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U. S. DEPARTMENT OF COMMERCE

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**AN ANNOTATED BIBLIOGRAPHY ON CLIMATIC MAPS
OF PARAGUAY**

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By

Virgilio Torres-Rentas

Foreign Section

Office of Climatology



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January 1965

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BIBLIOGRAPHY OF CLIMATIC MAPS FOR:

- 1958
- WB/BM-1 *Eastern Mediterranean
 WB/BM-2 *British Isles
 WB/BM-3 *Ireland
 WB/BM-4 Germany
 WB/BM-5 Iraq
 WB/BM-6 *Mexico (Revised by #59)
 WB/BM-7 *Southwest Pacific Ocean
 WB/BM-8 Western Pacific Ocean
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- WB/BM-14 Lebanon
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- 1961
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*In manuscript form.

Revised means brought up to date

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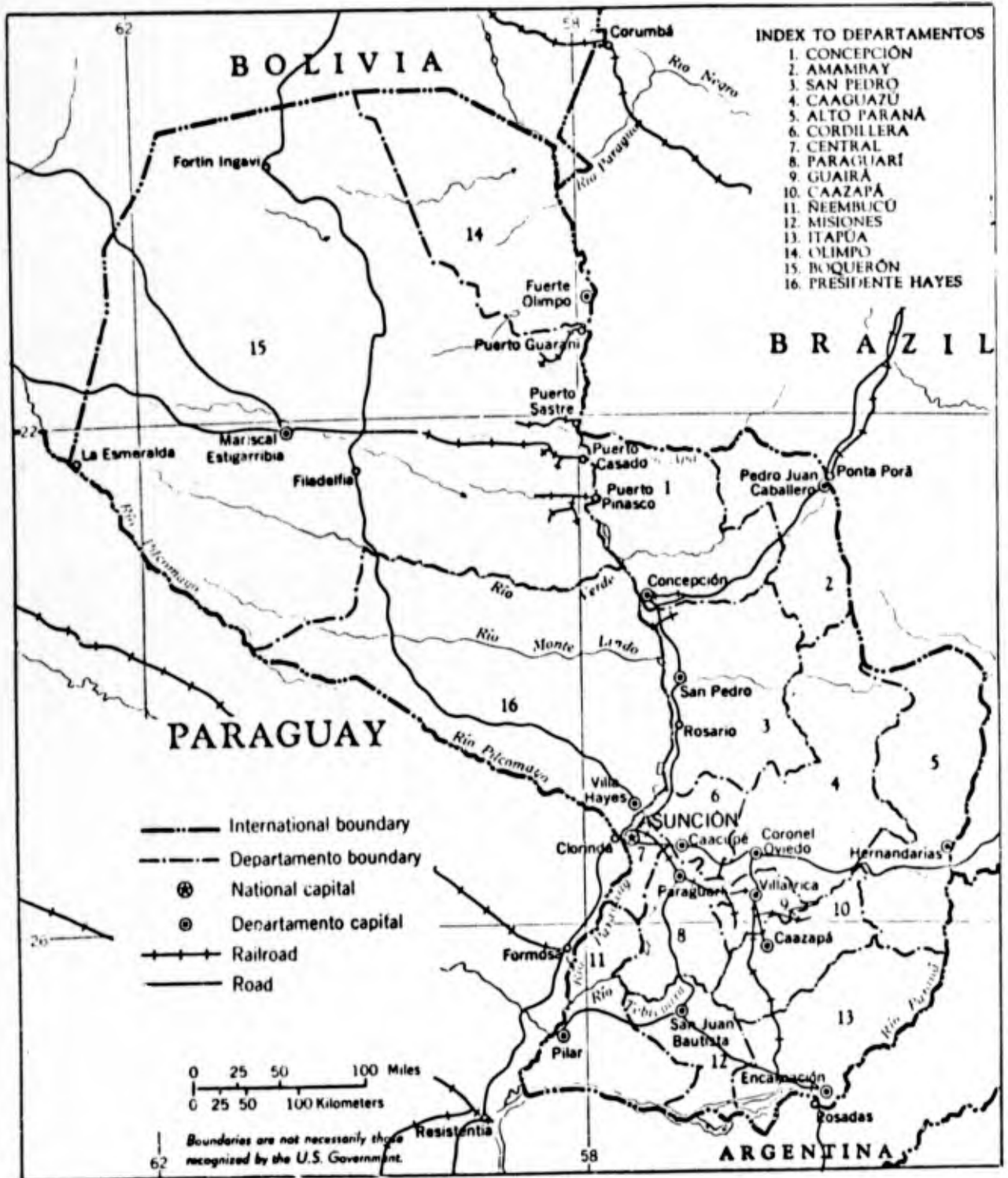
INTRODUCTION

This bibliography on climatic maps of Paraguay has been compiled from available sources in various libraries of the Washington Metropolitan Area. Owing to the scarcity of climatic maps of Paraguay, data for a larger area or for all of South America had to be used. Some sources may be in more than one of these libraries, however the call number is recorded in the abstract for only one of them in the preferential order listed below:

- DWB U. S. Weather Bureau Library
- DLC Library of Congress
- DGS U. S. Geological Survey Library
- DN-HO U. S. Naval Oceanographic Library

For example, a source listed in the U. S. Geological Survey Library was not located at the time of search in the U. S. Weather Bureau Library or the Library of Congress but it may also be in the U. S. Naval Oceanographic Library which is lower on the preference list.

Map scales are presented in the abstracts. In the absence of printed information the scales have been determined by a natural map scale indicator, prepared by S. W. Boggs, Chief, Division of Geography and Cartography, Department of State. These approximate values have been enclosed in sub-brackets, as [1:46 500 000], if they are ascertained from maps having graticules or distance scales. However, maps with no graticules or distance scales require the estimation of distance; the values obtained by the natural map scale indicator from these estimated distances are recorded, as follows: scale is not indicated (about 1:46 500 000).



An Annotated Bibliography on Climatic Maps of Paraguay
U. S. Weather Bureau



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AN ANNOTATED BIBLIOGRAPHY ON CLIMATIC MAPS OF PARAGUAY

1901 - 1910

1. Davis, Gualterio G. Clima de la República Argentina. (Climate of the Argentine Republic). 111p. (In Spanish). Buenos Aires, 1909. DWB M82.1/82 A691c1.

...Includes maps, scale 1:28 000 000 of South America (south of latitude 20°S) showing seasonal and annual mean isobars and mean isotherms, annual mean max and mean min isotherms, annual absolute max and min isotherms, mean isohyets (also hatched areas) during the wet season (October to March), dry season (April to September) and the year. No period of record specified.

2. Herbertson, A. J. and Taylor, E. G. R. South America, mean annual rainfall. 1909. DLC Map Division.

...Is a polychrome map (scale 1:7 500 000) of South America showing mean annual rainfall (intervals of 0-10, 10-20, 20-40, 40-60, 60-80, >80 inches; and 0-25, 25-50, 50-100, 100-150, 150-200, >200 cm.). No period of record is indicated.

3. Reed, William Gardner, Jr. South American rainfall types. Quarterly Journal of the Royal Meteorological Society, 36:49-59. London, 1910. DWB M(05) R888q.

...Contains a map (scale 1:62 500 000, determined from graticules) of South America showing the distribution of seasons with maximum rainfall by hatched areas based on data for 138 stations. Periods of record vary from two to over ten years.

1911 - 1920

4. Argentina. Servicio Meteorológico Argentino. Historia y organización con un resumen de los resultados. (History and organization with a condensed summary of results). 181 pp. (In Spanish and English). Buenos Aires, 1914. DWB M06/82 A691se.

...Includes maps (scale 1:14 175 000) of South America (south of 20°) showing seasonal and annual mean isobars and mean wind direction by arrows; seasonal and annual mean, mean max and mean min isotherms; seasonal and annual mean rainfall by hatched areas and mean number of days with rain by isolines; annual mean daily temperature range, absolute max and min temperatures and extreme temperature range by isolines. A map (scale 1:9 000 000, determined from graticules) showing the location of the stations. These maps are based on data for an unspecified period.

5. Bacon, G. W. & Co., Ltd. Wall atlas map of South America. 1914. DLC Map Division.

...Polychrome maps (scale 1:12 500 000) of South America showing mean annual rainfall (intervals of 0-10, 10-20, 20-40, 40-60, 60-80, 80-120, 120-160 and >160 inches; and 0-25.4, 25.4-50.8, 50.8-101.6, 101.6-152.4, 152.4-203.2, 203.2-304.8, 304.8-406.4 and >406.4 centimeters); distribution of seasons

Source No. 5 (continued)

with rainfall (type classification: rain at all seasons with maximum in summer, rainy season in summer, rainy season in winter and generally rainless); mean temperature for January (intervals of 0-50, 50-60, 60-70, 70-80 and >80°F); mean temperature for July (intervals of 0-30, 30-40, 40-50, 50-60, 60-70, 70-80, 80-90 and >90°F). These maps are based on an unspecified period.

6. Clayton, H. Helm. A study of the moving waves of weather in South America. Quarterly Journal of the Royal Meteorological Society, 41:201-208. London, 1915. DWB P.

...Contains maps (scale 1:30 000 000, determined from graticules) of South America (south of 20° latitude) showing lines of observed pressure at 8 am. on April 20 and April 21, 1910; predicted pressure change between April 20 and April 21, 1910 at 8 am. and predicted pressure for April 21, 1910 at 8 am.

7. Mossman, R. C. Abnormal weather in South America during 1911. Symon's Meteorological Magazine, 46:238-241. London, 1912. DWB M(05) G786m.

...Contains a map (scale 1:37 500 000, determined from graticules) of South America (South of latitude 20°) showing mean temperature departures from normal by isolines for the winter season (June to August 1911).

8. Philip, George and Son, Ltd. Philip's comparative wall atlas of South America. Climate. 1914. DLC Map Division.

...Polychrome maps (scale 1:9 000 000) of South America showing the mean total rainfall and prevailing wind by arrows for two seasons (May-October, November-April); mean isobars (in) for January and July. No period of record is indicated.

9. Philip, George and Son, Ltd. Philip's comparative wall atlas of South America. Temperature. 1914. DLC Map Division.

...Is a polychrome map (scale 1:9 000 000) of South America with January and July mean isotherms based on data for an unspecified period.

1921 - 1930

10. Franze, Bruno. Die Niederschlags-verhältnisse in Südamerika. (The distribution of precipitation in South America). Petermanns Mitteilungen, Ergänzungsheft Nr. 193. 79pp. (In German). Gotha, 1927. DWB P.

...Includes a polychrome map (scale 1:30 000 000) of South America with mean isohyets and a map (scale 1:10 000 000) of the same area with graphs showing monthly precipitation values for individual stations (Estacion Misionera, Nueva Germania, Asuncion and Puerto Bertoni in Paraguay). These maps are based on data for specified periods at individual stations.

11. Jefferson, Mark. Preliminary map of annual rainfall of South America. 1924. DLC Map Division.

...Is a map (scale 1:30 000 000, determined from partial graticules) of

Source No. 11 (continued)

South America with mean annual isohyets (intervals of <10, 10-20, 20-30, 30-40, 40-60, 60-80, 80-120, 120-200, >200 inches; and <250, 250-500, 500-750, 750-1000, 1000-1500, 1500-2000, 2000-3000, 3000-5000, >5000 millimeters) based on an unspecified period.

12. Van Cleef, Eugene. Rainfall maps of Latin America. Monthly Weather Review 49(10):537-540. Washington, 1922. DWB M(05) U587m.

...Contains maps (scale 1:38 750 000, determined from graticules) of Latin America with annual, summer and winter mean isohyets (mm) based on an unspecified period.

1931 - 1940

13. "GAEA, Anales de la Sociedad Argentina de Estudios Geograficos". Tomo IV, No. 2. América del Sur-Precipitaciones. (South America - Precipitation). (In Spanish). Buenos Aires, 1935. One page photostatic copy. DLC Map Division.

...Is a map (scale 1:30 000 000, determined from partial graticules) of South America showing mean annual precipitation (intervals of 0-50, 50-100, 100-250, 250-500, 500-1000, 1000-2000, 2000-3000, 3000-4000, 4000-5000, 5000-6000 and >6000 mm) by hatched areas. No period of record is indicated.

14. Handbuch der Klimatologie, Köppen and Geiger, Ed., Klimakunde von Südamerika. (Climatology of South America). Knoch, K. Band 2, Teil G. (In German). Berlin, 1930 DWB M8 H236h.

...Contains maps (scale 1:70 000 000, determined from graticules) of South America with bimonthly (January-November) mean sea level isotherms (°C); true mean isotherms (°C) for January and July; isanomals of temperature for January, July and the year; annual range of temperature according to monthly means by isolines; mean sea level isobars (mm) and mean wind direction by arrows for January and July; annual range of station and sea level pressure (mm) and annual interdiurnal variation of pressure by isolines; mean isonephs (0-10) for January, July and the year; location of dry areas (monthly precipitation <25 mm) for January and July by hatched areas; annual mean isobronts (days). The source also presents maps (scale 1:50 000 000, determined from graticules) of South America with bimonthly (January-November) mean isohyets (also hatched areas: 0, 0-25, 25-100, 100-200, 200-400 and >400 mm); annual mean isohyets (also hatched areas: 0-250, 250-500, 500-1000, 1000-2000, 2000-5000 and >5000 mm); climatic zones according to Köppen. In addition to the above maps there is a map (scale 1:52 000 000, determined from graticules) of South America showing the location of the main stations. These maps are based on various periods within the years 1850-1925.

15. Johnston, W. & A. K., Ltd. W. & A. K. Johnston's "Effective" class-room atlas of South America-rainfall & temperature. Edinburgh, 193-. DLC Map Division.

...Polychrome map (scale 1:7 500 000) of South America showing mean annual rainfall (intervals 0-10, 10-20, 20-30, 30-40, 40-60, 60-80, 80-100 and

Source No. 15 (continued)

>100 inches); polychrome maps (scale is not indicated (about 1:30 000 000)) of South America showing mean isotherms (°F) at sea level for January and July. These maps are based on an unspecified period.

16. Kanter, Helmuth. Der Gran Chaco und seine randgebiete. (The Gran Chaco and its bordering regions). 376pp. (In German). Hamburg, 1936. DLC F2876.K33.

...Includes a map (scale is not indicated (about 1:8 000 000)) of Chaco and adjacent areas with annual mean isohyets; maps (scale is not indicated (about 1:15 000 000)) of Chaco and adjacent areas with monthly mean isohyets; a map (scale is not indicated (about 1:11 000 000)) of Chaco and adjacent areas showing the distribution of total number of months with rainfall by hatched areas. No period of record is specified.

17. Wheaton, A. & Co., Ltd. Weaton's practical wall maps of world climates, seasonal winds, rainfall & temperature map. South America. England, 1931. DLC Map Division.

...Is a map (scale is not indicated (about 1:9 000 000)) of South America with graphs (block diagram) showing mean monthly rainfall (1 square of height = 1 inch of rain) for individual stations (Asunción in Paraguay); mean isotherms for January and July (°F); hottest areas in January and July by hatched areas. This map is based on an unspecified period.

1941 - 1950

18. Blair, Thomas A. Climatology, general and regional. 484 pp. New York, 1942. DWB M8 B635cl.

...Contains a map (scale 1:46 000 000, determined from graticules) of South America showing the climatic regions by hatched areas.

19. Great Britain. Meteorological Office. Aviation meteorology of South America. Meteorological Reports No. 1. 50pp. London, 1948. DWB M82 G786m.

...Includes maps (scale 1:80 000 000, determined from partial graticules) of South America with mean isobars, tracks of depressions, regions of frontogenesis and stream-lines of mean winds at 3000 and 1500 ft. above sea level in January and July; maps (scale 1:80 000 000, determined from partial graticules) of South America showing typical trajectories of tropical air masses; maps (scale 1:100 000 000, determined from partial graticules) of South America showing a schematic sequence illustrating the passage of a cold front northwards and the development of a wave depression over the River Plate area. These maps are based on data for an unspecified period.

20. Junqueira-Schmidt, José Carlos. O clima da Amazonia. (The climate of the Amazonas). Revista Brasileira de Geografia, 4(3):465-500. (In Portuguese). Rio de Janeiro, 1942. DWB M(05) R454br.

...Contains a map (scale 1:70 000 000, determined from partial graticules) of South America (10° North-30° South latitude) showing the climatic regions by hatched areas.

21. Klages, K. H. W. Classification of climate. Ecological crop geography: 294-322. New York, 1942. DWB M8:63 K63ec.
- ...Contains maps (scale is not indicated (about 1:40 000 000)) of South America showing the climatic regions by hatched areas according to Köppen's and Thornthwaite's classification.
22. Paraguay. S.T.I.C.A. Republica del Paraguay, temperatura y lluvia. (Republic of Paraguay, temperature and rainfall). (In Spanish). 1947. DLC Map Division.
- ...Is a map (scale 1:2 000 000) of Paraguay with annual mean isohyets (mm) and isotherms (°C) based on an unspecified period.
23. Serra, Adalberto and Ratisbonna, Leandro. As massas de ar da America do Sul. (The air masses of South America). Brazil. Servico de Meteorologia. 59pp. (In Portuguese). Rio de Janeiro, 1942. DWB M15.8/8 B827m.
- ...Presents the following for South America: maps (scale is not indicated (about 1:100 000 000)) with mean wind direction by arrows at 500, 1000, 2000, 3000, 4000 and 5000 meters for January and July. The source also contains maps (scale is not indicated (about 1:50 000 000)) of South America showing seasonal air mass regions; mean annual amplitude of temperature by isolines; climatic zones; mean surface wind direction by arrows, mean isobars (January and July) and mean surface wind roses for January, April, July and October; mean isotherms, isohumes, isonephs, isohyets and isobronts for January, April, July and October. No period of record is given. An English translation with maps (scale reduced) of this source is found under: Weather Information Branch, Headquarters Army Air Forces. Report No. 43. November 1943. DWB M15.8/8 B827m(E).
24. U. S. Army Air Forces. Preliminary climatic atlas of the world. Special Series, No. 1 (Revised). July 1943. DWB M82.3 U585s (oversize).
- ...Includes maps (scale 1:18 000 000, determined from graticules) of South America with mean isobars (mb) and wind roses for individual stations (names are not designated, however 1 station is in Paraguay) for January, April, July and October; graphs showing monthly values of mean daily max and min and absolute max and min temperatures (°F) at selected stations (Asunción in Paraguay). No period of record specified.
25. U. S. Army Air Forces. Preliminary climatic atlas of the world. Special Series No. 1 (Supplement). July 1943. DWB M82.3 U585s (oversize).
- ...Contains maps (scale 1:18 500 000, determined from graticules) of South America with graphs showing monthly values of mean daily max and min and absolute max and min temperatures (°F) based on data for an unspecified period at individual stations (Asunción in Paraguay).
26. Zarur, Jorge. Latin America. Revista Brasileira de Geografia, 4(3):587-600. (In Portuguese). Rio de Janeiro, 1942. DWB M(05) R454br.
- ...Contains a map (scale 1:75 000 000, determined from marginal graticule indicators) of South America showing the climatic regions by hatched areas.

1951 - 1960

27. Albani, F., Fletschner, C. and Ferreira, H. Paraguay-Clima. (Paraguay-Climate). (In Spanish). [1960]. DLC Map Division.
- ...Is a map (scale 1:4 000 000, determined by DLC) of Paraguay with mean annual isohyets (mm) and isotherms (°C) based on data for 10 stations for varying periods within the period 1941-1960.
28. Alissow, B. P. Die Klimagebiete Südamerikas. (The climatic regions of South America). Die Klimate der Erde: 124-140. (In German). Berlin, 1954. DWB M8 A414klg.
- ...Includes maps (scale 1:85 000 000, determined from graticules) of South America with mean isobars and prevailing winds (by arrows) in January and July; mean isotherms for January and July; climatic zones and regions. No period of record specified.
29. Brazil. Departamento Nacional de Obras de Saneamento. As chuvas e o clima nas bacias dos rios Acaray e Monday. (The rainfall and climate of the basins of the Acaray and Monday rivers). Hidrologia e geologia das bacias dos rios Acarai e Mondai. 164pp. (In Portuguese). Rio de Janeiro, 1959. Foreign Area Section Files.
- ...Contains the following: map (scale 1:4 000 000, determined from graticules) of Paraguay with annual mean isohyets based on the period 1929-1958; map (scale is not indicated (about 1:13 000 000)) with graphs showing monthly distribution of rainfall for individual stations in Paraguay and adjacent areas (Ingavi, Bahía Negra, Col. Filadelfia, Pto. Casado, Ballivian, Cerro Torin, Guaira, Asunción, Pte. Franco, Villarrica, Encarnación in Paraguay) based on data for specified periods (vary by station); map (scale 1:4 000 000, determined from graticules) of Paraguay with annual wind roses for individual stations (Bahía Negra, Mcal, Estigarribia, P. Casado, Encarnación, Villarrica, Puerto P. Franco and Asunción) and monthly (January and July) wind roses for individual stations (Asunción, Villarrica, and Pto. P. Franco); polychrome map (scale 1:4 000 000, determined from graticules) of Paraguay showing climatic regions according to Köppen, annual mean isotherms (°C) and graphs for individual stations of monthly rainfall and mean, mean maximum and mean minimum temperatures for 7-14 stations.
30. Ferreira de Barros, Linton. Contribuição ao estudo das massas de ar da bacia do São Francisco. (Contribution to the study of air masses of the basin of the San Francisco). Revista Brasileira de Geografia, 19(3):301-340. (In Portuguese). Rio de Janeiro, 1957. DWB M(05) R454br.
- ...Contains maps (scale 1:110 000 000, determined from graticules) of South America with prevailing winds (by arrows) at specified heights (500, 1000 and 3000 m.) in summer and winter, prevailing winds (by arrows) at the end of autumn and winter, and prevailing winds (by arrows) at 500 m. in October and April; maps (scale 1:40 000 000, determined from partial graticules) of South America (10° North-30° South latitude) with prevailing winds (by arrows) in summer and autumn during the passage of a polar front, prevailing winds (by arrows) in winter during the passage of an easterly wave and prevailing winds (by arrows) during the spring. No period of record specified.

31. Ferreira Gubetich, Hugo. Geografía del Paraguay. (Geography of Paraguay). 252pp. (In Spanish). Asunción, 1960. DGS 504(490) F413g.

...Contains maps (scale is not indicated (about 1:12 500 000)) of Paraguay with annual mean isotherms (°C); annual mean isohyets (mm.). These maps are based on data for an unspecified period.

32. Freeman, Otis W. and Morris, John W. World geography. 623pp. New York, Toronto, London, 1958. DN-HO G126 F8.

...Contains a map (scale 1:32 000 000, determined from partial graticules) of South America showing the climatic regions by hatched areas.

33. Mendaro, Ernesto Paraguay. Ministerio de Agricultura y Ganadería, Servicio Técnico Interamericano de Cooperación Agrícola (STICA). Boletín No. 235. (In Spanish). Asunción, August 1960. DLC HD1897.M4.

...Includes a map (scale 1:5 000 000) of Paraguay with annual mean isotherms (°C) based on the period 1940-1950.

34. Paraguay. Dirección General de Estadística. Anuario estadístico de la República...1948-1953. (Statistical yearbook of the Republic of Paraguay... 1948-1953). (In Spanish). Asunción, 1955. DLC HA1041.A2.

...Includes maps (scale is not indicated (about 1:7 000 000)) of Paraguay with annual mean isotherms (°C) and mean isohyets (mm) for 1951.

35. Paraguay. S.T.I.C.A. Paraguay, promedio anual de lluvia. (Paraguay, mean annual rainfall). (In Spanish). 1954. DLC Map Division.

...Is a map (scale 1:1 000 000) of Paraguay with annual mean isohyets (mm and in) based on an unspecified period.

36. Paraguay. S.T.I.C.A. Promedio anual de temperatura del Paraguay. (Mean annual temperature of Paraguay). (In Spanish). 1954. DLC Map Division.

...Is a map (scale 1:1 000 000) of Paraguay with annual mean isotherms (°C) based on an unspecified period.

37. Thompson, Will F. Analogs of Canal Zone climate in South America. Quarter-master Research & Engineering Center Environmental Protection Research Division - Technical Report EP-97. 24pp. Natick, Massachusetts, September 1958. DWB M86 U58t.

...Contains polychrome maps with hatched areas of Canal Zone-South America (scale 1:20 250 000, determined from graticules) showing station locations (13 in Paraguay) and physiographic features; mean temperature for warmest month and coldest month; mean daily max temperature for warmest month; mean daily min temperature for coldest month; mean daily temperature range for warmest month; mean annual precipitation; mean monthly precipitation for wettest month; number of wet months; mean relative humidity for driest month; mean cloudiness for wettest month; mean wind speed for wettest month; and composite analogous areas.

38. U. S. Air Weather Service Climatic Center. Weather factors affecting aerial photography in Paraguay. Report 3635. 23pp. Washington, September 1960. Foreign Area Section Files.

...Includes maps (scale 1:6 800 000, determined from marginal graticule ticks) of Paraguay showing station locations; best months for photographic operations and approximate number of days per month with total cloud amount $\leq 1/10$ and visibility ≥ 6 miles by zones (western and eastern).

1961 -

39. Air France Airline. Direction de l'Exploitation. Department des Vols. Division Navigation Infrastructure. Climatologie. Amerique du Sud. (Climatology. South America). 80pp. (In French). October 1962. Foreign Area Section Files.

...Contains maps (scale 1:95 000 000, determined from graticules) of area 40°N and 60°S and approximately 105°W to 30°E (South America, North and South Atlantic Ocean and most of Africa): surface charts (January and July) of general circulation which show pressure regime (mb), general windflow lines, isotachs (4, 8, 12 and 16 kts.) and zone of Intertropical Convergence (Z.I.C.); positions of anticyclones (January and July) at surface, 700, 500 and 300 mb. heights; 200 mb. pressure height contours (isohypses) and isotachs (10 kts. intervals) for January and July; monthly movement of Z.I.C. (Zone of Intertropical Convergence) (mean and north and south limits, degree of activity-weak, light, moderate, strong-of ZIC), general windflow lines, mean monthly isohyets (<3, 3-30, 30-100, 100-200, 200-300, >300 mm); seasonal displacement of climatic zones by monthly isolines (rainy season R>200 mm and dry season R<3 mm). No period of record specified.

40. Kendrew, W. G. The climates of the continents. Fifth Edition. 607pp. London, 1961. DWB M8 K33c.

...Contains maps (scale is not indicated (about 1:250 000 000)) of South America with mean isotherms (°C) for January, April, July and October; maps (scale 1:100 000 000, determined from partial graticules) of South America with mean isobars and mean streamlines for January and July; map (scale is not indicated (about 1:62 500 000)) of South America showing mean annual precipitation (intervals of 0-10, 10-20, 20-30, 30-40, 40-80 and >80 in.; and 0-254, 254-508, 508-762, 762-1016, 1016-2032 and >2032 mm) by hatched areas; map (scale 1:85 000 000 determined by partial graticules) of South America with mean isohyets (inches) for January and July. These maps are based on data for an unspecified period.

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