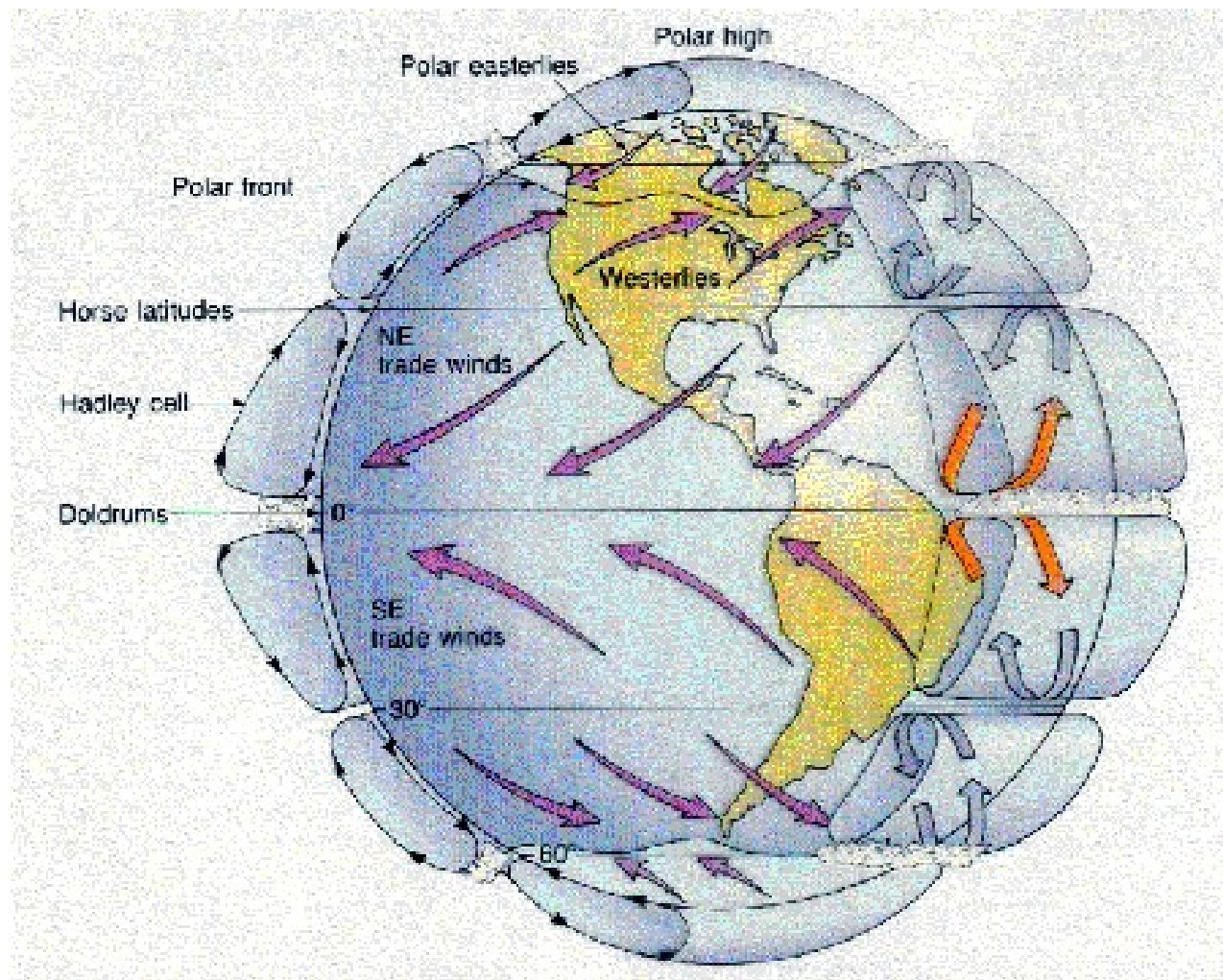
Region	Dates	Change (days)
Novi Sad	13.03.2015.	- 58
	14.01.2016.	
Bačka Topola	19.03.2015.	- 58
	20.01.2016.	
Pančevo	12.03.2015.	- 26
	15.02.2016.	
Ruma	22.02.2015.	- 53
	31.12.2015.*	
Sombor	03.03.2015.	- 73
	21.12.2016.*	

## GROWING PROBLEM

Shift in appearance of "four tillers detectable" - growing stage of winter wheat in Serbia (Source: PIS Serbia).



## Chalanges of tropical weather monitoring and forecasting

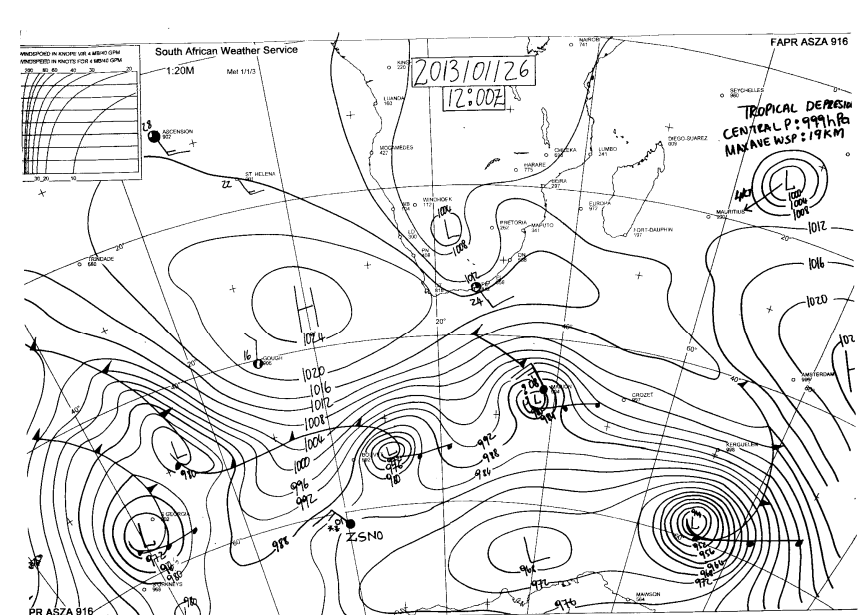
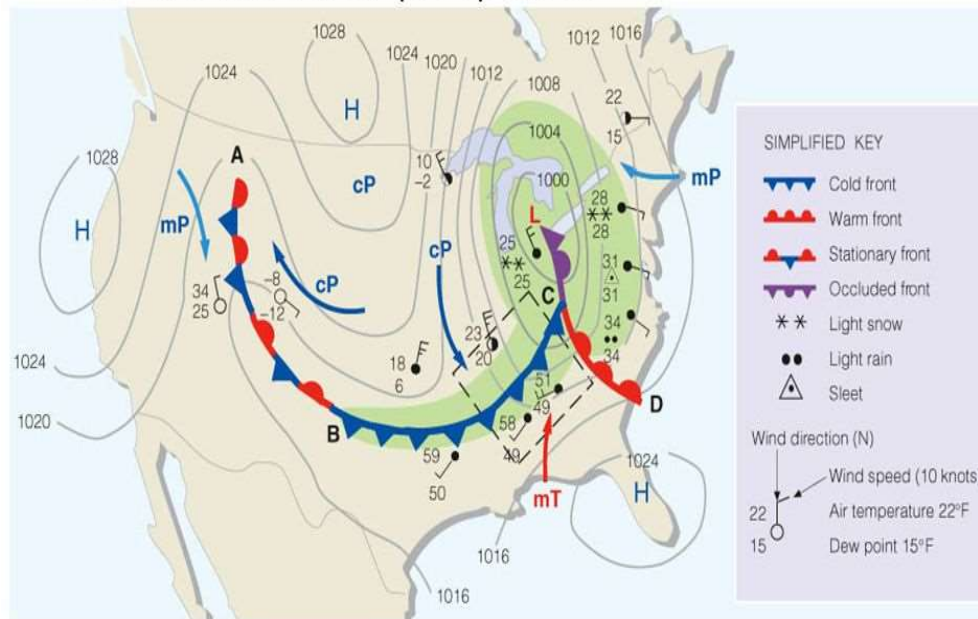




## Challenges of tropical weather monitoring and forecasting

### Weather Map

- Shown: surface-pressure systems, air masses, fronts, isobars, winds and air flow (large arrows)
- Green-shaded area: precipitation





## Tropical weather systems

### Synoptic scale

- Most hazardous - tropical cyclones.
- At high elevations in the Americas, Africa, and Asia – blizzards.
- Cold fronts in the subtropics and tropics (pushed by strong extratropical cyclones during the cool season) bring heavy rain, strong winds and severe weather in prefrontal troughs.
- The monsoon regimes of the tropics generate monsoon depressions, monsoon gyres, and tropical cyclones



## Tropical weather systems

### Other scales

- Within the large-scale pattern set up by the synoptic environment are mesoscale and convective-scale systems
- Scales of tropical convection occurs at a range of scales: isolated thunderstorms (1-10 km, hour), mesoscale convective systems (100-500 km, day), synoptic-scale superclusters (1000-4000 km, week), and the Madden-Julian Oscillation (~10000 km, weeks to months).



## Sources of meteorological data

### Measured data

NHMI observation network – *in situ*  
AWS network for special purposes – *in situ*  
Radars - remote  
Satelite measurements - remote  
GCOS - <https://public.wmo.int/en/programmes/global-climate-observing-system>

### Forecasted data

Short-range weather forecast (out to 5 days)  
Medium-range weather forecast (out to 15 days)  
Monthly forecast (out to 30 days)  
Seasonal forecast (out to 7 months)  
Climate model simulations (decades)



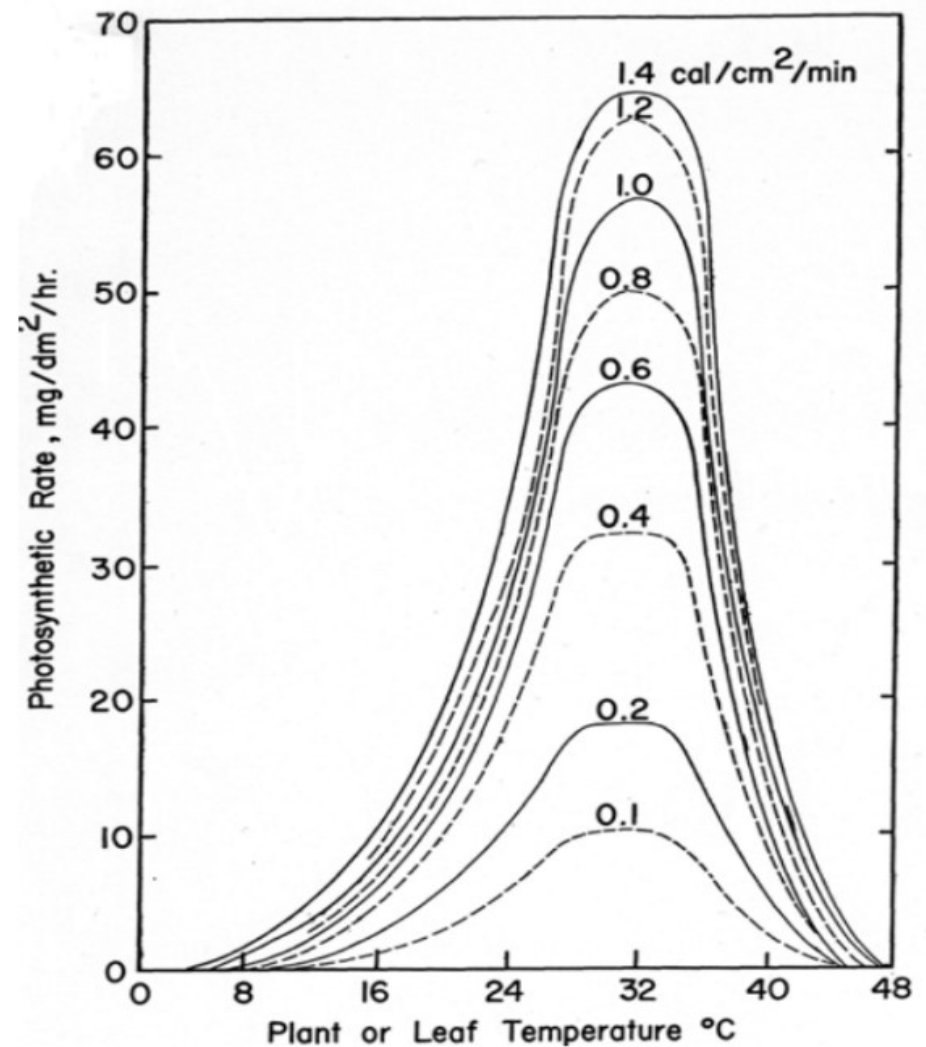
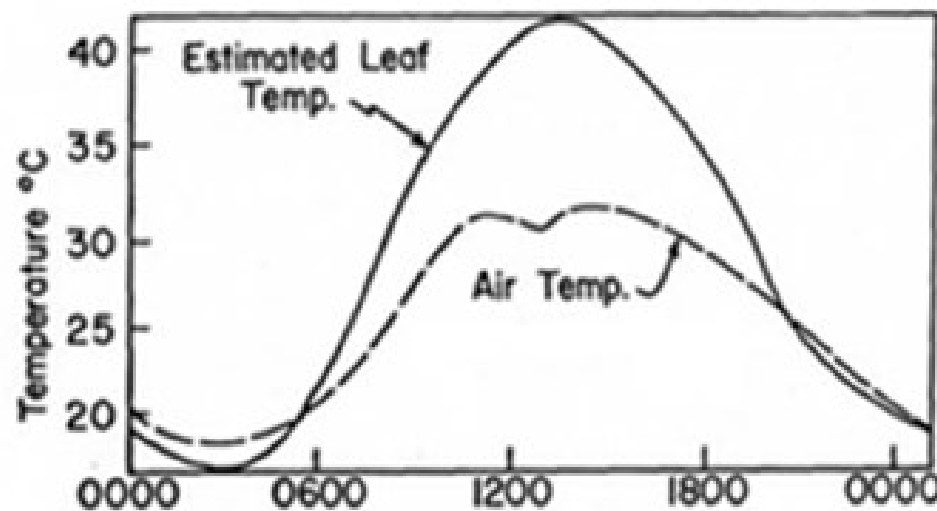
## Sources of meteorological data

Trustfulness

Representativeness

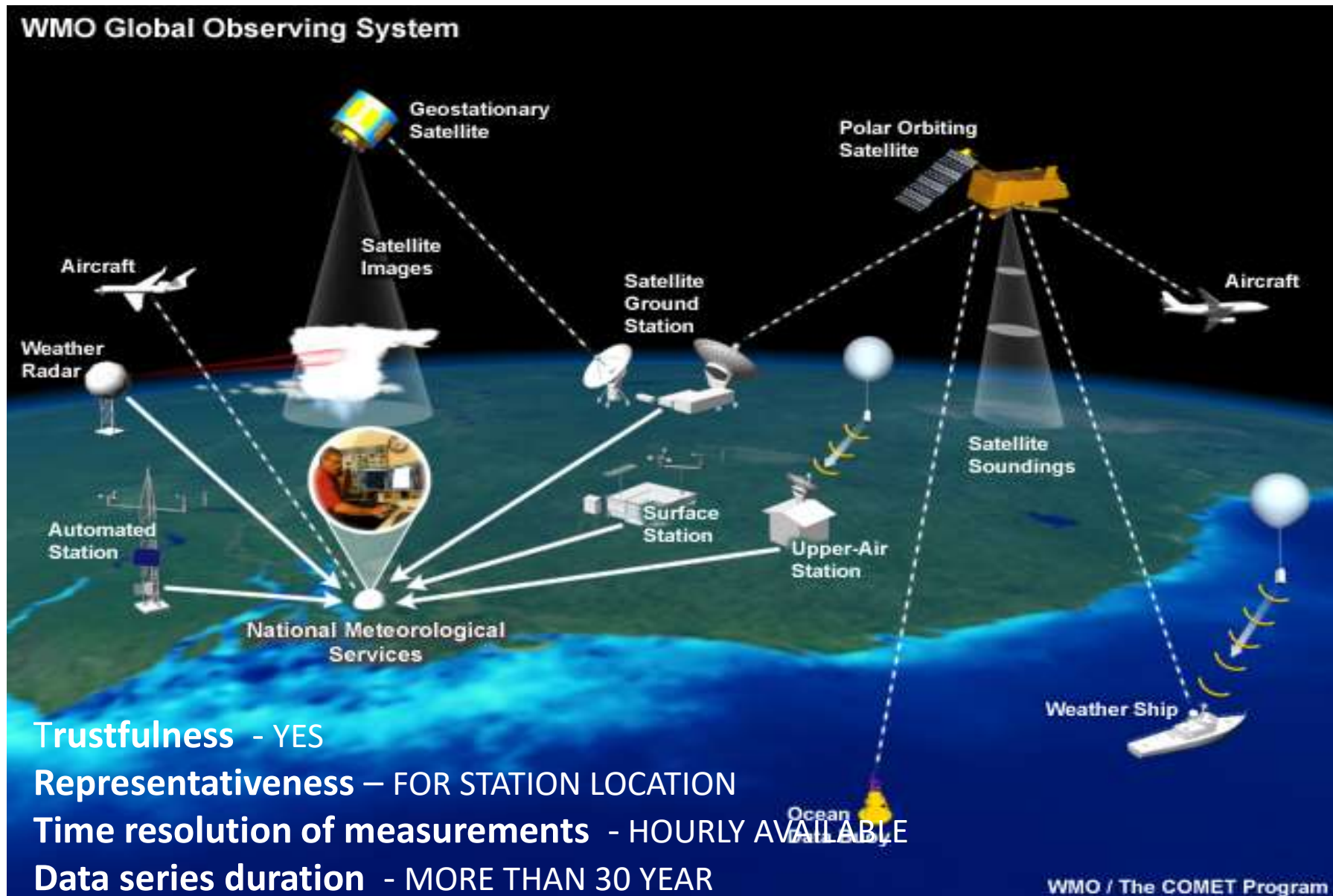
Time resolution of  
measurements

Data series duration





## Sources of meteorological data: Measured data





## Sources of meteorological data: Measured data

### NHMI observation network

Trustfulness - YES

Representativeness – FOR STATION LOCATION

Time resolution of measurements - HOURLY AVAILABLE

Data series duration - MORE THAN 30 YEAR



## Sources of meteorological data: Measured data

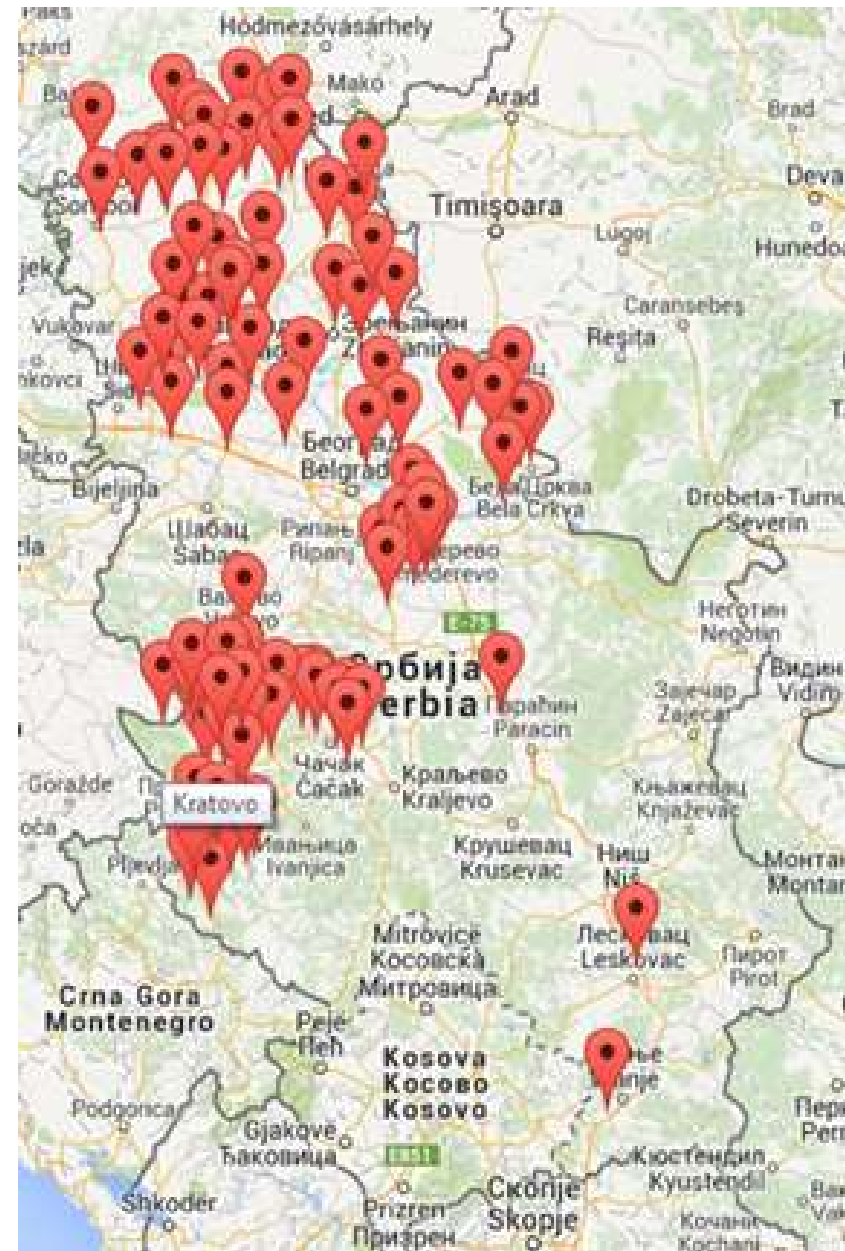
### AWS network for special purposes

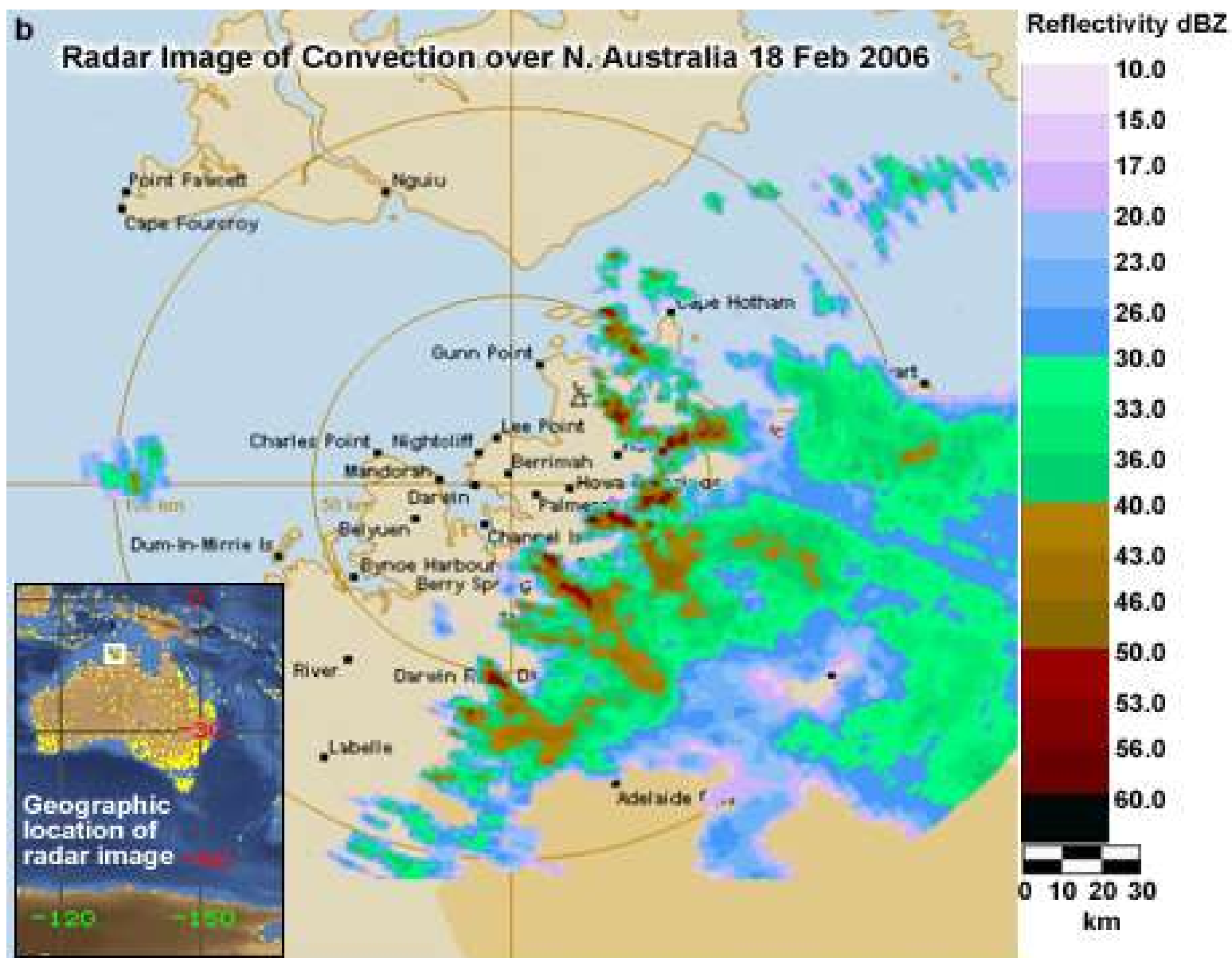
Trustfulness - YES/NO

Representativeness – DEPENDS ON NETWORK DESIGN (NOT IN CANOPY, SWITCHED LOCATION WITHOUT METADATA AVAILABLE)

Time resolution of measurements - COMMONLY HOURLY AVAILABLE

Data series duration - COMMONLY FOR VEGETATION PERIOD ONLY







## Sources of meteorological data: Measured data

### Radar measurements

Trustfulness - YES BUT AWARENESS OF  
LIMITATIONS IS IMPORTANT

Representativeness – FOR CERTAIN TYPES  
OF CLOUDS OUT OF “RADAR SHADOW”

Time resolution of measurements - N/A

Data series duration - N/A



## Sources of meteorological data: Measured data

### Satellite measurements

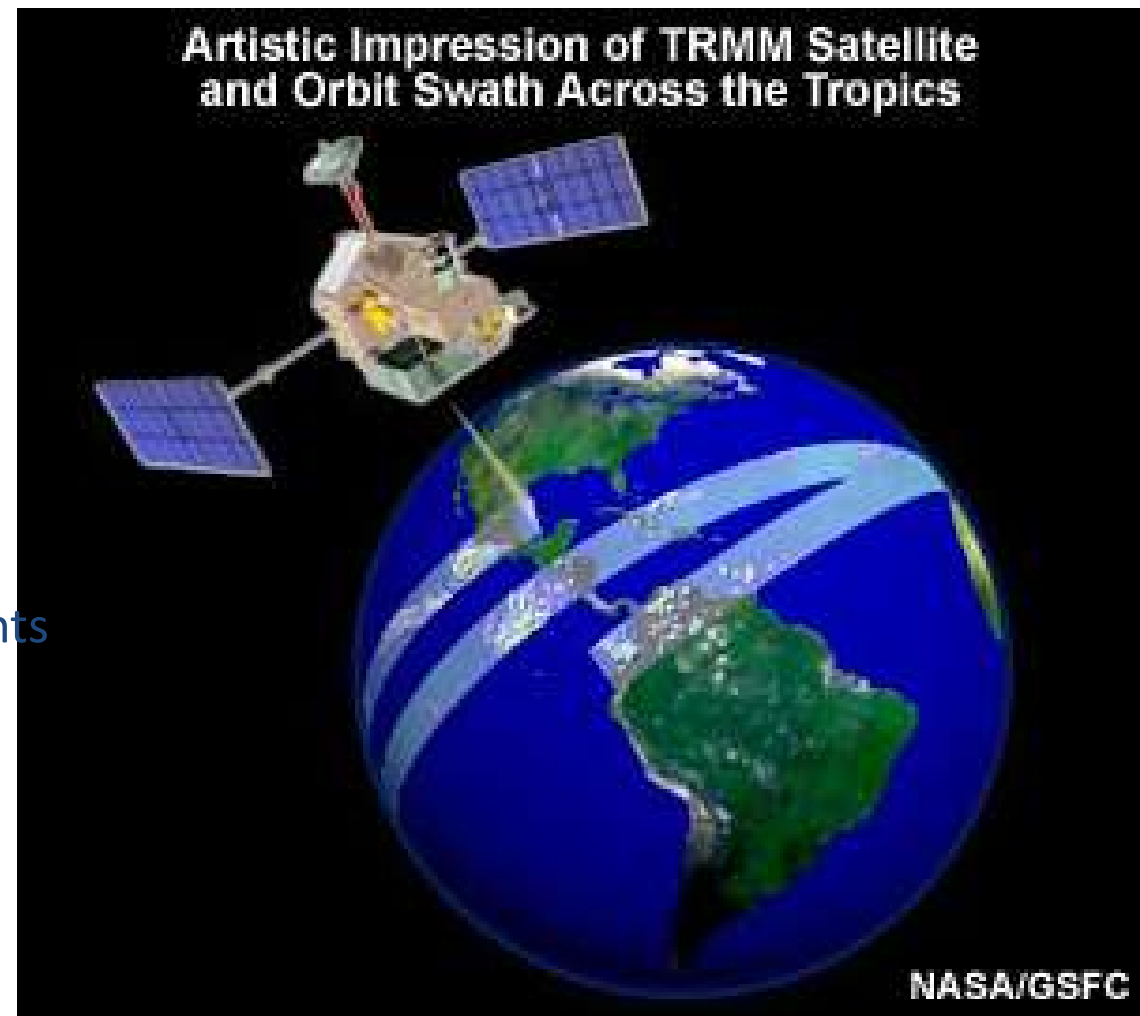
Trustfulness - YES (LIMITATIONS  
ARE IMPORTANT ISSUE)

Representativeness – ON  
RESOLUTION INDICATED

Time resolution of measurements

- N/A

Data series duration - N/A





## Sources of meteorological data: Measured data

### Global Climate Observing System (GCOS)

Trustfulness - YES

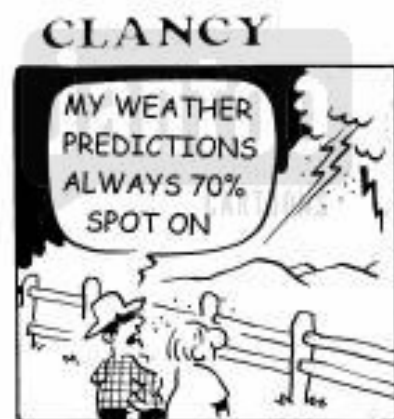
Representativeness – FOR STATION LOCATION

Time resolution of measurements - HOURLY AVAILABLE

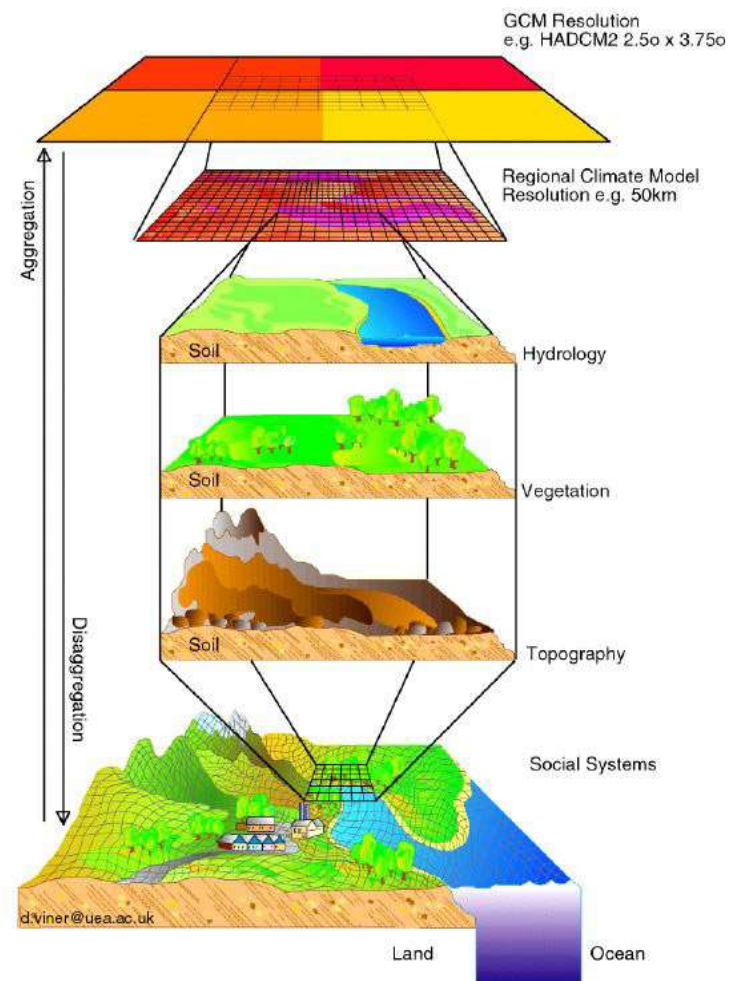
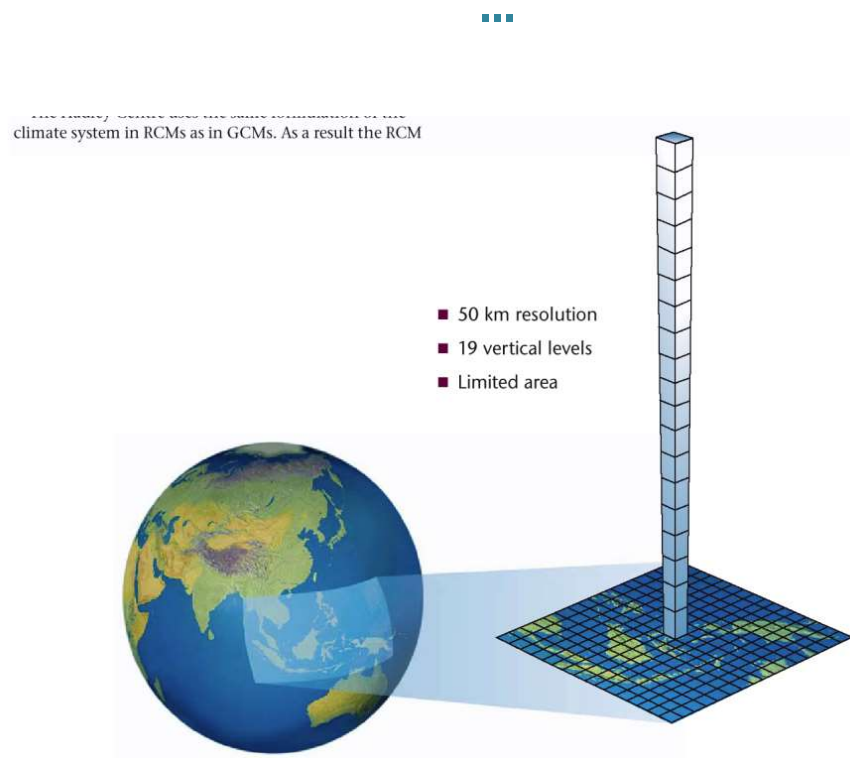
Data series duration -

<https://public.wmo.int/en/programmes/global-climate-observing-system>

## WEATHER FORECAST ACCURACY ...



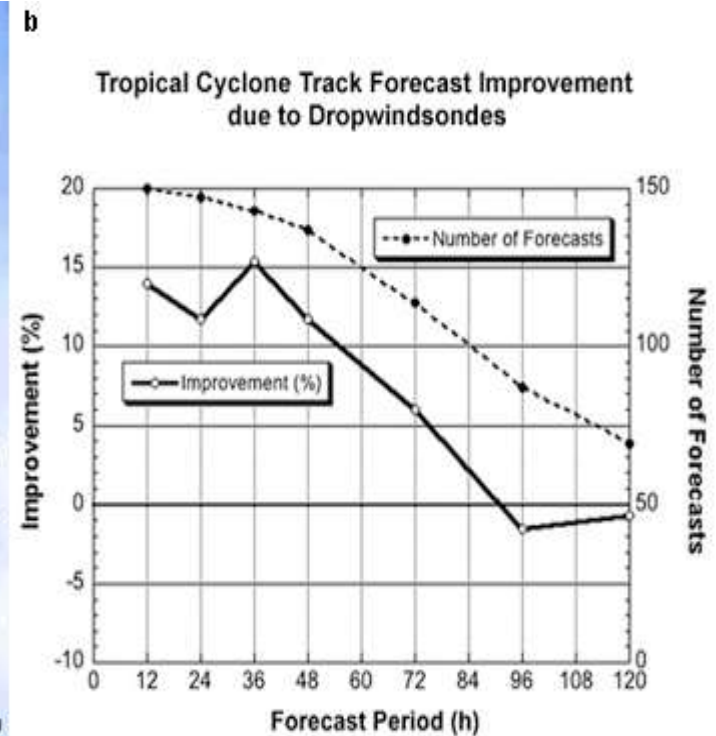
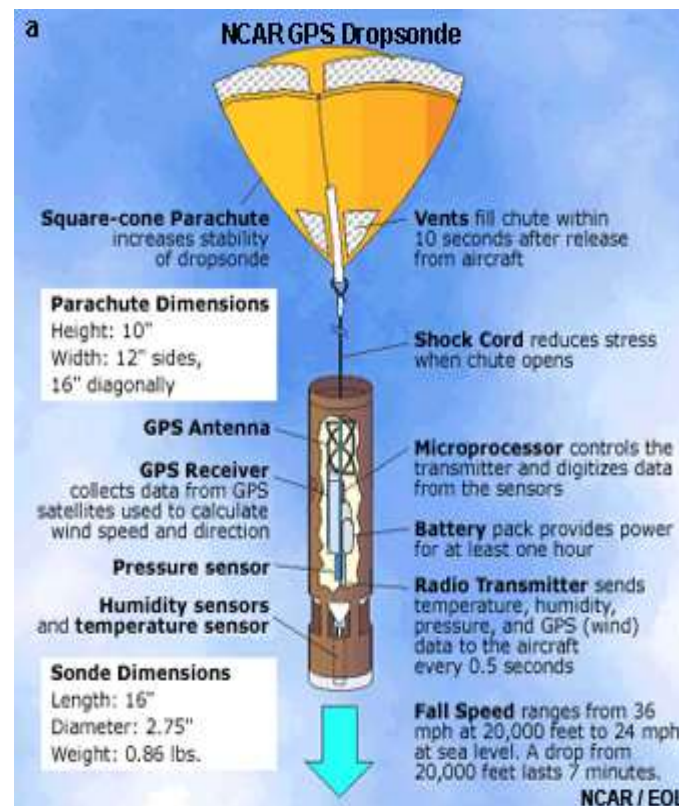
## WEATHER FORECAST ACCURACY – EARTH FROM NWP MODEL “PERSPECTIVE”





## Sources of meteorological data: Forecasted data

### Short-range weather forecast





## Sources of meteorological data: Forecasted data

- ◆ AgM - forecasting : ♣ leaf wetness and temperature ♣ canopy air temperature and humidity ♣ soil temperature and moisture ♣ precipitation ...
- ◆ AgM - forecasting application : ♣ fruit vegetation dynamic ♣ meteorological conditions for plant disease appearance
- ◆ CM forecasting application : ♣ scheduling of farm operations according to weather and crop conditions ♣ optimization of irrigation, fertilization and plant protection application-spraying
- ◆ CM - forecasting : ♣ crop dynamic on daily level ♣ soil moisture deficit ♣ evapotranspiration ♣ precipitation ...



## Sources of meteorological data: Forecasted data

### Monthly and seasonal weather forecast

Long range forecasts - expected future atmospheric and oceanic conditions, averaged over periods of one to three months.

The long range forecasts are produced by the IFS **coupled ocean-atmosphere** model.

Earth system variability which have long time scales (months to years)

ENSO (El Nino Southern Oscillation) cycle. Although ENSO is a coupled ocean-atmosphere phenomenon centered over the tropical Pacific the influence of its fluctuations extends around the world.

(Source: ECMWF)



## Sources of meteorological data: Forecasted data

### Monthly and seasonal weather forecast

#### Ensemble forecast

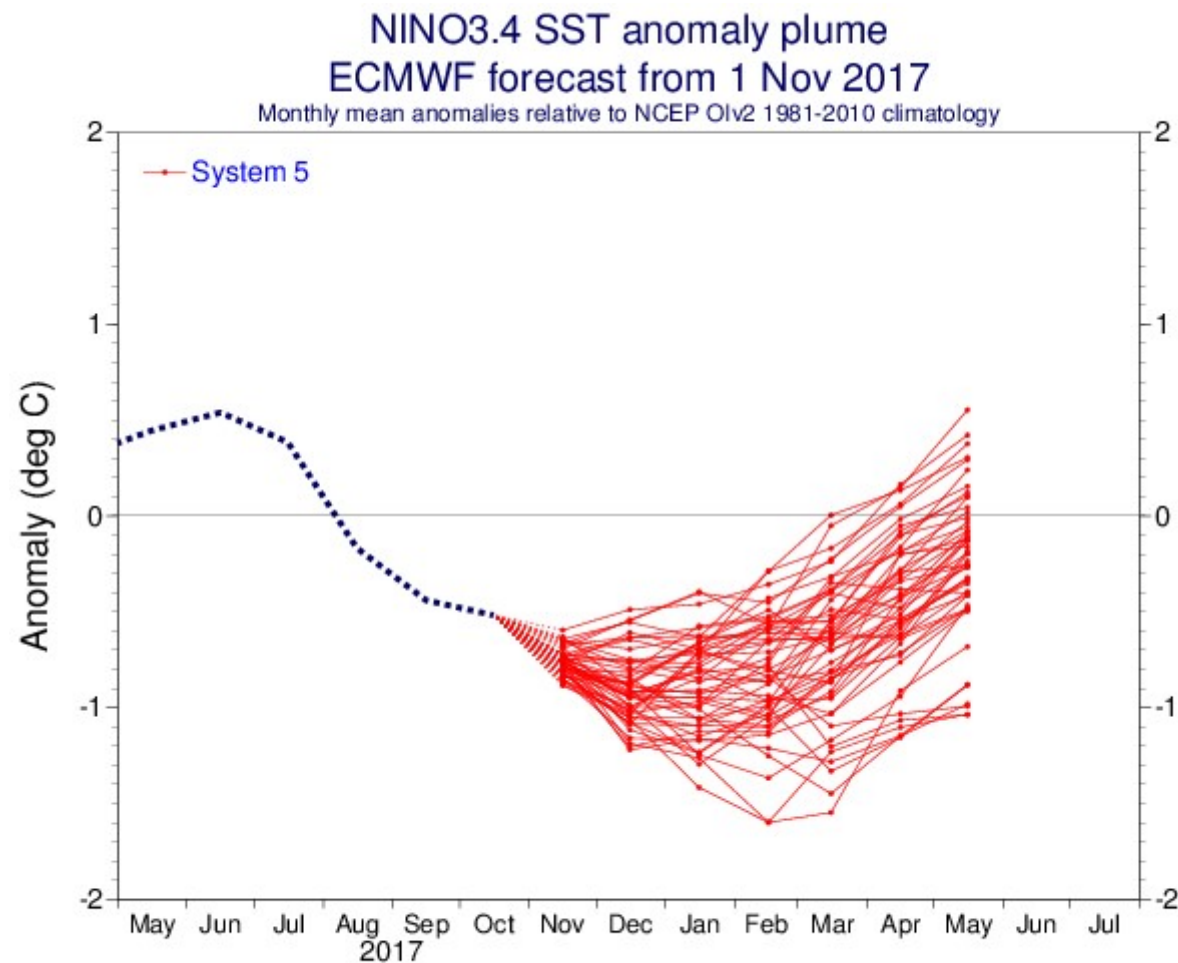
#### Control run

“Anomalies are calculated from the 51 member model forecast distribution relative to the model climatological PDF calculated from a set of 25 member ensemble re-forecasts covering the 24 year period 1993-2016. For each forecast product several verification scores are also provided, calculated from the full 36 year period of the re-forecast 1981-2016. ”

**(Source: ECMWF)**



## Sources of meteorological data: Monthly and seasonal weather forecast





Source

ECMWF Seasonal Forecast

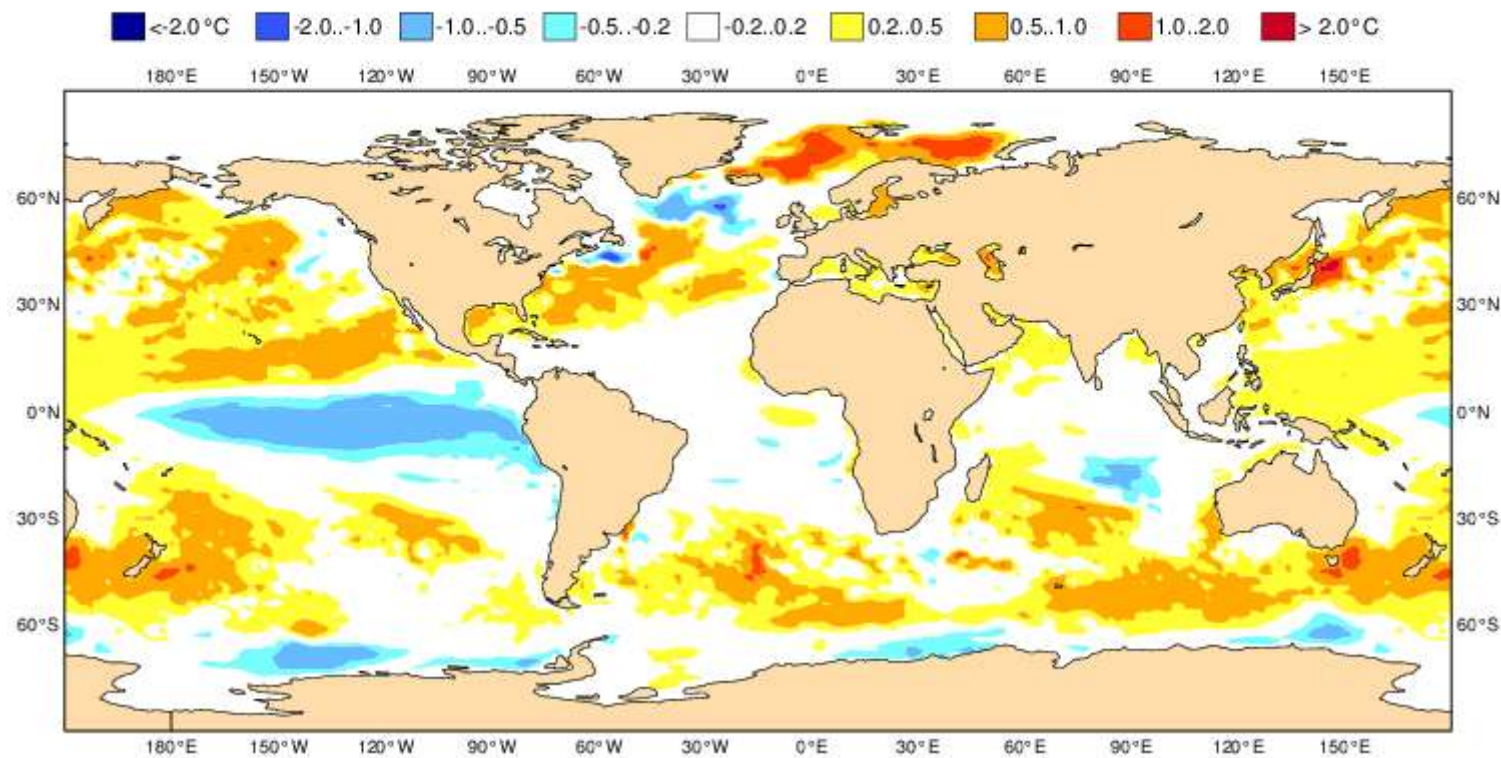
Mean forecast SST anomaly

Forecast start is 01/11/17, climate period is 1993-2016

Ensemble size = 51, climate size = 600

System 5  
FMA 2018

recast



[https://www.ecmwf.int/en/forecasts/charts/catalogue/seasonal\\_system5\\_public\\_standard\\_ssto?time=2017110100,2208,2018020100&stats=enm](https://www.ecmwf.int/en/forecasts/charts/catalogue/seasonal_system5_public_standard_ssto?time=2017110100,2208,2018020100&stats=enm)



## Sources of meteorological data: Monthly and seasonal weather forecast

ECMWF Seasonal Forecast

Mean 2m temperature anomaly

Forecast start is 01/11/17, climate period is 1993-2016

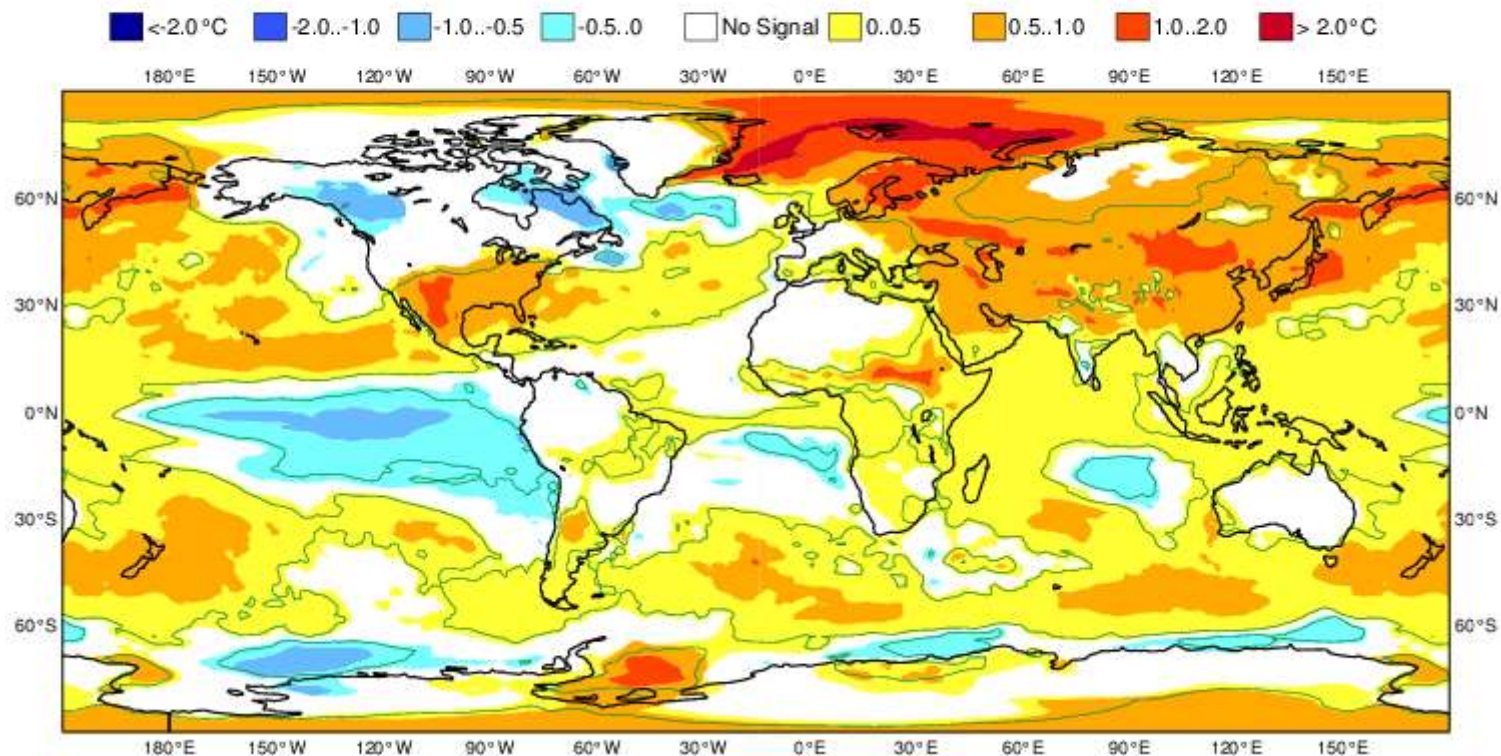
Ensemble size = 51, climate size = 600

System 5

FMA 2018

Shaded areas significant at 10% level

Solid contour at 1% level



[https://www.ecmwf.int/en/forecasts/charts/catalogue/seasonal\\_system5\\_public\\_standard\\_2mtm?time=2017110100,2208,2018020100&stats=ensm](https://www.ecmwf.int/en/forecasts/charts/catalogue/seasonal_system5_public_standard_2mtm?time=2017110100,2208,2018020100&stats=ensm)



***“This project has received funding from the *European Union’s Horizon 2020 research and innovation programme* under grant agreement No 691998”.***