Testing historical reconstructions of global sea surface temperature using early satellite data

Supervisor: Chris Merchant
Co-supervisors: Liz Kent (National Oceanography Centre Southampton) and Helen Brindley (Imperial College)

To understand the evolution of climate since the Industrial Revolution, it is crucial to have quantified knowledge of how sea surface temperatures (SSTs) across the global oceans have evolved. For most of that period, developing a global picture of SSTs depends on ‘historical reconstruction’ from relatively sparse, ship-based SST measurements. The question addressed in this project is whether the historically reconstructed SSTs are correct to within their stated uncertainties. To answer this question, the student will use very early satellite measurements (from ~1970) to create independent SST estimates to compare with reconstructed SSTs.

Estimates of climatic change in ocean surface temperatures have been created based on historical ship-based measurements, e.g., of temperature of seawater hauled up in buckets (left). Early satellite spectra (mid) will be used to critically assess these historical reconstructions (right).

In 1970, a decade before the advent of sensors routinely capable of observing sea surface temperature from space, the Infra-Red Interferometer Spectrometer (IRIS) collected 10 months of global data, consisting of infra-red spectra. It has been demonstrated that seasonal sea surface temperature (SST) can be obtained from IRIS observations, although SST estimation was not the primary focus of that study.

The purpose of this studentship is to obtain IRIS SSTs and use these to test historical reconstructions of global SST against this new, independent source of observations. Compared to the early work, the student will need to obtain SST with improved screening against cloud-contamination, and will need to design an estimation technique that is tolerant of partial cloudiness. The IRIS SSTs will give a wholly new and independent opportunity to test how well historical reconstruction techniques work – i.e., whether our understanding of 20th C climate change is as secure as we think.

Student profile:
The project will involve physics (simulation of radiation through the atmosphere), inverse theory (inference of SST from spectra) and statistics. It will suit someone with a degree in physics, geophysics, applied mathematics or another numerate environmental science.

Funding:
Full funding is available, tied to a UK collaborative project, funded by NERC, “Historical Ocean Surface Temperature: Assessment, Characterisation and Evaluation”. This grant can only be awarded to UK citizens or EU citizens who have lived in the UK for more than three years prior to the start of the grant.