RSMC for Climate Reanalysis

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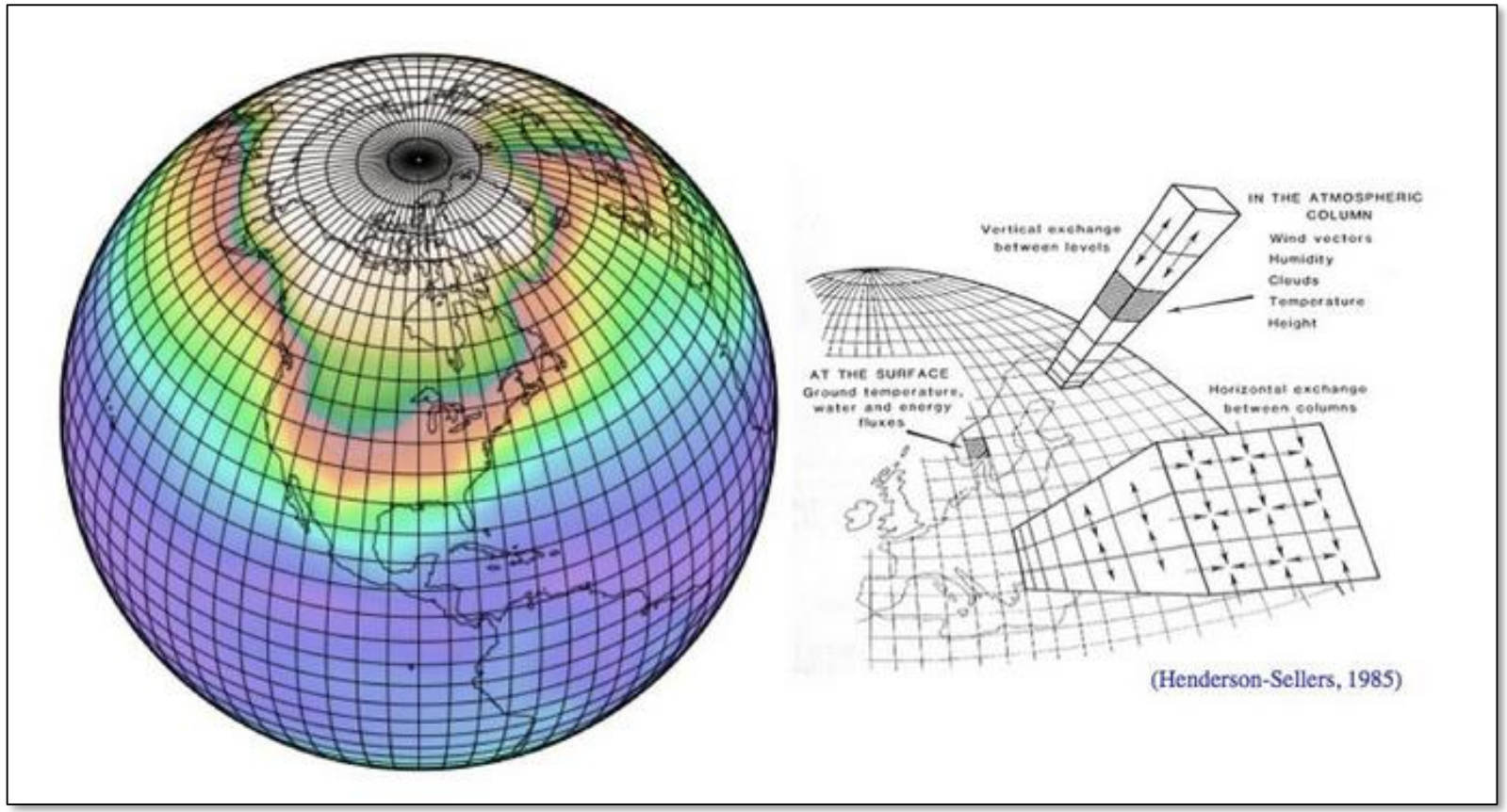
Outline

- Background on climate reanalysis.
- Characteristic and utility of climate reanalysis.
- Thoughts on including climate reanalysis in the Manual on GDPFS.

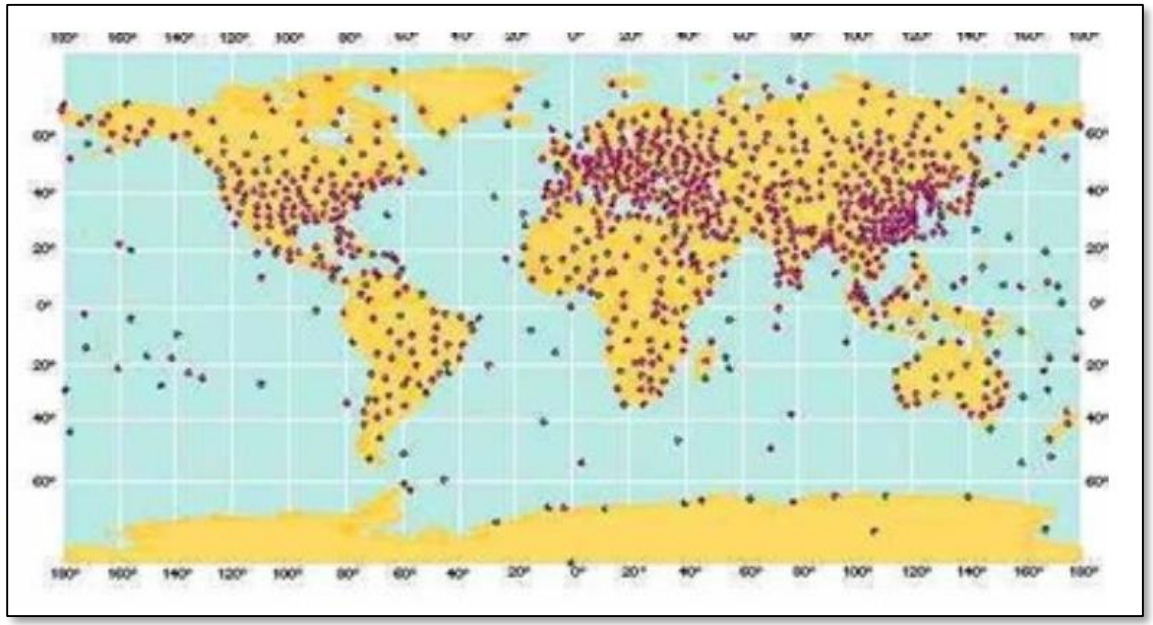
Numerical prediction systems

- The fundamental premise of numerical prediction models is to represent the earth surface as regular grid.

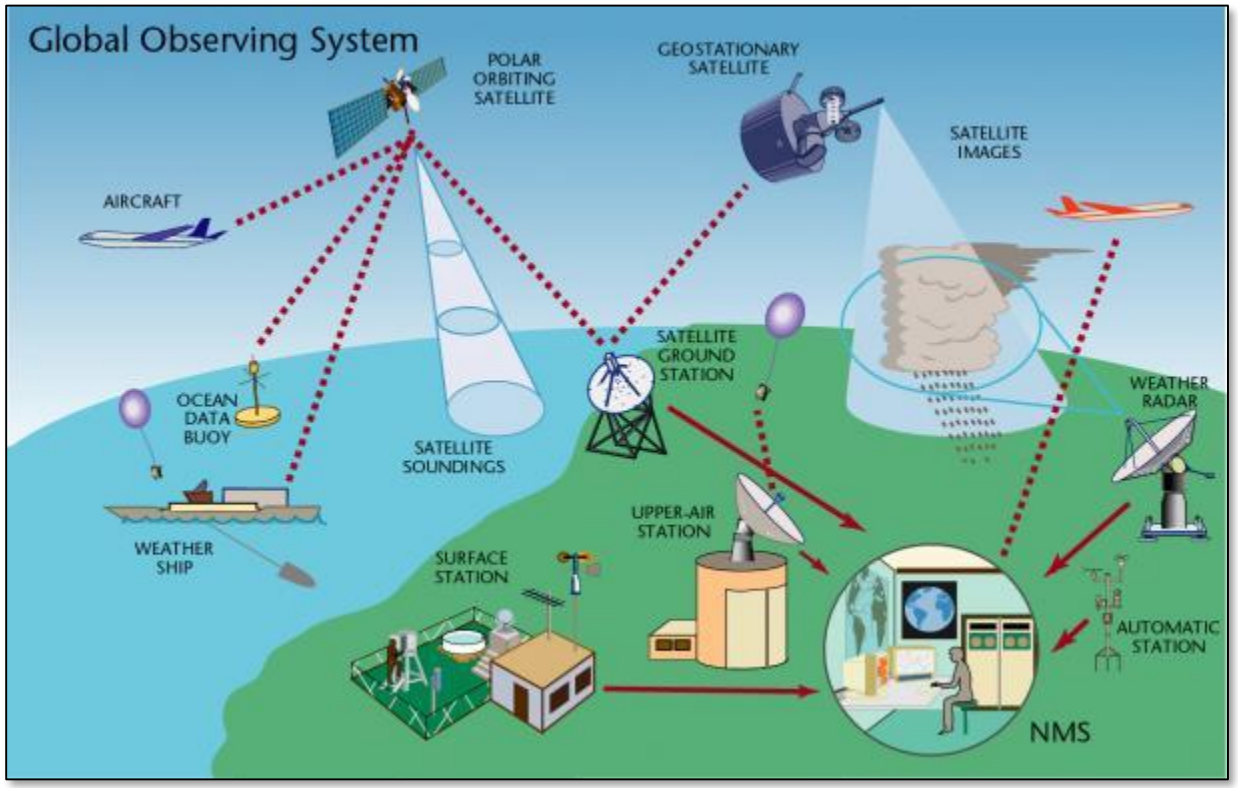


Numerical prediction systems

- Observational data, however, is at irregular locations.



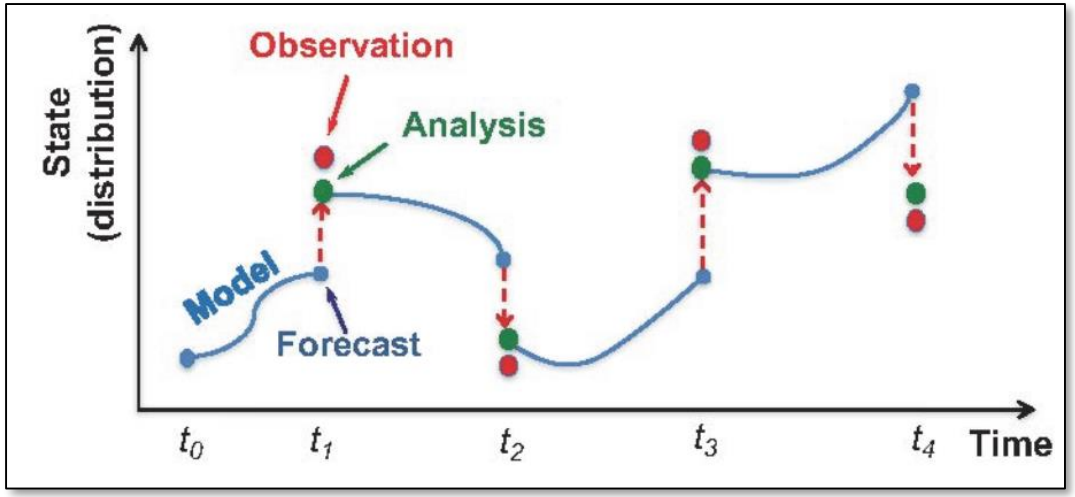
Radiosonde locations



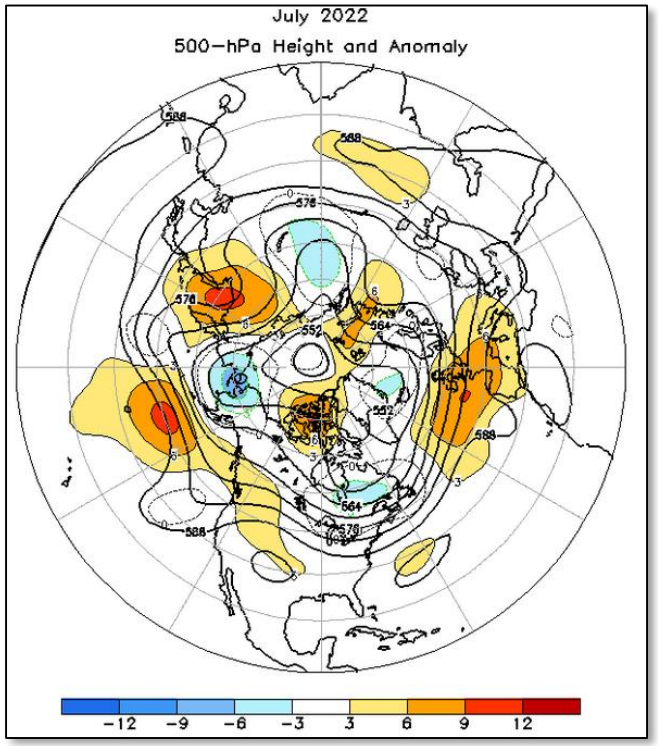
Observing network

Numerical prediction systems

- Using the same numerical model used for prediction, data assimilation (DA) techniques ingest the spatially inhomogeneous observations and provide a gridded rendition for the state for the different components of the Earth System.



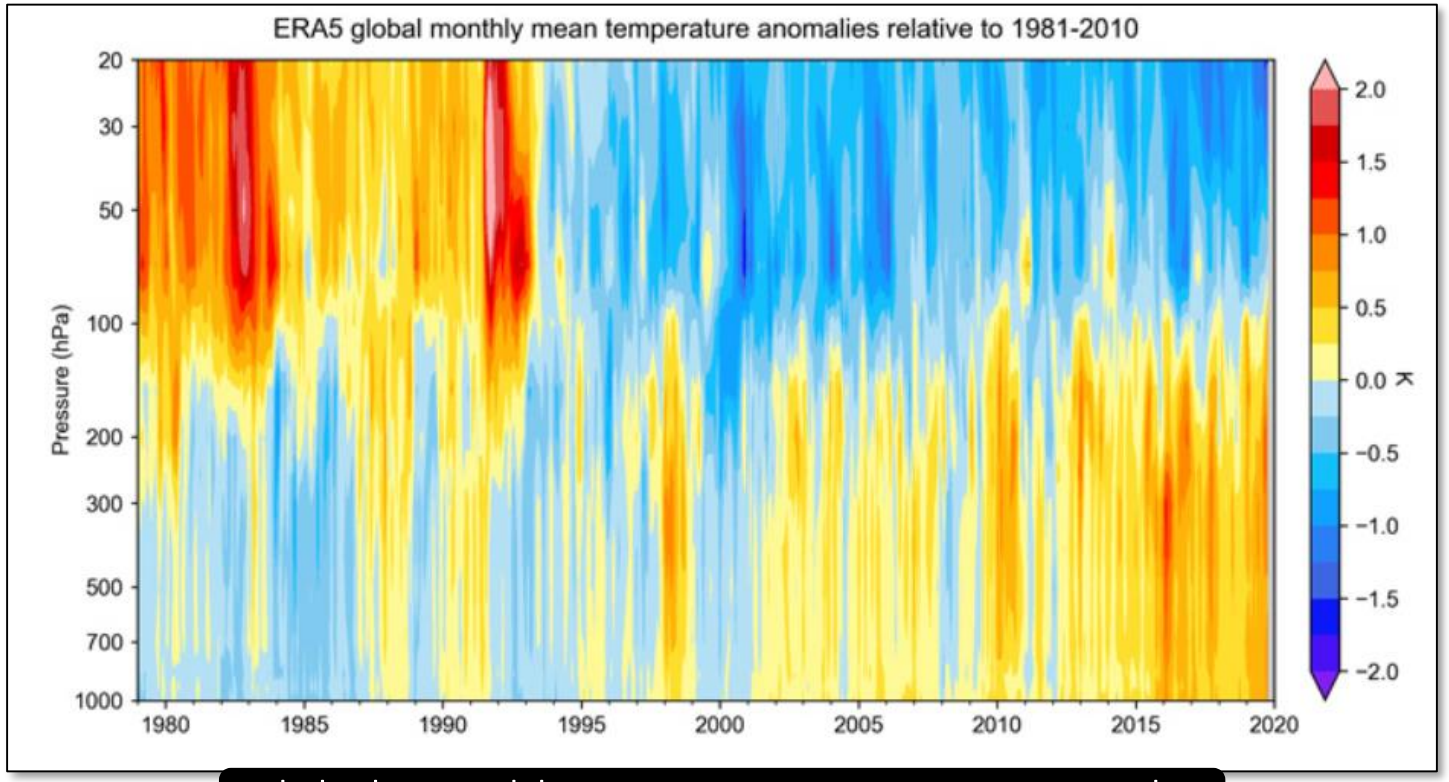
Assimilation System



500-hPa height anomaly

Climate reanalysis

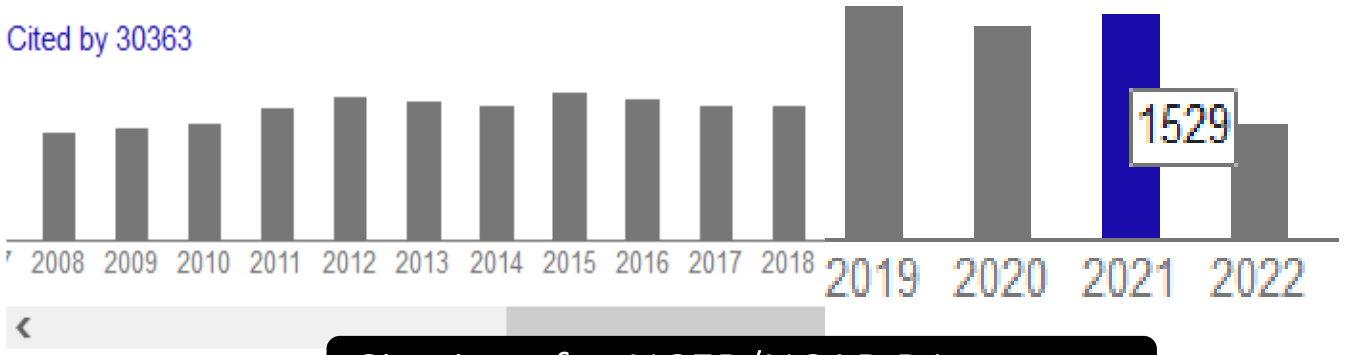
- The same analysis that is used to create the initial conditions for the numerical prediction systems can also be extended back in time, and is what defines the climate reanalysis.



Global monthly mean temperature anomaly

Evolution of climate reanalyses

- 1995: NCEP/NCAR Reanalysis (1948 – present)
- NCEP: NCEP/NCAR R1, R2, CFSR
- NASA: MERRA 1, MERRA 2
- ECMWF: ERA 15, ERA-40, ERA Interim, ERA-5
- JMA: JRA-25, JRA-55



Citations for NCEP/NCAR R1 paper

Characteristics and advantages of climate reanalysis

- Analysis uses a fixed data assimilation system.
- As model and data assimilation methods improve, newer generation of climate reanalysis can be generated.
- Data rescue efforts are always improving historical observational data bases.
- Climate reanalysis products provide information about a host of variables that are difficult to observe.

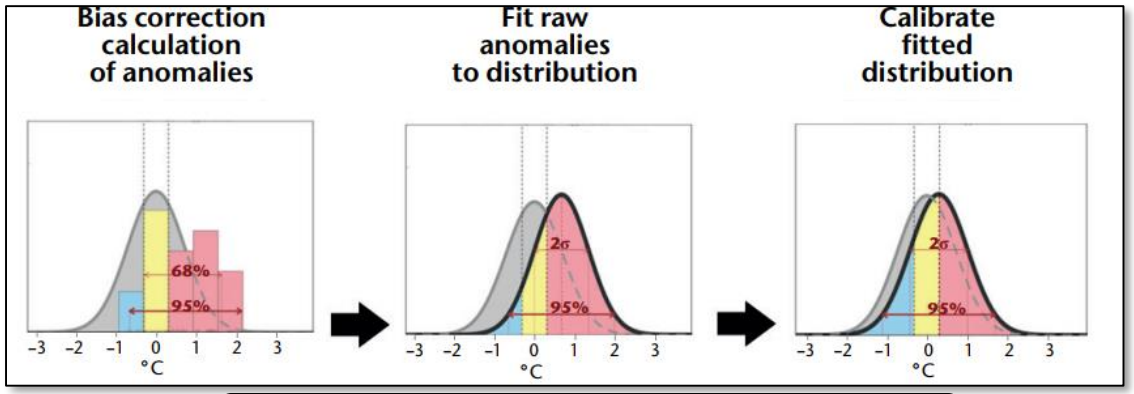
Usage of climate reanalysis

- Understanding of climate variability.
- Real-time monitoring of various components of the Earth System.
- Placing current climate in a historical perspective.
- Hindcast initialization and verification.
- Model development and validation.
- Development of climatologies for various societal needs (solar and wind energy, extreme events)
- *Climate reanalysis is a foundational data set*

Climate reanalysis and GDPFS context

- Some mandatory functions of different RSMCs have requirements for the climate reanalysis.
  - LRF, SSF
    - Initialization of hindcasts and their verification
    - Statistical downscaling (e.g., Climate Prediction Tool)
    - Computation of terciles
    - Bias correction and calibration

Guidance on Operational Practices for Objective Seasonal Forecasting



Bias correction and calibration

Climate reanalysis and GDPFS context

- Some mandatory functions of different RSMCs have requirements for the climate reanalysis.
  - Regional Climate Centers (RCCs)
  - Catalog of ENSO impacts and teleconnections etc.
  - Evolution towards Seamless GDPFS will bring additional requirements for climate reanalysis

(b) Conduct operational activities for climate monitoring:

- **Perform climate diagnostics including analyses of climate variability and extremes, at the regional and subregional scales;**
- **Establish a historical reference climatology for the region and/or subregions;**
- **Implement a regional climate watch;**

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CBS 2018 Management Group Report

OPAG DPFS DRAFT DECISIONS AND RECOMMENDATIONS

4/4	4(4)/1	Doc 4-4	To integrate with the core functions of CSIS encompassing climate data, climate monitoring, climate prediction and climate projection, evolve GDPFS to include a class of RSMCs to include (i) centres that maintain Climate Reanalysis, and (ii) centres that provide Climate Monitoring on global scale

- Recommend this activity to move forward and to Inform EC-70 about the development of new class of RSMCs in support of climate monitoring.

Climate Reanalysis and GDPFS

- With emerging requirements for climate reanalysis, it is time to actively consider inclusion of RSMC for climate reanalysis in the Manual on GDPFS.

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Thank you

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