Upper-air Wind Speed and Direction

ESSENTIAL CLIMATE VARIABLE (ECV) FACTSHEET

GLOBAL CLIMATE OBSERVING SYSTEM

KEEPING WATCH OVER OUR CLIMATE

WMO IOC International Science Council UN environment

ECV IN BRIEF

Domain: Atmosphere
Subdomain: Upper Atmosphere
Scientific Area: Physical Properties
ECV Stewards: Shinya Kobayashi
Products: Upper-air wind retrievals

Upper-air Wind Speed and Direction

Wind is one of the fundamental state variables for understanding and predicting the behaviour of the atmosphere. It is basic to the working of the climate system through transport of heat, moisture and trace constituents. Measurements of wind are vital for initializing and verifying climate projections and for detecting, understanding and attributing variability and change in the climate system.

ECV Product[1]

PRODUCT	DEFINITION	REQUIREMENTS				
		FREQ.	RES.	REQUIRED MEASUREMENT UNCERTAINTY	STABILITY	STANDARDS/ REFERENCES
Upper-air wind retrievals	**3D field of the horizontal vector component (2D) of the 3D wind vector (m/s)**	1hr	10km/ 0.5km	2m/s, 20deg	0.5m/s, 5deg	

Data Sources[2]

In Situ Data:

- Integrated Global Radiosonde Archive (IGRA)
  https://www.ncdc.noaa.gov/data-access/weather-balloon/integrated-global-radiosonde-archive
- GCOS Reference Upper-Air Network (GRUAN)
  https://www.gruan.org/

Reanalysis:

[1] Current Products and Requirements as in the Implementation Plan 2016 (GCOS-200). GCOS is reviewing and will update the requirements until 2022. More information on: gcos.wmo.int and climatedata.wmo.int.

[2] This list provides sources for openly accessible data sets with worldwide coverage for which metadata is available. It is curated by the respective GCOS ECV Steward(s). The list does not claim to be complete. Anyone with a suitable dataset who would like it to be added to this list should contact GCOS.

- REANALYSES.ORG (Inventory for Reanalysis)
  http://reanalyses.org

Satellite:

- Satellite ECV Inventory by the CEOS/CGMS Working Group on Climate (WGClimate)
  http://climatemonitoring.info/ecvinventory

Hadley and Walker Circulation

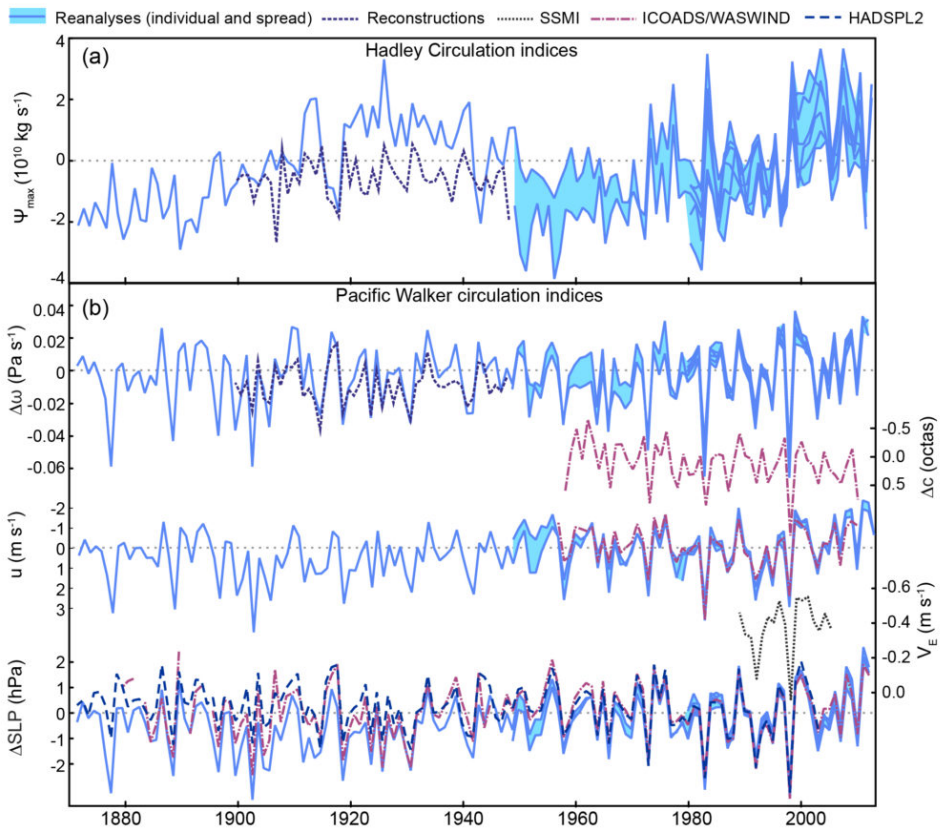

Figure: (a) Indices of the strength of the northern Hadley circulation in December to March (Ψmax is the maximum of the meridional mass stream function at 500 hPa between the equator and 40°N). (b) Indices of the strength of the Pacific Walker circulation in September to January (Δω is the difference in the vertical velocity between [10°S to 10°N, 180°W to 100°W] and [10°S to 10°N, 100°E to 150°E] as in Oort and Yienger (1996), Δc is the difference in cloud cover between [6°N to 12°S, 165°E to 149°W] and [18°N to 6°N, 165°E to 149°W] as in Deser et al. (2010a), vE is the effective wind index from SSM/I satellite data, updated from Sohn and Park (2010), u is the zonal wind at 10 m averaged in the region [10°S to 10°N, 160°E to 160°W], ΔSLP is the SLP difference between [5°S to 5°N, 160°W to 80°W] and [5°S to 5°N, 80°E to 160°E] as in Vecchi et al. (2006)). Reanalysis data sets include 20CR, NCEP/NCAR, ERA-Interim, JRA-25, MERRA, and CFSR, except for the zonal wind at 10 m (20CR, NCEP/NCAR, ERA-Interim), where available until January 2013. ERA-40 and NCEP2 are not shown as they are outliers with respect to the strength trend of the northern Hadley circulation (Mitas and Clement, 2005; Song and Zhang, 2007; Hu et al., 2011; Stachnik and Schumacher, 2011). Observation data sets include HadSLP2, ICOADS (only 1957–2009 data are shown) and WASWIND, reconstructions are from Brönnimann et al. (2009). Where more than one time series was available, anomalies from the 1980/1981 to 2009/2010 mean values of each series are shown.

Source: Figure 2.39 of Hartmann, D.L., A.M.G. Klein Tank, M. Rusticucci, L.V. Alexander, S. Brönnimann, Y. Charabi, F.J. Dentener, E.J. Dlugokencky, D.R. Easterling, A. Kaplan, B.J. Soden, P.W. Thorne, M. Wild and P.M. Zhai, 2013: Observations: Atmosphere and Surface. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.