

Master of Development Practice

Lesson Plan for Course Code DPR624: Climate Change in South Asia

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Lesson Plan Title: Climate Change in South Asia (24hrs)

Concepts / Topics to Teach:

1. Introduction to Climate System (2 hrs)
2. Climate in South Asia (2hrs)

General Goal(s): Enable Students from Different Background to have a framework to understand climate in general and that of Southern South Asia in particular.

Specific Objectives:

- Understand the linkages between various components of the Geo-system.
- To provide a basic understanding of the components of the global climate system and relate it to seasonal and regional variation of climate in Southernmost South Asia.

Required Materials: Power Point Presentations, Hand Outs, and Reference Materials

Assessment Based On Objectives: Knowledge and skills will be assessed through discussions, Continuous Assessments (CAs), Practicals and Written Examinations.

Selected Readings

- Basic Climate Science, 2011. Available from: <<http://climateprediction.net/content/basic-climate-science>>. [27 September 2011].
- Pant, GB & Kumar, KR 1997, *Climates of South Asia*, Regional Climatic Features, Chichester, Jhon Wiley & Sons Ltd, pp. 197-256.
- Robinson, P and Sellers, H 1999, *Contemporary Climatology*, 2nd Edn, Pearson/Prentice Hall, London, pp. 9-13.
- Robinson, P and Sellers, H 1999, *Contemporary Climatology*, 2nd Edn, Pearson/Prentice Hall, London, pp. 39-47.
- Robinson, P and Sellers, H 1999, *Contemporary Climatology*, 2nd Edn, Pearson/Prentice Hall, London, pp. 56-69.

Additional Readings

- Burroughs, W (ed.) 2003, *Climate into the 21st Century*, Cambridge University Press, United Kingdom.
- Pant, GB & Kumar, KR 1997, *Climates of South Asia*, Jhon Wiley & Sons Ltd, Chichester, England, pp. 320.

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Concepts / Topics to Teach: Climate Variability and Predictability (4 hrs)

1. Primary modes of climate variability and predictability (2 hrs)
2. Statistical and dynamical predictions (2 hrs)

General Goal(s): Gain knowledge about the uncertainty of climate/ weather predictions.

Specific Objectives:

- To Introduce:
 - a) Primary modes of climate variability and predictability
 - b) Predictions based on statistical methods and dynamical models

Required Materials: Power Point Presentations, Hand Outs, and Reference Materials

Assessment Based On Objectives: Knowledge and skills will be assessed through discussions, Continuous Assessments (CAs), Practicals and Written Examinations.

Selected Readings

- Christy, JR, Clarke, RA, Gruza, GV, Jouzel, J, Mann, ME, Oerlemans, J, Salinger, MJ, Wang, SW, Observed Climate Variability and Change, 101-104pp. Available from :< http://www.grida.no/climate/ipcc_tar/wg1/pdf/tar-02.pdf > [28 September 2011].
- Christy, JR, Clarke, RA, Gruza, GV, Jouzel, J, Mann, ME, Oerlemans, J, Salinger, MJ, Wang, SW, Observed Climate Variability and Change, 155-163pp. Available from: <http://www.grida.no/climate/ipcc_tar/wg1/pdf/tar-02.pdf> [28 September 2011].
- Hegerl, G.C., F. W. Zwiers, P. Braconnot, N.P. Gillett, Y. Luo, J.A. Marengo Orsini, N. Nicholls, J.E. Penner and P.A. Stott, 2007: Understanding and Attributing Climate Change. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 667-669. Available from: <<http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter9.pdf>>. [28 September 2011].
- Luo, J.J., 2011: [The Tropics] Indian Ocean Dipole [in "State of the Climate in 2010"]. *Bull.Amer.Meteor.Soc.*, 92(6), S138-S140.
- Diamond, H.J., 2011: [The Tropics] Overview [in "State of the Climate in 2010"]. *Bull.Amer.Meteor.Soc.*, 92(6), S109.
- Bell, G.D., M. Halpert, and M. L'Heureux, 2011: [The Tropics] ENSO and the Tropical Pacific [in "State of the Climate in 2010"]. *Bull.Amer.Meteor.Soc.*, 92(6), S109-S113.

Additional Readings

- TOGA program 1996, *Learning to predict climate variations associated with El Nino and the Southern Oscillation: Accomplishment and Legacies of the TOGA program*, National Academy of Sciences, Washington.
- Wickramagamage, P 2010, 'Seasonality and spatial pattern of rainfall of Sri Lanka. Exploratory factor analysis, *International Journal of Climatology*, vol. 30, no. 8, pp. 1235-1245.
- Zubair, L, Siriwardhana, M, Chandimala, J, & Yahiya, Z 2008, 'Predictability of Sri Lankan Rainfall based on ENSO', *International Journal of Climatology*, vol. 28, no.1, pp. 91-101.

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Concept / Topic to Teach: Climate Change and Projections (6hrs)

1. Introduction to Climate change and Projections (2 hrs)
2. Global Warming and Its Impacts (2 hrs)
3. Climate Change in South Asia and their projections, examples from Sri Lanka, Maldives and India (2 hrs)

General Goal(s): Learn various theories of Climate Change and Projections

Specific Objectives:

- To identify effects of climate change on South Asia focusing on Sri Lanka, Maldives and India.
- To provide an overall understanding on climate change scenario and allied concepts and to introduce comprehensive projections for future changes done by reputed scientific bodies/panels (e.g. IPCC).

Required Materials: PowerPoint Presentations, Hand Outs, Reference materials

Assessment Based On Objectives: Knowledge and skills will be assessed through discussions, Continuous Assessments (CAs), Practicals and Written Examinations.

Selected Readings:

- Cruz, R.V., H. Harasawa, M. Lal, S. Wu, Y. Anokhin, B. Punsalmaa, Y. Honda, M. Jafari, C. Li and N. Huu Ninh, 2007: Asia. *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 478-479pp. Available from <<http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-chapter10.pdf>>. [28September 2011].
- Eriyagama, N, Smakhtin, V, Chandrapala, L, & Fernando, K, 2010. Impacts of Climate Change on Water Resources and Agriculture in Sri Lanka: *A Review and Preliminary Vulnerability mapping*, International Water Management Institute, Colombo, pp. 2-9.
- Hegerl, G.C., F. W. Zwiers, P. Braconnot, N.P. Gillett, Y. Luo, J.A. Marengo Orsini, N. Nicholls, J.E. Penner and P.A. Stott, 2007: Understanding and Attributing Climate Change. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 665-669. Available from: <<http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter9.pdf>> . [28 September 2011].
- Intergovernmental Panel on Climate Change 2007: Summary for Policymakers. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth*

Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. pp.2-18. Available from: <<http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf>>. [28 September 2011].

- Joseph, PV 2008, 'Climate Change in India', *Geography & You*, vol.8, pp.16-20.

Additional Readings

- Hegerl, G.C., F. W. Zwiers, P. Braconnot, N.P. Gillett, Y. Luo, J.A. Marengo Orsini, N. Nicholls, J.E. Penner and P.A. Stott, 2007: Understanding and Attributing Climate Change. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Available from: <<http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter9.pdf>>. [28 September 2011].
- Intergovernmental Panel on Climate Change 2007, Climate Change 2007: Fourth Assessment Report (AR4), Physical Science Basis: Working Group I, (Chapter 11.4). Available from: <http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch11.html>. [28 September 2011].
- Liebig, V 2009, 'The ESA Climate Change Initiative: Foundations, Objectives and Benefits', *Climate Sense*, eds J Dodd, R Lambert, A Lawrence & S Townsend, Tudor Rose, England, pp. 114-190.
- World Meteorological Organization 1996, *WMO and Climate Change*, WMO No.848, WMO, Geneva, Switzerland, pp. 20.
- Zubair et al., Climate Change in Sri Lanka 2009, *International Journal of Climatology*, in review.

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Concepts / Topics to Teach: Climate Impacts (6hrs)

1. Introduction to climate impacts (2 hrs)
2. Climate Impacts on South Asia (2 hrs)
3. Assessment of Climate Impact (2 hrs)

General Goal(s): To discuss the major climate impacts on different sectors such as, Water, Agriculture, Energy, Disasters etc. and introduce procedures for impacts assessment.

Specific Objectives: Allow the students to explore the possible Climate/ Climate Change impacts and introduce Climate/ Climate Change impacts tipping points.

Required Materials: Power point Presentations, Hand Outs, Reference Materials

Assessment Based On Objectives: Knowledge and skills will be assessed through discussions, Continuous Assessments (CAs), Practicals and Written Examinations.

Selected Readings

- Cruz, R.V., H. Harasawa, M. Lal, S. Wu, Y. Anokhin, B. Punsalmaa, Y. Honda, M. Jafari, C. Li and N. Huu Ninh, 2007: Asia. *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, pp. 471-472.
- Climate Change 2007: Impacts, Adaptation and Vulnerability (Chapter 10.2.4) ,IPCC Working Group II: Edited by M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson (eds), Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, Available from: http://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch10.html.
- Eriyagama, N, Smakhtin, V, Chandrapala, L, & Fernando, K 2010. Impacts of Climate Change on Water Resources and Agriculture in Sri Lanka: *A Review and Preliminary Vulnerability mapping*, International Water Management Institute, Colombo, pp. 9-14.
- Zubair, L, Corner, SJ, Ward, N, Galapaththy, GNL, Mahanama, S, Fizal, Z, Yahiya, Z, Siriwardhana, M, Tennakoon, U, Chandimala, J, Razick, S, Nawarathna, B, Shaman, J, Ndiaye, O, & Yang, H 2011, Analysis of Impacts of Climate Variability on Malaria Transmission and the development of an early warning system, Project report: Foundation for Environment, Climate and Technology, Digana Village.
- Zubair, L, Ralapanawe, V, Toennakone, U, Yahiya, Z, and Perera, R 2006, Natural Disaster Risks in Sri Lanka: Mapping Hazards and Risk Hotspots, eds M Arnold, R Chen, U Deichmann, M Dilley and A Lerner-Lam, RE Pullen, Z Trohanis, Natural Disaster Hotspots Case Studies, World Bank, Washington, DC, pp. 109-136.

- Zubair, L, Ralapanawe, V, Yahiya, Z, Perera, R, Tennakoon, U, Chandimala, J, Razick, S, & Lyon, B 2011, Fine Scale Natural Hazard Risk and Vulnerability Identification Informed by Climate in Sri Lanka. Project Report: Foundation for Environment, Climate and Technology, Digana Village, Available from: http://sanetra.net/~recoverl/mdp/downloads/Projects/Disaster_Finalzwplz-Rev_10.pdf >. [02 November 2011].

Additional Readings

- Climate Change 2007: Impacts, Adaptation and Vulnerability (Chapter 10) ,IPCC Working Group II: Edited by M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson (eds),Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Available from: (<http://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch10.html>).
- Carter, TR, Parry, ML, Harasawa,H, Nishioka, S 1994, IPCC Technical Guidelines for Assessing Climate Change Impact and Adaptation, University College London, UK & Center for global Environmental Research , National Institute for Environmental Studies, Japan. Available from: (<<http://www.ipcc.ch/pdf/special-reports/ipcc-technical-guidelines-1994n.pdf>>). [28 September 2011].
- Gunatilleke, G, Qureshi, A 1994, Climate Change in Asia: Sri Lanka, Asian Development Bank, Manila, pp. 229.
- National Research Council 2001, *Under the Weather: Climate, Ecosystems and Infectious Disease*, 2001, National Academy Press, Washington, D.C, pp. 146.
- United Nations Development Programme 2006,Developing a Disaster Risk Profile for Maldives, Available from : http://www.preventionweb.net/files/11145_MaldivesDisasterRiskProfileFinalRep.pdf>.

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Concept / Topic to Teach: Vulnerability, Mitigation and Adaptation to Climate variability and change (6hrs)

1. Vulnerability (2hrs)
2. Mitigation (2hrs)
3. Adaptation (2hrs)

General Goal(s): Learning about what humans can do to minimize causes of climate change and coping strategies.

Specific Objectives: a) to introduce the concepts behind vulnerability, Mitigation and Adaptation focused on scenarios on Climate Variability and Change b) to identify different vulnerable groups towards the climate change b) Allow the students to explore mitigation options for Climate Change in a regional context and adaptation options for Sri Lanka and Maldives.

Required Materials: Power point Presentations, Hand Outs, Reference Materials

Assessment Based on Objectives: Knowledge and skills will be assessed through discussions, Continuous Assessments (CAs), Practicals and Written Examinations.

Selected Readings

- Climate Change 2007: Impacts, Adaptation and Vulnerability (Chapter 10.1) ,IPCC Working Group II: Edited by M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson (eds),Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, Available from: <http://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch10.html>.
- Cruz, R.V., H. Harasawa, M. Lal, S. Wu, Y. Anokhin, B. Punsalmaa, Y. Honda, M. Jafari, C. Li and N. Huu Ninh, 2007: Asia. *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds.,Cambridge University Press, Cambridge, UK, pp. 479-492.
- First National Communication by Sri Lanka to UNFCCC 2000, Final Draft, pp. 64-83. Available from: <<http://unfccc.int/resource/docs/natc/srinc1.pdf> >. [22 September 2011].
- Huq, S, Karim, Z, Asaduzzaman, M, Mahtab, F (eds) 1999, *Vulnerability and Adaptation to Climate Change for Bangladesh*, Kluwer Academic Publishers, The Netherlands, pp.125-138.
- Ministry of Home Affairs, Housing and Environment 2001, First National Communication of the Republic of Maldives to the UNFCCC, Novelty press, Maldives, pp. 79-85.
- United Nations Framework Convention on Climate Change Climate Change: Impacts, Vulnerabilities, and Adaptation in Developing Countries, pp.20-22. Available from: <<http://unfccc.int/resource/docs/publications/impacts.pdf>>. [22 September 2011].

- Zubair,L, Yahiya,Z, Chandimala, J, Siraj,MRA, Ariyaratne, K, Tennakoon, U, Wickramasinghe, C, Bandara, I, Blathsinhala, H , Abeyratne, T, Rajakaruna, SB, Samuel, TDMA, & Hansen, J 2011, Adaptation and Impact Assessment to Climate Change (AIACC) project on Plantation Agriculture in Sri Lanka : Project Report, Foundation for Environment, Climate and Technology, Digana Village.

Additional Readings

- Carter, TR, Parry ML, Harasawa,H, Nishioka, S 1994, IPCC Technical Guidelines for Assessing Climate Change Impact and Adaptation, University College London, UK & Center for global Environmental Research , National Institute for Environmental Studies, Japan. Available from :<<http://www.ipcc.ch/pdf/special-reports/ipcc-technical-guidelines-1994n.pdf>>. [22 September 2011].
- Huq, S, Karim, Z, Asaduzzaman, M, Mahtab, F (eds) 1999, *Vulnerability and Adaptation to Climate Change for Bangladesh*, Kluwer Academic Publishers, The Netherlands.
- Ministry of Home Affairs, Housing and Environment 2001, First National Communication of the Republic of Maldives to the UNFCCC, Novelty press, Maldives, pp.127.
- Pachauri, RK. & Reisinger, A. (Eds.) IPCC, Climate Change: 2007, Synthesis Report, IPCC, Geneva, Switzerland. pp 104. Available from: <http://www.ipcc.ch/publications_and_data/ar4/syr/en/spm.html>. [02 September 2011].
- United Nations Framework Convention on Climate Change Climate Change: Impacts, Vulnerabilities, and Adaptation in Developing Countries, pp.68. Available from: <<http://unfccc.int/resource/docs/publications/impacts.pdf>>. [22 September 2011].

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Concept / Topic to Teach: Integrating Climate Concerns into National and Regional Resource Management and Policy Making (4hrs)

1. Introduction : Policies , Strategies and Decision Making in integrating climate concerns (2hrs)
2. Kyoto Protocol and its importance (2hrs)

General Goal(s): To provide an understanding how climate concerns are to be integrated in to National and Regional Management and Policy Making.

Specific Objectives:

- To introduce policy making strategies for climate change mitigation and Adaptation
- Allow the students to undertake case studies on issues of equity, ethics and on the integration of climate concerns into development policy, planning and resource management
- To identify Bottlenecks and failures in integrating climate concerns into national planning and resource management
- To identify the impacts on the economic indicators

Required Materials: Power point Presentations, Hand Outs, Reference materials

Assessment Based On Objectives: Knowledge and skills will be assessed through discussions, Continuous Assessments (CAs), Practicals and Written Examinations.

Selected Readings

- Burton, I, Malone, E & Huq, S 2004, Adaptation policy frameworks for climate change: Developing strategies, policies and measures, Cambridge University press, United Kingdom, pp.9-28.
- Ahmad, IH 2009, Climate Policy Integration: Towards Operationalization, DESA Working Paper No. 73ST/ESA/2009/DWP/73, Available from : http://www.un.org/esa/desa/papers/2009/wp73_2009.pdf. [28 September 2011].

Additional Readings

- Burton, I, Malone, E & Huq, S 2004, Adaptation policy frameworks for climate change: Developing strategies, policies and measures, Cambridge University press, United Kingdom,pp.257. Available from: http://content.undp.org/go/cmservice/stream/asset/?asset_id=2200844). [28 September 2011].

- Houghton, JT, Filho, LGM, Griggs, DJ & Maskell, K (eds) 1997, *Stabilization of Atmospheric Greenhouse Gases: Physical Biological and Socio-economic implications*, IPCC technical paper III, IPCC, Geneva, Switzerland, pp. 48.
- IPCC 1995, Climate Change 1995, IPCC 2nd Assessment Report (AR2): Impacts, Adaptations and Mitigation: Summary for Policy Makers.
<http://www.ipcc.ch/ipccreports/sar/wg_II/ipcc_sar_wg_II_full_report.pdf>. [28 September 2011].